

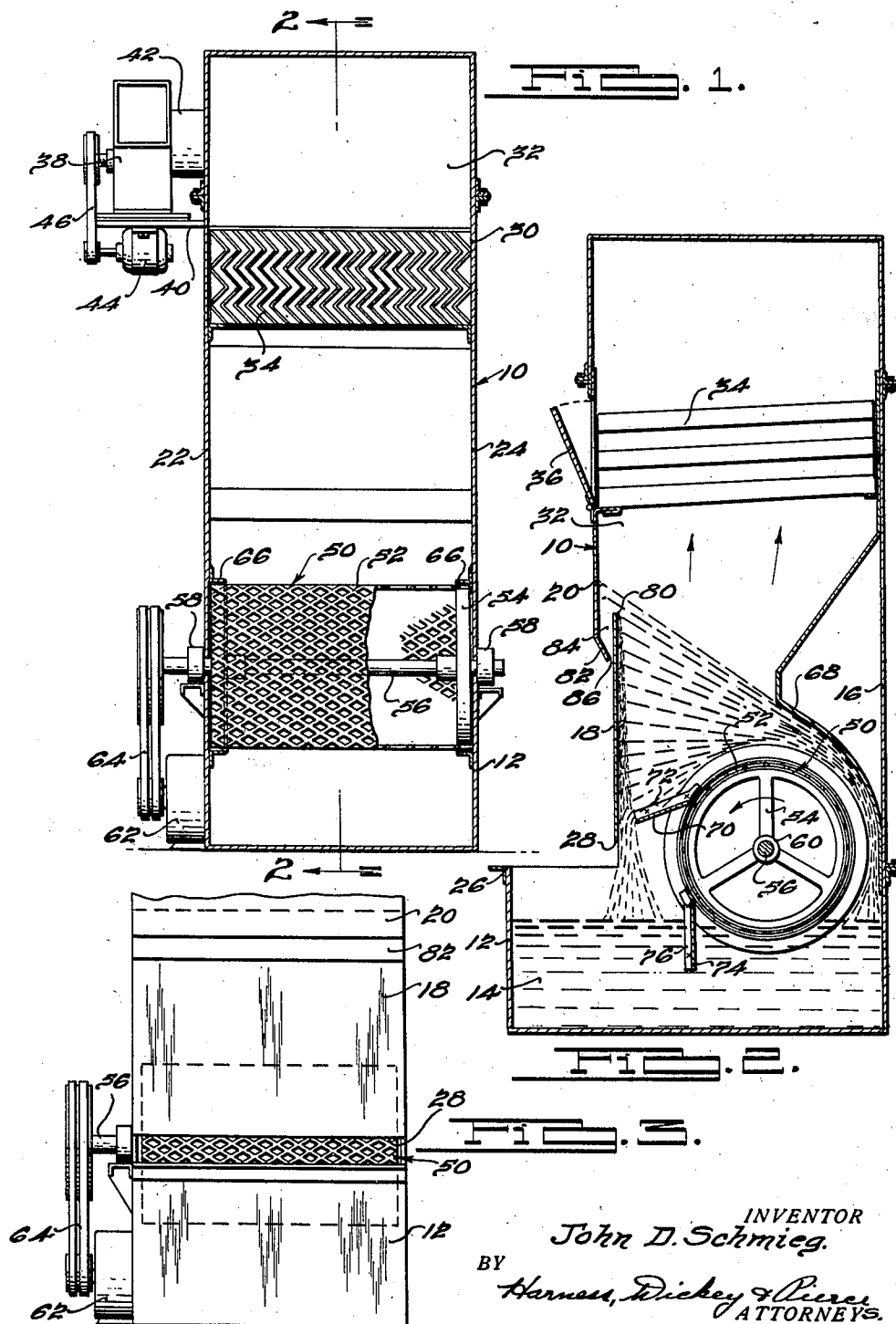
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METHOD OF AND APPARATUS FOR REMOVING FOREIGN MATERIAL FROM AIR

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METHOD OF AND APPARATUS FOR REMOVING FOREIGN MATERIAL FROM AIR

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This invention relates to an improved method of and apparatus for removing foreign material, such as paint, lacquer, enamel, and dust, or the like, from air.

