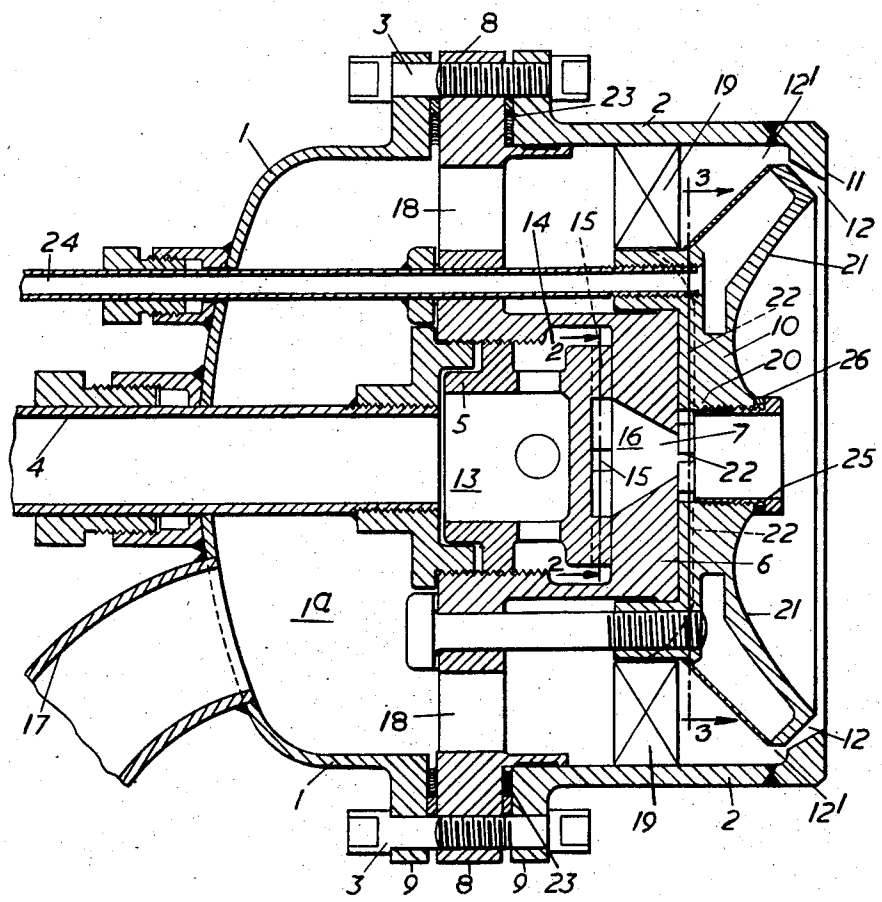
Nov. 25, 1958 R. P. FRASER 2,861,628

LIQUID ATOMISERS

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FIG. 1



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FIG. 2.

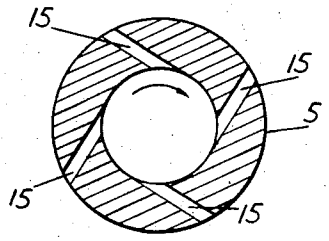
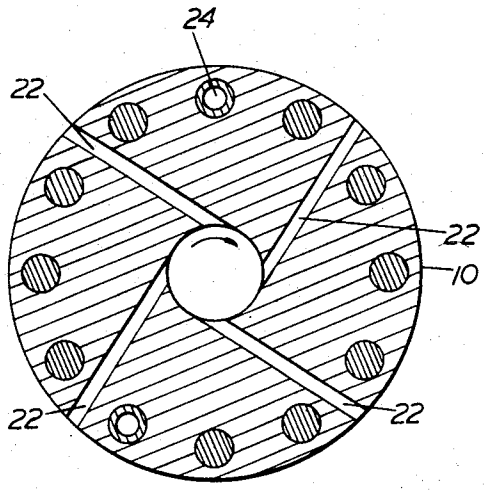


FIG. 3.



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LIQUID ATOMISERS

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Application November 10, 1955, Serial No. 546,134

Claims priority, application Great Britain October 10, 1955

2 Claims. (Cl. 158—75)

This invention relates to liquid atomisers and especially to twin-fluid or blast atomisers of the medium or high pressure type and in which energy is supplied to both fluids. More particularly the present invention is concerned with atomisers of the kind that can be defined as being constituted by the combination of an outer nozzle delivering an annular jet or stream of converging gas, air, or steam, and an inner liquid swirl-spray pressure nozzle the liquid from which issues as an open cone of spray.

