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 APPARATUS FOR SUPPLYING AND MIXING A LIQUID
 INTO A GASEOUS MEDIUM
 Filed June 1, 1955

2,883,167

FIG. 1.

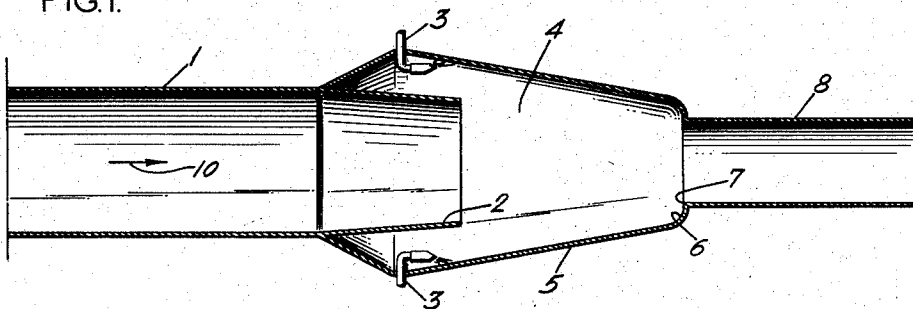


FIG. 2.

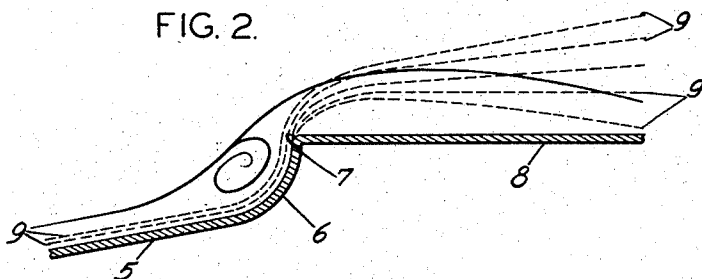
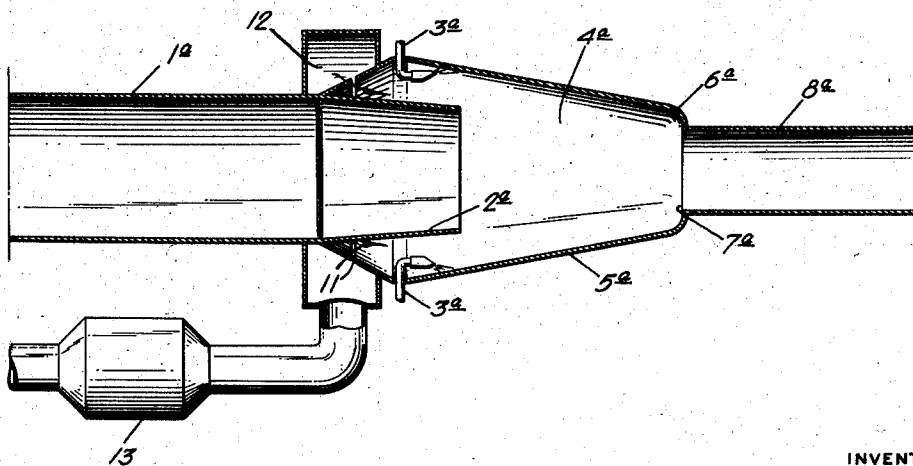


FIG. 3.



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APPARATUS FOR SUPPLYING AND MIXING A LIQUID INTO A GASEOUS MEDIUM

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4 Claims. (Cl. 261—16)

The present invention relates to a device for supplying and spraying a liquid in a gaseous medium flowing in a channel. The need for spraying a liquid occurs within many technical fields. When spraying a liquid in connection with precipitation, liquid particles of the smallest possible size are desired in order to cause an intimate contact with the dust particles. In a similar manner, in humidifying, cooling, dehumidifying, or other conditioning, a division of the liquid into very small particles is desired in order to obtain as great a contact surface as possible. The present invention relates to an apparatus for obtaining said effect by simple means. The invention is mainly characterized in that the flow of gas—after it first may have been free to expand—is contracted abruptly, and that the liquid is conducted towards and is introduced peripherally into the flow of medium at said contraction point, as a thin liquid film, which is caught and broken by the contracted flow of gas and is mixed intimately with the flow of gas in the form of small water particles.

A suitable apparatus for performing the invention consists of a supply conduit for a gaseous medium, which conduit is provided with a concentric expansion chamber, which is formed with an abrupt shoulder defining a restricted orifice to the subsequent portion of the channel. The expansion chamber is provided with means for supplying the liquid, arranged in such a manner that the liquid forms a continuous liquid film around the inner periphery of the chamber, which runs along the convergent envelope surface of said chamber, increasing in thickness towards the said shoulder and orifice to the subsequent portion of the conduit.

Other characteristics of the invention will be evident from the following description and from the claims.

The invention will now be described more in detail with reference to the accompanying drawings, in which:

Fig. 1 is a view in section of a conduit embodying the invention;

Fig. 2 is an enlarged detail of a portion of the apparatus shown in Fig. 1; and,

Fig. 3 is a view similar to Fig. 1 showing a modification within the scope of the present invention.