The main object of the present invention is to effectively and completely clean air laden with foreign material in suspension by completely arresting and removing the foreign material from the air.

Another object of the invention is to provide a moving mass of liquid, such as water, of such a character and having a high speed of movement that air laden with foreign material in suspension passed through the path of the moving mass of liquid at a speed less than the speed of the moving mass of liquid will have the foreign materials carried thereby completely removed therefrom. Other liquids which are capable of use with the present invention are oils, caustics, and acids, or the like, and the reference to water is to be considered as illustrative only.

A further object of the present invention is to provide an apparatus capable of creating a moving mass of liquid of the required character so that the moving mass of liquid is thrown against the front wall of the receptacle above an air inlet opening and dropped downwardly across the inlet opening so that the air passed through the apparatus receives a double wash, in that it passes first through the downwardly moving mass of liquid and then passes upwardly through the upper moving mass of liquid.

Another object of the present invention is to provide a simplified structure by which the outer front wall of the apparatus adjacent the inlet opening is automatically and constantly kept clean and free of any foreign material.

Other objects of the invention will become apparent from the following specification, the drawing relating thereto, and the claims hereinafter set forth.

In the drawing, in which like numerals are used to designate like parts of the several views throughout:

Figure 1 is a front vertical cross-sectional view, showing parts in elevation, of an apparatus illustrating an embodiment of the present invention;

Fig. 2 is a vertical cross-sectional view taken substantially along the line 2—2 of Fig. 1; and

Fig. 3 is a fragmentary front elevational view of the structure illustrated in Figs. 1 and 2.

The present invention has particular utility in removing paint in suspension in air from the air, and the embodiment of the invention illustrated in the drawing is particularly adaptable for the

removal of such paint; but it is to be understood that the method and apparatus described have, also, general utility for removing foreign material such as acid fumes, dust, sand, fly ash, and the like, from air in which the foreign material is held in suspension.

In the embodiment of the invention illustrated in the drawing, a cabinet 10, preferably formed of sheet metal material, is provided in which a lower portion 12 provides a receptacle for a bath of liquid, such as water, 14. The rear outer wall 16 of the cabinet is substantially straight; and the front wall of the cabinet is preferably formed of two separate wall portions 18 and 20. Side, or end, walls 22 and 24 connect the front and rear walls to substantially enclose the cabinet.

Referring particularly to Fig. 2, the front wall portion 18 is spaced inwardly from the front edge 26 of the receptacle 12 and preferably terminates above the upper edge of the receptacle 12 and above the normal level of the liquid 14 to provide an air inlet opening 28 therethrough across the front face of the cabinet or receptacle. Although in the present illustration, the opening 28 is illustrated as communicating directly with the room or space within which the unit is mounted, it is to be understood that conduits may be provided over the inlet opening 28 which may be extended therefrom to another point such as the interior of a paint spray booth, or other quarters, within which the air laden with foreign material is located.

The upper portion 30 of the cabinet 10 forms an exhaust conduit 32 communicating with the lower portion of the receptacle and through which the clean air is exhausted to the outside. The exhaust conduit 32 is preferably provided with vertical extending zig-zag baffles 34 at spaced intervals across the exhaust conduit 32 and sloping downwardly to one of the front or rear walls for rapidly changing the direction of travel of the exhausted air and removing any moisture included in the air which may have been carried into the exhaust conduit. It has been found as the result of tests over an extended period that the air within the exhaust conduit 32 is completely cleaned; and any water entrained with the exhausted air is removed from the air within the baffles and returned to the bath. In order to clean out the baffles, a door 36 is provided in the front face of the cabinet over the zig-zag baffle, so that upon opening the door, the baffles are readily accessible for thorough cleaning.

A blower 38 of conventional construction is

mounted on a bracket or platform 40 suitably secured to the cabinet adjacent the top of one end of the cabinet and is in communication with the interior of the cabinet and with the exhaust conduit 32 by means of a communicating conduit 42. The blower 38 is driven by a suitable variable speed motor 44 suitably mounted on the platform 40 and operatively connected to the blower 38 by means of a conventional belt and pulley arrangement 46.

