Sept. 30, 1952 E. KIRSCHBAUM 2,612,405

SPRAYING NOZZLE

Filed June 5, 1950

Fig. 1

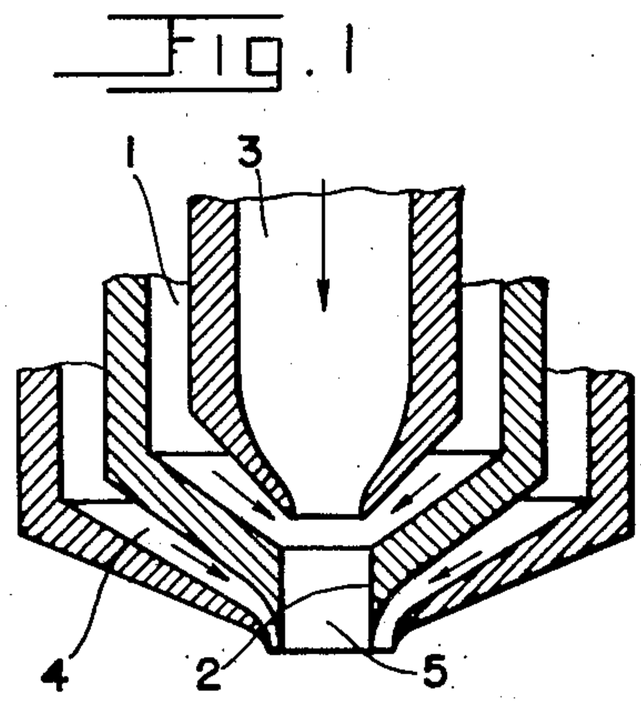


Fig. 2

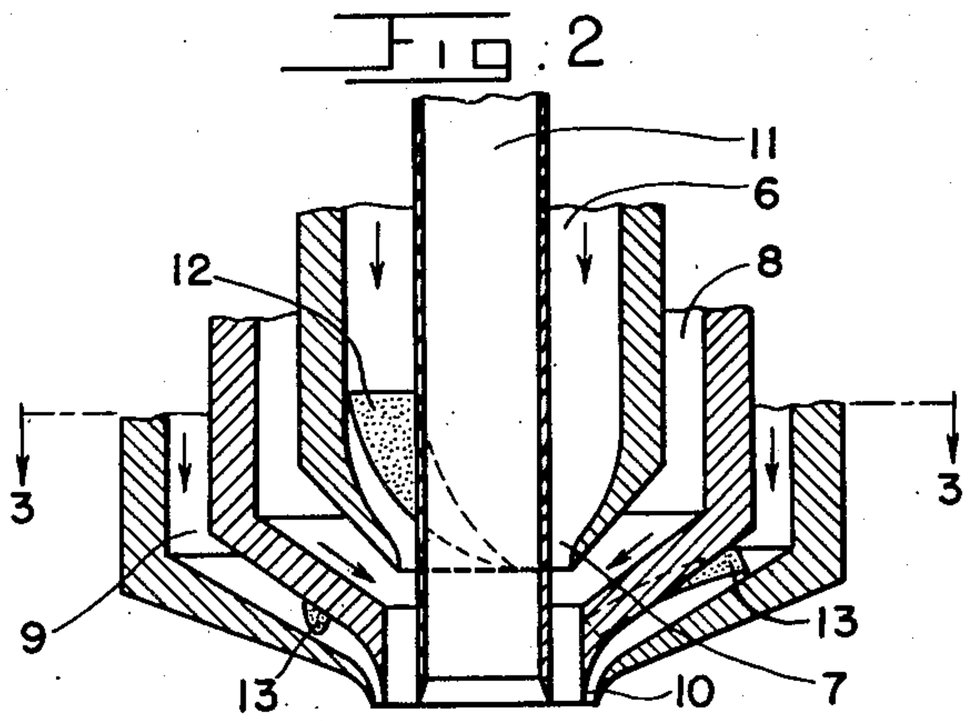
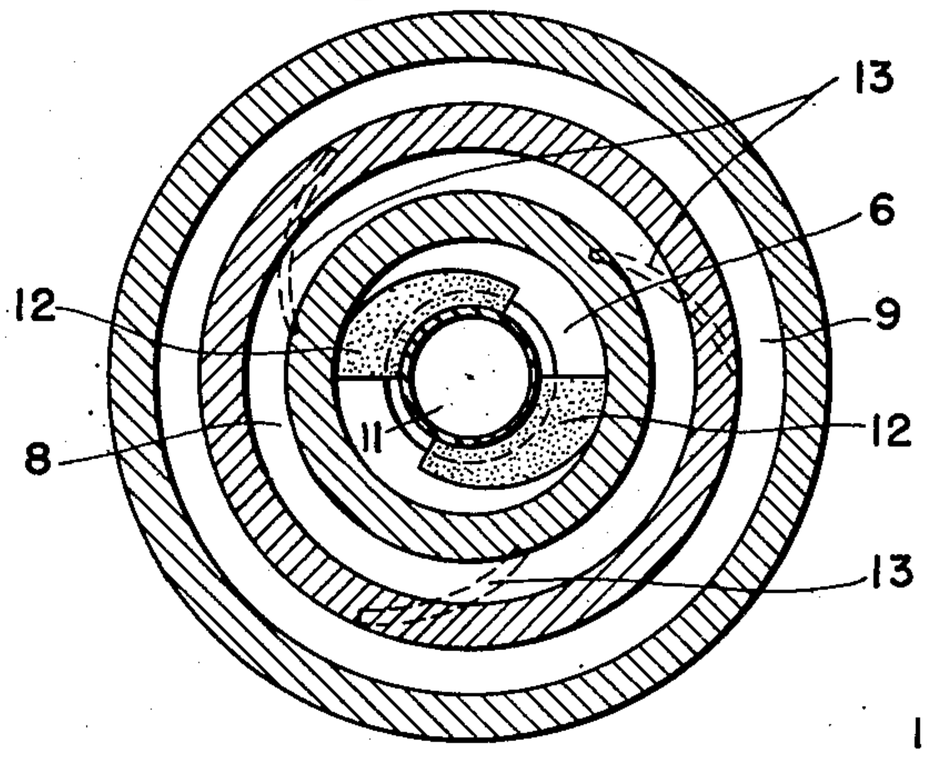