Efficient atomisers of the above stated kind are already known and in use comprising a tubular casing within which is mounted a liquid supply member, the front end piece of which constitutes a liquid swirl-spray pressure nozzle for forming an open cone of spray, the exit orifice of the said nozzle being surrounded by a dished or cupped formation, whilst an annular stream of converging gas or air or steam for intensified atomisation of the liquid is supplied through the casing alongside or around the liquid supply member and issues annularly at the rim of the said dished or cupped formation so as to strike the open cone of liquid after it has formed. An example of an atomiser of this kind may be seen in Figure 6 of my pending patent application Serial No. 543,572, and now Patent No. 2,762,656 of September 11, 1956. Such atomisers may be referred to as vortex cup-type atomisers.

The problem of atomisation of the liquid becomes increasingly difficult with increase of discharge or output of the liquid from the pressure nozzle and the chief objects of the present invention are to provide improvements in atomisers of the kind referred to both in functional performance and in construction when dealing with large volumes of liquid.

According to one feature of the present invention a liquid atomiser of the swirl-spray pressure nozzle type is provided with a stationary hollow cylindrical or outwardly conical or flared tube extending axially forward from the central liquid exit orifice of the said nozzle, and with tangential passage at or near the base of the said tube for enabling a gaseous stream such as air or steam under pressure to become whirled and issue as a gaseous liner to the said tube, the diameter or smallest diameter of which is greater than the diameter of the liquid exit orifice. In this way a substantially cylindrical vortex of the gaseous stream is created within the tube, and the liquid film leaving the swirl spray nozzle is accelerated and rotated.

The foregoing feature of improvement applies to atomisers in which a liquid swirl spray pressure nozzle is combined with a concentric outer nozzle delivering an annular stream of gas or air or steam around the said spray nozzle as above referred to. A further feature of improvement applies to such atomisers and consists in making the annular exit passage of the said outer nozzle, progressively convergent-divergent in every cross section of the passage. Alternatively this novel exit formation

may be defined as a two-dimensional convergent-divergent nozzel precessed to generate the improved annular exit. The supply pressure of the gaseous stream may be greater than fourteen pounds per square inch and the said annular exit passage may be designed for controlled gaseous expansion within it such as to create supersonic velocity in the stream.

Atomisers of the twin-fluid kind referred to, when of large size, necessarily have a large facial area exposed to radiation of heat from combustion chambers into which they may project. So long as the liquid and the atomising gaseous stream are flowing through the atomiser they are sufficient to cool the atomiser face, but when the supply is cut off the face of the atomiser may become excessively hot from the heat in the chamber. A still further feature, therefore, of the present invention consists in providing for positive cooling of the atomiser head.

The above and other novel features of the present invention will now be described more fully with reference to the accompanying drawings in which:

Fig. 1 is a longitudinal section of the atomiser according to the invention;

Fig. 2 is a cross section detail view taken along line 2—2 of Fig. 1; and

Fig. 3 is a cross sectional detailed view taken along line 3—3 of Fig. 1.

The body or casing of the atomiser consists of a base or rear part **1** and a cylindrrical open ended front or cap part **2**, these parts being held together by bolts **3**. Through the base **1** of the casing extends axially a liquid supply pipe **4** the front end of which carries a liquid swirl spray nozzle constituted by the hollow liquid atomising member **5**, having swirl grooves **15** on its face, as shown in Fig. 2, and the overlying nozzle piece **6** in the centre of which is the central exit orifice **7**. In the particular construction shown the nozzle piece **6** is formed with a flange **8** which is clamped between opposing flanges **9** on the parts **1** and **2** of the casing. Fitting over the face of the nozzle piece **6** is a cover plate **10**, the front surface of which is inwardly dished or cupped as shown at **21** to constitute a vortex cup formation, and the periphery of which is symmetrically disposed adjacent to but spaced from the rim **11** of the cap **2** so as to constitute an outer nozzle having the converging annular exit passage **12**.

Liquid fed under pressure along the supply pipe **4** enters the rear chamber **13** of the swirl spray nozzle and thence outwardly into the annular space **14**, then back through tangential slots **15** on the face of the member **5** into the swirl chamber **16**, and thence forwardly through the orifice **7** of the nozzle piece **6**.

A gaseous stream such as air or steam is supplied through a pipe **17** to the interior of the base **1** of the casing and passes forwardly along the inside **1a** of the casing through holes **18** in flange **8** and past whirl-imparting vanes **19** to the converging annular exit passage **12** of the outer nozzle.