In order to create a moving mass of liquid having the desired characteristics through which the air laden with foreign material is passed, thereby cleaning the air and removing the foreign material therefrom, a rotatable hollow member 50 is mounted within the lower portion of the cabinet 10. The member 50 comprises a substantially cylindrical hollow portion 52 preferably formed of expanded metal. The cylindrical portion 52 is mounted on pulleys 54, one pulley being provided at each end of the cylindrical portion 52 and the pulleys being suitably secured to the inner surface of the portion 52 adjacent its ends. The rotatable member 50 is mounted within the cabinet 10 by means of a shaft 56 which is preferably arranged substantially horizontally and extends through openings in the sides of the cabinet 10 and is mounted for rotation in bearings 58 which are suitably secured to the outer surfaces of the ends of the cabinet in alignment with the openings in the ends. The shaft 56 extends through hubs 60 of the pulleys 54, the pulleys 54 being suitably keyed to the shaft for rotation therewith. The shaft 56 is driven by a variable speed motor 52 which is connected to the shaft 56 by means of a conventional belt and pulley mechanism 64.

The rotatable member 50 is longitudinally located within the receptacle with the ends of the member adjacent the sides of the receptacle. Flanged annular members 66 are suitably secured to the sides 22 and 24, respectively, of the cabinet in embracing relationship to the ends of the rotatable member 50 so as to substantially enclose the ends of the member 50. The air entering the receptacle or cabinet through the inlet opening 28 is, therefore, confined in its passage to the longitudinal surface of the rotatable member 50 and passes either directly through the moving mass of liquid or into and through the open cylindrical portion 52 in a manner that will be hereinafter described in further detail.

In order to provide a moving mass of liquid, such as water, of the desired characteristics, the liquid 14 within the receptacle 12 is maintained at such a level that the top surface of the liquid extends above the lower edge of the rotatable member 52 as indicated in the drawing. Upon rapid rotation of the cylindrical member 50, a fast moving sheet-like free mass of liquid is created in that portion of the cabinet surrounding the rotatable member 52. A member 68 forms a rear wall portion within the cabinet extending from one side wall to the other and is suitably secured to the rear wall 16 of the cabinet. A portion of the wall member 68 extends inwardly within the cabinet and extends longitudinally of the rear wall of the cabinet in spaced relation to the peripheral surface of the member 50. The moving free mass of liquid created by the rotation of the member 50 is guided by the wall portion 68 and thrown forwardly of the receptacle.

The operation of the apparatus so far described is as follows:

Motors 44 and 62 are started and start opera-

tion of the blower 38 and rotation of the cylindrical member 50, respectively. The operation of the blower 38 creates a suction within the cabinet 10 and causes air laden with foreign material to pass through the inlet opening 28 into the interior of the receptacle 10. Rotation of the cylindrical member 52 in the direction indicated by the arrow in Fig. 2 creates the moving mass of liquid and throws this moving mass of liquid against the front wall portion 18 as best indicated in Fig. 2. It has been found by actual tests that as the member 50 is rotated the liquid picked up from the bath is caused to travel several times around with the rotatable member 50 on the peripheral surface thereof before being thrown forwardly and outwardly of the rotatable member. A thin film of liquid is, therefore, formed over the exposed peripheral surface of the rotatable member 50. The liquid thrown against the front wall 18 is caused to drop downwardly forming a substantially continuous sheet of liquid across the inlet opening 28. Air passing through the opening 28 passes first through the downwardly moving sheet of liquid adjacent the inlet opening and receives a first or preliminary wash when passing through this sheet of liquid. The air then enters the interior of the cylindrical member 50 through the openings in the member, and its direction of flow is then changed so that it passes upwardly and outwardly through the openings in the member and further passes upwardly through the moving mass of liquid above the rotatable member. As the air is passed transversely of the direction of movement of the moving mass of water and as the moving mass of water is moved at a higher rate of speed than the speed of the air passed therethrough, any foreign material carried by the air is removed therefrom, and the air passed out through the exhaust conduit 32 is in a cleaned condition.

