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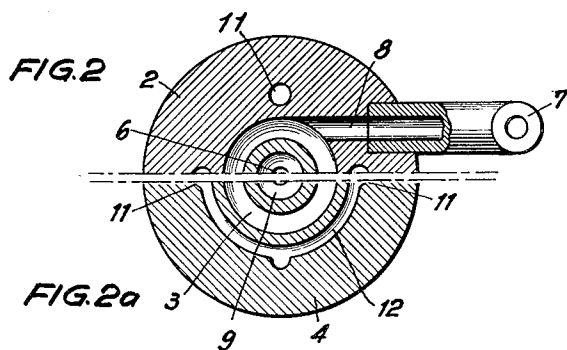
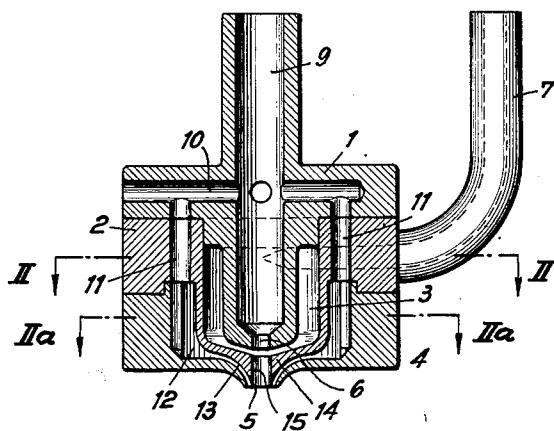
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SPRAYER NOZZLE

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FIG. 1



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SPRAYER NOZZLE

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My invention relates to improvements in sprayer nozzles and, more particularly, to sprayer nozzles for drying or dehydrating liquids such as solutions, emulsions and suspensions, to thereby transform the same into dry powder. Liquids containing dissolved or suspended substances are dissipated for the purpose of drying in order to obtain a great contact surface with the drying gases used in this connection. A successfully employed principle for dissipating such liquids consists in introducing the liquid into rapidly flowing gas. In consequence of the high relative speed between gas and liquid, the latter is torn into finest particles. The dissipating effect on the liquid is achieved by sprayer nozzles of various types.

Especially when spraying tough or adhesive liquids, it was found that the sprayer nozzles lose their efficiency more and more and that they do not work at all after a certain period of operation. This disadvantage is caused by the fact that the nozzle is situated in the hot gas atmosphere of the drying apparatus so that the liquid is evaporated before being sprayed, and solid substances are precipitated. These substances, when arriving at the outlet of the nozzle, obstruct the latter or at least disturb the spraying operation. Furthermore, turbulence in consequence of the high speed is caused outside the nozzle at the outlet of same creating crusts of solid substances which likewise obstruct the spraying effect.

It is, therefore, an object of my invention to provide a method of and device for preventing the formation of incrustations at the nozzle outlet of spray dryers, so that proper functioning of the spray dryer will be assured even though the nozzle has to work in hot air, as is frequently the case with spray dryers.

It is a further object of my invention to provide a sprayer nozzle for drying or dehydrating liquids such as solutions, emulsions and suspensions, in which a portion of the fluid medium used as spraying medium is used for a dual purpose, namely, to cool the liquid conducting chamber or channel means in the nozzle head and to prevent incrustation at the extreme nozzle outlet.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing, in which

Figure 1 is a cross-sectional view of a sprayer nozzle according to the invention,

Figure 2 is a sectional view indicated by line II—II on Figure 1 and showing about one-half

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of the nozzle assembly, and Figure 2a is a sectional view similar to Figure 2 but showing the other one-half of the nozzle assembly and indicated by line IIa—IIa on Figure 1.

Referring to the drawing the sprayer nozzle comprises three main parts, viz. the conduit part 1 for the spraying medium, as e. g. cold air, part 2 forming the liquid containing and/or conducting chamber 3, and part 4 surrounding the outlet aperture 5 of the nozzle. Parts 1, 2 and 3 are arranged concentrically and conveniently secured to another, so that the proper nozzle aperture 6 lies coaxially with and above the somewhat wider outlet aperture 5 of the liquid conducting chamber 3. The liquid to be dissipated is led into the chamber 3 through an inlet conduit or pipe 7 which tangentially communicates with said chamber through the passage 8 as may be seen from sectional view, Figure 2.