Referring now to Fig. 1, a tubular supply conduit 1 is provided for supplying gaseous dust-laden medium, the direction of flow of which is indicated by the arrow 10. The downstream terminal portion 2 of the conduit 1 is surrounded by an expansion chamber 4 which is arranged concentric with the conduit 1, this expansion chamber being defined by a side wall 5 and upstream and downstream, inwardly-extending end walls. The side wall 5 of said wall means converges in the direction of flow of the medium and terminates in the inwardly projecting, downstream end wall or shoulder 6, provided with a restricted discharge orifice 7, which orifice is in axial alignment with the downstream terminal portion 2 of conduit 1 and is of less diameter than the downstream end of the wall means and of a diameter less than the smallest interior diameter of the converging side wall 5. As shown,

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a number of inlets 3 for supplying the liquid are arranged in the space between the upstream end of side wall 5 and the terminal portion 2 of conduit 1 which projects into the chamber a distance less than the length of the chamber.

The inlets 3 are disposed peripherally about the chamber, which causes the liquid to run along the inner surface of converging side wall 5 as a thin film under the influence of the gaseous medium flowing through the chamber. In the preferred form of my invention, the downstream end of side wall 5 merges into the downstream, inwardly extending end wall 6 on a gradual, inwardly-extending curve as clearly illustrated in the accompanying drawing, which assists in directing the liquid into contact with the gaseous medium flowing through discharge orifice 7. A discharge conduit 8 corresponding in size to the size of the orifice 7 constitutes a continuation of the supply conduit 1.

Referring now to Fig. 2, it is seen that the liquid fed through the inlets 3 is caused to flow along the side wall 5 in a film by the flow of the gaseous medium through the chamber. Since the side wall 5 converges in the direction of flow of the medium, the film gradually increases in thickness as it approaches the downstream, inwardly-directed end wall or shoulder 6. The end wall or shoulder 6, preferably of inwardly-curved configuration, guides the film of liquid peripherally into the flow of the medium in the chamber, the flow at the orifice 7 being abruptly contracted. This breaks up the liquid into a very great number of small liquid particles, which, as indicated by broken lines 9 in Fig. 2, are mixed intimately with the flowing medium indicated by the full line in Fig. 2.

As shown in Fig. 3, wherein parts similar to those shown in Fig. 1 are designated by similar reference characters followed by the letter *a*, an annular slot 11 may be provided between the side wall 5a of the chamber 4a and the supply conduit terminal portion 2a. A separate gaseous medium, such as air from the surrounding room, may be supplied by a chamber 12 communicating with the slot 11 for the purpose of preventing condensation and/or deposit of dust in the apparatus from the dust-laden medium introduced by the conduit 1. In the alternative, the chamber 12 may be supplied with conditioned air, for example by a conditioner 13 which decreases the viscosity of the liquid supplied by the inlets 3a.

While particular embodiments have been herein disclosed, it is not intended to limit the invention to this disclosure, but changes and modifications may be made therein and thereto within the scope of the following claims.

What I claim is:

1. Apparatus for introducing a liquid into a flowing gaseous dust-laden medium comprising means to supply the dust-laden gaseous medium including a tubular supply conduit having an open, downstream end; wall means defining an expansion chamber surrounding that portion of said supply conduit adjacent the open, downstream end thereof and including a side wall and upstream and downstream, inwardly-extending end walls, said portion of said conduit projecting inwardly into said chamber a distance less than the length of said side wall, the side wall of said wall means converging in the direction of flow of the dust-laden medium and merging into the downstream, inwardly-extending end wall of said wall means downstream from said open, downstream end of said supply conduit, said downstream end of said wall means having a restricted discharge orifice therein in axial alignment with said tubular supply conduit, said discharge orifice being of less diameter than said downstream end wall and of a diameter less than the smallest interior diameter of said converging side wall so as to provide an inwardly projecting shoulder in said expansion chamber surrounding said discharge orifice and located substantially transverse to the direction of flow of said dust-laden gaseous

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medium; and liquid supply means mounted in said expansion chamber about the inner surface of said side wall and surrounding the inwardly-projecting portion of said supply conduit to form a continuous liquid film covering the entire inner surface of said converging side wall so that upon flow of the gaseous medium from said open, downstream end of said supply conduit and through said expansion chamber and said discharge orifice, said liquid film flows along said inner surface toward and into contact with the shoulder formed by said downstream end wall, said converging side wall effecting a gradual increase in the thickness of said film toward said shoulder, said shoulder directing and deflecting said thickened film inwardly into contact with the gaseous medium flowing through said discharge orifice.

2. Apparatus according to claim 1 wherein the downstream end of said side wall merges into said downstream, inwardly-extending end wall on a gradual, inwardly-extending curve to assist in directing said thickened film inwardly into contact with the gaseous medium flowing through said discharge orifice.

3. Apparatus according to claim 1 wherein the upstream end wall of said wall means is provided with an annular slot positioned intermediate that portion of said supply conduit surrounded by said wall means and said liquid supply means for supplying a separate gaseous medium into said expansion chamber, said annular slot communi-

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cating with the surrounding atmosphere and said separate gaseous medium serving to prevent condensation and deposit in said chamber of dust from the dust-laden gaseous medium.

4. Apparatus according to claim 1 wherein the upstream end wall of said wall means is provided with an annular slot positioned intermediate that portion of said supply conduit surrounded by said wall means and said liquid supply means for supplying a separate gaseous medium into said expansion chamber, and wherein there is a separate supply chamber in fluid communication with said annular slot and a conditioner in connection with said separate supply chamber to condition the separate gaseous medium supplied to said expansion chamber through said annular slot.

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