As already stated an important feature of the present invention is a hollow cylindrical or outwardly conical or flared tube extending axially forward with respect to the central liquid exit orifice **7** of the swirl spray nozzle. This tube is seen at **20** and in the particular construction shown the tube **20** is shown as a hollow forward central projection from the vortex cupped or dished face **21** of the plate **10**. The diameter of the tubular walled passage so provided may be as much as, say, ten times the diameter of the liquid exit orifice. The rear face of the said plate **10** is formed, as shown in Fig. 3, with tangential slots **22** which at their outer ends are open to the interior **1a** of the casing, thereby enabling some of the air or

steam inside the casing to pass along the said slots and into tube **20** at the base thereof. The said tube **20** can extend forwardly as far as or even beyond the transverse plane containing the annular exit passage **12**. The air under pressure passing inwardly along the slots **22**, emerges into the tube **20** tangentially at its base, and forms inside the tube a high velocity substantially cylindrical gaseous vortex advancing along the internal surface of the tube. The free cone of whirling liquid spray that has left the orifice **7** of the liquid spray nozzle and is spreading as a free cone towards the internal surface of the tube **20** meets the air vortex inside the tube **20** and becomes accelerated by it and intimately admixed with it. As soon as this mixture reaches the forward rim of the tube it expands radially outwards as a substantially disc-like sheet and strikes the converging annular stream of air or steam issuing from the annular exit passage **12**.

It is important to observe that the spaced walls of the annular exit passage **12** are not parallel but are convergent at **12'** and then divergent and that the length of the passage in the direction of travel of the air or steam is appreciable so that the air or steam can undergo appreciable increase in velocity (above sonic). The width of the exit passage **12** is determined by the correct choice of a flat washer or shim **23** at the base of the cap **2** of the casing.

The front plate **10** is shown as being hollow, this being so as to enable a cooling fluid to be circulated within its annular cavity for cooling purposes as already explained.

One of the feed pipes for the cooling fluid is seen at **24**, its front end being secured to and leading through the rear wall of the said hollow plate **10**.

The above described tube **20** may be provided with a detachable tubular liner **25**, as shown, for ready interchangeability when desired. The rear rim of the said liner **25** may reach to or slightly overlap the mouths of the tangential slots **22**. With a shim of the thickness shown in Figure 1 the exit mouths of the slots **22** are just clear of obstruction by the liner **25**, but if a thinner shim were used and the liner **25** were screwed down tight onto it, the rear rim or base of the liner would correspondingly overlap the mouths of the slots **22** and thereby alter the effective exit areas, this constituting one way of enabling the effective exit area of the said slots to be changed at will by interchanging the gasket or shim **26** for one of different thickness.

What I claim is:

1. A liquid atomiser consisting of a liquid swirl nozzle having a swirl chamber with tangential passages leading into it and a central exit orifice therefrom, a cover plate fitting over the face of said nozzle and having a central opening around said orifice, a tubular walled passage

extending axially forwardly from said central opening and being itself open to atmosphere at its front end, a casing around said nozzle and cover plate, said cover plate having passages therein leading from inside said casing tangentially into said walled passage at the end thereof adjacent the face of said nozzle for delivering and whirling a gaseous medium under pressure from inside said casing into the rear end of said walled passage to create a gaseous lining inside said passage, the diameter of said walled passage being substantially greater than the diameter of the said swirl nozzle exit orifice, a tubular liner inserted in said tubular walled passage, and means for securing said liner at a plurality of positions along the length of said passage with the rear end of said liner partially obstructing the exits from the tangential passages leading into the said tubular walled passage.

2. A twin-fluid atomiser consisting of a liquid swirl nozzle having a swirl chamber with tangential passages leading into it and a central exit orifice therefrom, a cover plate fitting over the face of said nozzle and having a central opening around said orifice, a tubular walled passage extending axially forwardly from said central opening and being itself open to atmosphere at its front end, a casing around said nozzle and cover plate, said cover plate having passages therein leading from inside said casing tangentially into said walled passage at the end thereof adjacent the face of said nozzle for delivering and whirling a gaseous medium under pressure from inside said casing into the rear end of said walled passage for creating a gaseous lining inside said passage, the diameter of said walled passage being substantially greater than the diameter of said swirl nozzle exit orifice, the said cover plate spreading forwardly and outwardly with the periphery adjacent the front end of the said casing and defining with said front end of said casing an annular space between them serving as a convergently directed annular nozzle, said annular space being convergent-divergent in cross section.

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