The foreign material removed from the air is caused to drop downwardly into the bath from which it may be readily removed. An elongated baffle member 70 having flanged ends 72 is mounted within the receptacle and is suitably secured to the side walls thereof, by spot welding the flanges to the walls for example, in a position adjacent the front portion of the rotatable member 52 so as to assist in directing the moving mass of water forwardly and against the wall portion 18. According to the broader aspects of the present invention the air may be passed directly through the moving mass of water without being passed through the hollow cylindrical member, but it is preferable that the air be passed into the interior of the hollow cylindrical member and then outwardly therefrom, and the baffle 70 assists in this purpose. Another longitudinally extending baffle member 74 is mounted within the receptacle 10 and is suitably secured to the side walls thereof by means of end flanges 76. The baffle member 74 extends downwardly within the bath below the surface thereof and is preferably mounted adjacent the front portion of the rotatable member. This baffle member 74 serves to prevent the entry of any foreign material collected on the surface of the bath adjacent the front edge of the receptacle 12 to a position adjacent the under surface of the rotatable member 52 within the receptacle. It is to be understood when materials which are heavier than water are being removed from air that the bath may be located adjacent the bottom of the receptacle 12, and the cleaned water thereby permitted to flow over the top of

the baffle 74 to a position adjacent the lower portion of the rotatable member 50.

Also, according to the present invention a structure is provided by which the front wall 18 of the receptacle may be automatically and continually washed so as to keep it in a clean condition. This is particularly important when the structure is being used to remove paint or acid fumes from air. In order to accomplish this purpose the front wall portion 18 terminates at its upper edge 80 and is spaced inwardly of the lower edge of the upper wall portion 20. The wall portion 20 extends downwardly below the upper edge 80 and has an inwardly directed portion 82 which extends to a position close to but spaced slightly from the front face of the wall portion 18. The lower portion of the wall portion 20 and the upper portion of the wall portion 18 form a trough 84 having an outlet 86. The wall portion 68 is so constructed as to direct the water thrown against the front wall of the receptacle so that a portion thereof passes over the upper edge 80 and is collected within the trough 84. The water within the trough 84 constantly flows through the opening 86 when the unit is in operation and flows downwardly over the front face of the wall portion 18 washing it free of any foreign material.

Formal changes may be made in the specific embodiment of the invention described without departing from the spirit and substance of the broad invention, the scope of which is commensurate with the appended claims.

What is claimed is:

1. The method of removing foreign material such as paint, dust, or the like, from air comprising creating a fast moving, sheet-like free mass of liquid; and passing air laden with foreign material in suspension across and through said free mass of liquid at a speed less than the speed of movement of said free mass of liquid thereby removing said foreign material from said air.

2. The method of removing foreign material such as paint, dust, or the like, from air comprising creating a fast moving, substantially continuous sheet of free liquid; and passing air laden with foreign material in suspension across and upwardly through said sheet of liquid at a speed substantially less than the speed of movement of said sheet of liquid to thereby remove said foreign material from said air.

3. The method of removing foreign material such as paint, dust, or the like, from air comprising creating a fast moving, sheet-like free mass of liquid and moving said mass of liquid first in a substantially horizontal direction and then downwardly; and passing air laden with foreign material in suspension across and through said downwardly moving free mass of liquid and then changing the direction of air movement upwardly to pass through said horizontal mass of liquid to thereby remove said foreign material from said air.

4. Apparatus for removing foreign material such as paint, dust, or the like, from air laden with foreign material in suspension comprising a receptacle containing a bath of liquid, an elongated rotatable member mounted within said receptacle longitudinally thereof and with a portion of said member extending into said bath, said receptacle having an upstanding wall portion to one side of said member, said wall portion having an air inlet opening there-through directed toward the longitudinal surface of said

rotatable member, a baffle member mounted within said receptacle longitudinally thereof above said inlet opening and between said opening and said rotatable member with the edge of said baffle member adjacent the inlet opening spaced from said wall portion, means for rotating said rotatable member to create a moving mass of liquid and to throw the liquid to one side of said receptacle, an exhaust conduit communicating with said receptacle above said mass of liquid and above said inlet opening, and means for drawing air laden with foreign material in suspension through said inlet opening, through said mass of liquid and upwardly through said exhaust conduit to remove the foreign material from the air and thereafter exhaust the cleaned air.