In order to prevent incrustations within the liquid chamber 3 on the outlet aperture 5 or other parts of the nozzle due to the influence of the ambient hot atmosphere prevailing in drying apparatus, the invention provides for cooling of the liquid chamber 3. This can, as will be understood, be realized in various ways. The example shown in the drawing provides for cooling by means of the spraying medium itself which is fed through the conduit 9. For this purpose the conduit 9 communicates by passages, channels or bores 10 with corresponding bores 11, and the ring chamber 12 respectively, surrounding the liquid chamber 3. The same part of spraying medium which is taken from the main spraying flow can also be used for preventing incrustations on the outlet aperture 5 of the nozzle if, as shown in Fig. 1, the outlet passage 13 of the ring chamber 12 is disposed to discharge in close relationship to the outlet aperture 5 of the nozzle. Preferably, the outlet section of the ring chamber 12 is profiled to correspond with the acutely tapering outer wall 14 of the nozzle outlet 5, as illustrated.

The nozzle operates as follows. Cold spraying medium, e. g. air, flows through the inlet conduit 9 to the proper nozzle aperture 6 in order to spray the liquid medium conducted to the chamber 3 through the pipe 7 and passage 8, when running down the inner walls 15 of the outlet bore and escaping through the aperture 5. On its way, part of the spraying medium flows through the bores 10, and 11 respectively, into the ring chamber 12, thus cooling the liquid chamber 3 up to its outlet aperture 5 where the

passages 13 discharge the cooling medium from the channel 12, thus preventing at the same time incrustations on this part of the nozzle.

If spraying is effected by hot gas, the bores 10 are dispensed with and the ring chamber 12 is fed through a separate pipe or conduit (not shown) with cooling medium, of gaseous or liquid constitution as the case may be.

Incrustations near the outlet aperture 5 are prevented even then when the spraying medium which escapes in the neighbourhood of the outlet is hot.

The arrangement can also be such that a cooling chamber is continuously fed with water through a separate inlet conduit and the cooling water is discharged from a cooling chamber through a special outlet conduit, while incrustations on the outlet aperture 5 of the nozzle are prevented by a current of air flowing through a properly disposed air inlet conduit into a chamber or into passages the discharge apertures of which being arranged in close relationship to the outlet aperture 5 of the nozzle.

It is also possible to arrange for a cooling chamber between the passages, channels or conduits of the spraying medium and the liquid containing and/or conducting chamber or channels. Important is that in order to avoid the formation of incrustations from precipitated solid particles in the interior of the nozzle, the wall on which the liquid medium moves before escaping from the nozzle, is cooled by means of cold liquid or gaseous media, whilst incrustations due to turbulence are avoided by a current of gaseous medium existing on the place of its formation, said current pushing out the particles of the liquid in the direction of the spraying medium, and serving, as the case may be, at the same time as cooling medium.

It is to be understood that the invention is not limited to the construction as illustrated in the drawings, but includes any modifications within the scope of the appended claims.

I claim:

1. In a sprayer nozzle for use in connection with spray dryers, a first body part provided with conduit means ending in a first nozzle opening for receiving and conveying a spraying medium through said nozzle opening, a second body part associated with said first body part and confining therewith channel means adjacent a portion of said conduit means near said first nozzle opening, said channel means ending in a second nozzle opening arranged in substantially axial alignment with said first nozzle opening and axially spaced therefrom, said second body part also being provided with inlet means communicating with said channel means for receiving the liquid to be dried so the said liquid can be supplied to the space between the said nozzle openings, and a third body part associated with said second body part and confining therewith a cooling chamber having means adapted to convey a cooling medium thereto, said cooling chamber including conduit means ending in a third nozzle opening at the outer edge of said second nozzle opening, said second and third nozzle openings being co-planar.

2. In a sprayer nozzle for use in connection with spray dryers, a first body part provided with main conduit means ending in a first nozzle opening for receiving and conveying a spraying medium through said nozzle opening, said first body part also being provided with branch conduit means branching off said main conduit

means, a second body part associated with said first body part and confining therewith chamber means adjacent a portion of said main conduit means near said first nozzle opening, said chamber means communicating with a second nozzle opening provided in said second body part and in substantially axial alignment with said first nozzle opening, said second nozzle opening being axially spaced from said first nozzle opening, said second body part also being provided with inlet means communicating with said chamber means for receiving liquid to be dehydrated so the liquid can be delivered through said chamber to the space between the nozzle openings, said second body part furthermore being provided with passage means communicating with said branch conduit means, and a third body part associated with said second body part and confining therewith a cooling chamber communicating with said passage means and including conduit means ending in a third nozzle opening at and around the outer edge of said second nozzle means, said second and third nozzle openings being co-planar.