Fig. 3



INVENTOR
EMIL KIRSCHBAUM
by Toulmin & Toulmin
ATTORNEYS

Patented Sept. 30, 1952 2,612,405

UNITED STATES PATENT OFFICE

2,612,405

SPRAYING NOZZLE

Emil Kirschbaum, Grotzingen, near Karlsruhe/Baden, Germany, assignor to Industriewerke Karlsruhe Aktiengesellschaft, Baden, Germany

Application June 5, 1950, Serial No. 166,119
In Germany June 2, 1949

5 Claims. (Cl. 299—115)

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This invention relates to an atomising nozzle.

In the atomisation of liquids, arrangements working on various physical principles are employed. In atomising liquids for the purpose of drying, particular care must be taken that solid substances separating from the liquid do not obstruct the atomising device, and that viscous solutions can also be dealt with.

Of the devices employed for the atomisation of liquids by means of compressed gases, particular practical importance attaches to that in which the liquid is introduced laterally into the rapidly flowing gas. In the case of spraying for drying purposes, the gas and the atomised liquid flow at great velocity into a drying chamber which almost always has the form of a vertical cylinder, which must be of very great length because the two aforesaid substances are conveyed parallel to the axis of the cylinder at one end thereof and because the droplets must remain therein for not less than a certain period of time. The great length of the drying chamber is a fundamental disadvantage because it entails high cost of production, occupies a great amount of space and causes considerable heat losses.

This invention has for its object both to avoid the formation of deposits at the point of discharge of the liquid and to reduce the kinetic energy after the discharge of the liquid from the atomising device, in order that the arrangements in which the atomising device is employed, for example drying towers, may be constructed in simpler forms, and to this end the atomising device according to this invention operates with two gas streams, between which the sprayed liquid particles move after leaving the nozzle mouth, and is characterised by the fact that at least one of the two air streams is set in circular motion before it leaves the nozzle mouth. The arrangement may be such that both gas streams rotate in opposite directions. The rotation of the gas streams can be obtained by guiding devices provided in the atomising device in front of the point of discharge of the gas streams, the said guiding devices having either equal or different pitches. Moreover, the gas streams themselves may have either equal or different velocities in order to influence the whirling effect.

It is preferable to employ the rotation of the gas streams in atomising devices in which, in accordance with a particular feature of the invention, the liquid to be atomised is guided over a wall over which gas also flows parallel to the wall at such a velocity that the liquid atomises on leaving the wall.

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When employing the atomising device in liquid driers, it is preferable to introduce part of the drying air into the drying arrangement through a central nozzle tube.

The invention is illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a diagrammatic longitudinal section through an atomising nozzle of the type to which the present invention is applicable.

Figure 2 is a diagrammatic longitudinal section through a constructional form comprising guide devices according to this invention, and

Figure 3 is a horizontal section through the device shown in Figure 2.

In the atomising nozzle shown in Figure 1, the liquid fed through the annular channel **1** is guided along a wall **2** and is atomised at the nozzle mouth **5** by means of the streams of atomising gas delivered through the ducts **3**, **4** the stream of atomising gas coming from the duct **3** flowing parallel to the wall **2**.