5. Apparatus for removing foreign material such as paint, dust, or the like, from air laden with foreign material in suspension comprising a receptacle containing a bath of liquid, an elongated rotatable member mounted within said receptacle longitudinally thereof and with a portion of said member extending into said bath, said receptacle having an upstanding wall portion to one side of said member, said wall portion forming an air inlet opening above the normal level of the liquid in said receptacle directed toward the longitudinal surface of said rotatable member, a baffle member mounted within said receptacle longitudinally of said rotatable member, said baffle member extending downwardly into said bath and being located between said rotatable member and said inlet openings, means for rotating said rotatable member to create a moving mass of liquid and to throw the liquid against said wall portion above said inlet opening, an exhaust conduit communicating with said receptacle above said mass of liquid and above said inlet opening, and means for drawing air laden with foreign material in suspension through said inlet opening, through said mass of liquid, and through said exhaust conduit to remove the foreign material from the air and thereafter exhaust the cleaned air.

6. Apparatus for removing foreign material such as paint, dust, or the like, from air laden with foreign material in suspension comprising a receptacle containing a bath of liquid, an elongated rotatable member mounted within said receptacle longitudinally thereof and with a portion of said member extending into said bath, said receptacle having an upstanding wall portion to one side of said member, said wall portion having an air inlet opening therethrough above the normal level of the liquid of said receptacle, said receptacle having another wall portion spaced from said member and directed upwardly above said member, means for rotating said rotatable member to create a moving mass of liquid between the exposed portion of said cylindrical member and said last named wall portion and to throw the liquid against said first named wall portion above said inlet opening, an exhaust conduit communicating with said receptacle above said mass of liquid and above said inlet opening, and means for drawing air laden with foreign material in suspension through said inlet opening, through said mass of liquid and through said exhaust conduit to remove the foreign material from the air and thereafter exhaust the cleaned air.

7. Apparatus for removing foreign material such as paint, dust, or the like, from air laden with foreign material in suspension comprising a re-

ceptacle containing a bath of liquid, a rotatable hollow substantially cylindrical member mounted within said receptacle longitudinally thereof with the lower portion thereof extending into said bath, said member having openings through the cylindrical wall thereof, said receptacle having an upstanding wall portion to one side of said member, said wall portion having an air inlet opening therethrough above the normal level of the liquid in said receptacle, said receptacle having another wall portion spaced from said member and directed inwardly above said member, means for rotating said rotatable member to create a moving mass of liquid between the exposed portion of said cylindrical member and said last named wall portion and to throw the liquid against said first named wall portion above said inlet opening, an exhaust conduit communicating with said receptacle above said mass of liquid, and means for drawing air laden with foreign material in suspension through said inlet opening, through the openings of the cylindrical member into the cylindrical member and outwardly therefrom and through said moving mass of liquid to remove the foreign material from the air and thereafter exhaust the cleaned air.

8. Apparatus for removing foreign material such as paint, dust, or the like, from air laden with foreign material in suspension comprising a receptacle containing a bath of liquid, a rotatable hollow substantially cylindrical member mounted within said receptacle longitudinally thereof with the lower portion of said member extending into said bath, said member having openings therethrough, said receptacle having an upstanding wall portion to one side of said member and spaced inwardly from the front edge of said receptacle leaving a portion of the bath exposed, the lower edge of said wall portion terminating above the normal level of the liquid within said receptacle to provide an air inlet opening therethrough, means for rotating said rotatable member to create a moving mass of liquid and to throw said liquid against said wall portion above said inlet opening, an exhaust conduit communicating with said receptacle above said mass of liquid, and means for drawing air laden with foreign material through said inlet opening and through said moving mass of liquid to remove the foreign material from the air and thereafter exhaust the cleaned air.