3. In a sprayer nozzle for use in connection with spray dryers for dehydrating liquid such as solutions, suspensions and emulsions, a first body part provided with conduit means ending in a first nozzle opening for receiving and conveying a spraying medium through said nozzle opening, a second body part associated with said first body part and confining therewith channel means adjacent a portion of said conduit means and near said first nozzle opening, said channel means ending in a second nozzle opening arranged in substantially axial alignment with said first nozzle opening, said second nozzle opening being axially spaced from said first nozzle opening, said second body part also being provided with inlet means communicating with said channel means for receiving the liquid to be dehydrated so the liquid can be delivered through said chamber to the space between the nozzle openings, and a third body part associated with said second body part and confining therewith a cooling chamber having means adapted to convey a cooling medium thereto, said cooling chamber including annular channel means surrounding said second nozzle opening and in substantially axial alignment therewith, said channel means tapering toward and ending in a third nozzle opening closely surrounding and co-planar with the edge of said second nozzle opening.

4. In a sprayer nozzle for use in connection with spray dryers for drying liquids such as solutions, suspensions and emulsions, a body having conduit means ending in a first nozzle opening for receiving and conveying a spraying medium through said nozzle opening, said body also being provided with channel means surrounding a portion of said conduit means adjacent said nozzle opening and adapted to receive liquid to be dried, said channel means ending near a second nozzle opening arranged substantially in alignment with said first nozzle opening, said second nozzle opening being axially spaced from said first nozzle opening, said body furthermore being provided with chamber means surrounding said channel means and comprising a tapering portion ending in a third nozzle opening that surrounds and is co-planar with said second nozzle opening for receiving a cooling medium and passing the same through said tapering portion and third nozzle opening.

5. In a sprayer nozzle for use in connection

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with spray dryers for drying liquids such as solutions, suspensions and emulsions, a body having conduit means ending in a first cylindrical nozzle opening for receiving and conveying a spraying medium through said nozzle opening, said body also being provided with channel means surrounding a portion of said conduit means adjacent said nozzle opening and adapted to receive liquid to be dried and ending in a second nozzle opening axially aligned with but spaced from the first nozzle opening, said second nozzle opening also being substantially cylindrical and having a diameter larger than said first nozzle opening, said body furthermore being provided with chamber means surrounding said channel means and comprising a tapering portion ending in a third nozzle opening surrounding and coplanar with said second nozzle opening for receiving a cooling medium and passing the same through said tapering portion and third nozzle opening.

6. In a sprayer nozzle for use in connection with spray dryers, a first body part comprising a hollow cylindrical extension ending in a first cylindrical nozzle opening at the end and adapted to receive and convey a spraying medium through said first nozzle opening, a second body part having a bell-shaped portion spaced from and surrounding said cylindrical extension of said first body part so as to confine with said extension an annular chamber, said bell-shaped portion containing an outwardly tapering part with a second cylindrical nozzle opening therein arranged in substantially axial alignment with but axially spaced from said second nozzle opening to provide a space between the nozzles for introducing the liquid to be dried, means communicating with said chamber for admitting liquid to be dried, and a third body part surrounding said bell-shaped portion so as to confine therewith annular channel means and having a portion of said third body part profiled in conformity with but spaced from said tapering part so as to confine therewith a cone-shaped annular passage communicating with said channel means and ending in a third nozzle surrounding and co-planar with the outer end of said second nozzle opening, said annular channel means having associated therewith means for admitting a cooling medium thereto.

7. A sprayer nozzle for drying or dehydrating liquids such as solutions, emulsions, and suspensions, thereby to transform the liquid being

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treated into a substantially dry powder comprising; a first body part comprising a downwardly directed cylindrical extension, said extension being hollow and terminating at its lower end in a cylindrical nozzle opening for a spraying medium, a second body part mounted on said first body part and comprising a hollow cylindrical portion surrounding the cylindrical extension of the first body part and spaced therefrom, thereby to define channel means with said cylindrical extension, said second body part also comprising a second cylindrical nozzle opening in spaced coaxial relation with said first nozzle opening whereby liquid to be dried can be introduced through said channel means and directed substantially at right angles to the stream of spraying medium passing from said first nozzle opening to said second nozzle opening, and a third body part surrounding said second body part in spaced relation therewith so as to define a chamber for receiving a cooling medium, said third body part having a third nozzle opening surrounding the said second nozzle opening and co-planar therewith, said second body part on the outside thereof surrounding the said second nozzle opening therein tapering inwardly toward the axis of the said second nozzle opening toward the discharge end thereof, and said third body part having a corresponding shape in the same region whereby the supply of cooling medium to the third nozzle opening will serve to prevent the formation of incrustations about the discharge end of the second nozzle opening.

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