Owing to the surface friction between the gas and the liquid on the wall **2**, the liquid is disintegrated and thus atomised. The stream of gas guided directly to the mouth **5** by the channel **4** serves to effect efficient atomisation such as is required mainly for the operation of spray driers, in which deposits may form at the point of discharge **5** of the liquid mist. The gas and liquid droplets leave the discharge areas in the direction of the axis of the nozzle with such kinetic energy that the liquid mist continues to move at considerable velocity at a great distance from the nozzle, for example at 5 m. This phenomenon, however, necessitates a considerable overall length of the arrangements in which the atomising device is employed, such as drying towers. In order to counteract this, special arrangements of the type hereinafter described may be employed.

In the atomising device shown in Figures 2 and 3, the compressed air at an absolute pressure of, for example, 0.4 atmosphere is delivered through the channel **6**. It expands until it reaches the narrowest cross-sectional area **7** of the nozzle, thus being brought to high velocity. This results in the atomisation of the liquid delivered through the channel **8**. In order that no deposits may form on and around the nozzle outlet, slightly compressed air is also forced through the passage **9** and its annular outlet slot **10**. In order to save compressed air, part of the drying air also flows through the tube **11**, the said drying air being conveyed without any special compression by means of a normal fan

through the drying apparatus. In order to reduce the kinetic energy of the liquid mist after it leaves the atomising device, at least one of the gas streams delivered through the passages 6 and 9 is, in accordance with the invention, set in rotation. This is effected by means of guiding devices 12, 13 provided in the passages 6 and 9. The walls 12 provided in the channel 6 deflect the gas stream tangentially in one direction, for example in the clockwise direction, so that the gas stream, for example air, leaves the area 7 and thereafter the nozzle with a circular motion. In the opposite direction, that is in the anti-clockwise direction, the gas stream, for example air, is also deflected in the tangential direction in the passage 9 by the guide blades 13. This second gas stream thus also leaves the nozzle with a circular motion in the same way as the first, but in the opposite direction thereto. As a result, the two gas streams come into frictional engagement with one another on a surface on which the greater part of the liquid mist is situated. Gas eddies are thereby set up which are permeated by liquid mist. These eddies move at considerably reduced velocity in the axial direction away from the mouth of the nozzle, while filling the drying chamber. The cylindrical length of the drying chamber can therefore be made smaller than when the liquid is atomised without the guide walls according to the invention.

Having regard to the fact that the atomising device in which the subject of the invention is employed always requires an inner and an outer gas stream, it is also possible to impart a circular motion only to one air stream and to cause the other to leave the nozzle axially. Other combinations are also possible for example one in which both the inner gas stream and the outer gas stream are given a circular motion in the same direction but with guide walls 12, 13 of different pitches in the two streams, or at different velocities with guide walls of equal pitch, or at different velocities with guide walls of different pitches. In all cases, friction and eddies are produced at the surface of contact between the two gas streams.

It is clear that the use of the guide blades 12, 13 is not limited to atomisers of the type shown in Figure 1, but may be provided in all cases where gas streams are used for spraying liquids.

I claim:

1. In an atomising nozzle, an inner gas stream conductor an outer gas stream conductor annularly disposed around said inner conductor, an annular liquid conductor disposed between said gas stream conductors, said conductors being coaxial, means in at least one of said gas stream conductors for imparting a circular component to the motion of the gas stream therein before it leaves the nozzle, whereby the discharge from the nozzle spreads over a wide angle, and means at the end of the liquid conductor for directing the liquid inwardly toward the axis of the nozzle to mingle the liquid.

2. An atomising nozzle comprising an inner gas stream conductor, an outer gas stream conductor annularly disposed around said inner conductor, an annular liquid conductor disposed between said gas stream conductors, and means in said gas stream conductors for imparting a circular motion to the gas streams before they leave the nozzle.

3. An atomising nozzle according to claim 2 wherein said means comprises a guiding device in each of said gas stream conductors, the two devices being so disposed as to impart circular motion to the gas streams in opposite directions.

4. An atomising nozzle according to claim 3 wherein said guiding devices comprise spiral blades, the blades in one gas stream conductor being of greater pitch than the blades in the other gas stream conductor.

5. An atomising nozzle comprising an inner gas stream conductor, an outer gas stream conductor annularly disposed around said inner conductor, an annular liquid conductor disposed between said gas stream conductors, means in said gas stream conductors for imparting a circular motion to the gas streams before they leave the nozzle and a further gas stream conductor disposed centrally of said inner gas stream conductors.

EMIL KIRSCHBAUM.

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