9. Apparatus for removing foreign material such as paint, dust, or the like, from air laden with foreign material in suspension comprising a receptacle containing a bath of liquid, a rotatable hollow substantially cylindrical member mounted within said receptacle with the lower portion thereof extending into said bath, said receptacle having a first wall portion spaced from said hollow cylindrical member and directed inwardly above said hollow cylindrical member, said receptacle having a second wall portion oppositely disposed to said first named wall portion to one side of said member, said second named wall portion having an air inlet opening therethrough, the upper edge of said second named wall portion terminating above the upper edge of said member, said receptacle having a third wall portion spaced forwardly of said second named wall portion and terminating below the upper edge of said second named wall portion, means for rotating said rotatable member to create a moving mass of liquid and to throw said liquid against said second named wall portion and

against said third named wall portion above the upper edge of said second named wall portion, and means for drawing air laden with foreign material in suspension through said inlet opening and through said moving mass of liquid to remove the foreign material from the air and thereafter exhaust the cleaned air.

10. Apparatus for removing foreign material such as paint, dust, or the like, from air laden with foreign material in suspension comprising a receptacle containing a bath of liquid, a rotatable hollow substantially cylindrical member mounted within said receptacle longitudinally thereof with the lower portion of said member extending into said bath, said member having openings therethrough, said receptacle having an upstanding wall portion to one side of said member, said wall portion having an air inlet opening therethrough above the normal level of the liquid in said receptacle, a baffle member mounted within said receptacle longitudinally thereof above said inlet opening and between said opening and said rotatable member, means for rotating said rotatable member to create a moving mass of liquid and to throw the liquid against the wall portion above said inlet opening, an exhaust conduit communicating with said receptacle above said mass of liquid, and means for drawing air laden with foreign material in suspension through said inlet opening into said hollow cylindrical member and then outwardly therefrom, through said moving mass of liquid to remove the foreign material from the air and thereafter exhaust the cleaned air.

11. Apparatus for removing foreign material such as paint, dust, or the like, from air laden with foreign material in suspension comprising a cabinet defined by upstanding walls, the lower portion of said cabinet forming a receptacle containing a bath of liquid, an elongated rotatable member mounted within said cabinet longitudinally thereof and with a portion of said member extending into said bath, the ends of said rotatable member terminating adjacent the sides of said cabinet, said cabinet having an upstanding wall portion to one side of said member, said wall portion forming an air inlet opening above the normal level of the liquid in said receptacle directed toward the longitudinal surface of said rotatable member, means for rotating said rotatable member to create a moving mass of liquid and to throw the liquid against said wall portion above said inlet opening, an exhaust conduit communicating with said receptacle above said mass of liquid and above said inlet opening, and means for drawing air laden with foreign material in suspension through said inlet opening, through said mass of liquid, and through said exhaust conduit to remove the foreign material from the air and thereafter exhaust the cleaned air.

12. The method of removing foreign material, such as paint, dust, or the like, from air comprising creating a fast moving, sheet-like free mass of liquid; moving such fast moving mass of liquid against a surface; and passing air laden with foreign material in suspension across and through said free mass of liquid at a speed less than the speed of movement of said free mass of liquid, thereby removing said foreign material from said air.

13. The method of removing foreign material such as paint, dust, or the like, from air comprising creating a fast moving, sheet-like free mass of liquid, moving said mass of liquid in a

generally horizontal direction against a surface; and passing air laden with foreign material in suspension across and through said moving mass of liquid at a speed less than the speed of movement of said free mass of liquid, thereby removing said foreign material from said air.

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14. The method of removing foreign material such as paint, dust, or the like, from air comprising creating a fast moving, sheet-like free mass of liquid; moving said mass of liquid first in a generally horizontal direction against a sur-

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face and then downwardly; and passing air laden with foreign material in suspension across and through said downwardly moving free mass of liquid and changing the direction of air movement upwardly and passing said air across and through said horizontal moving mass of liquid at a speed less than the speed of movement of said horizontal moving mass of liquid to thereby remove said foreign material from said air.

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