Oct. 9, 1951 E. D. BALLARD 2,570,190

FOG-PRODUCING ATTACHMENT FOR FIRE FIGHTING NOZZLES

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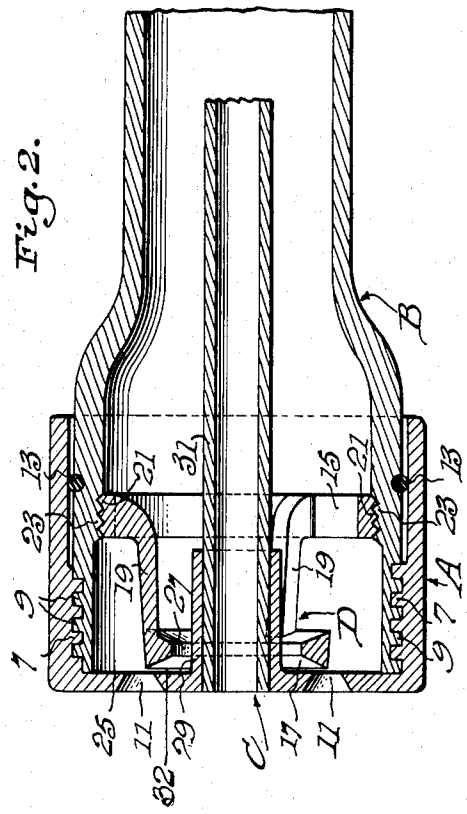


Fig. 2.

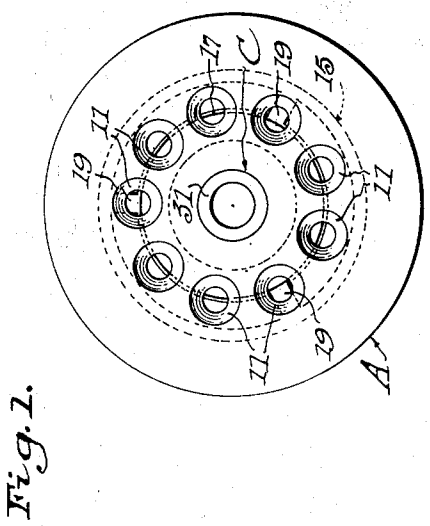


Fig. 1.

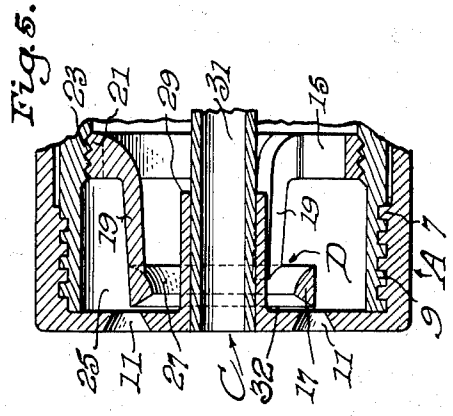


Fig. 5.

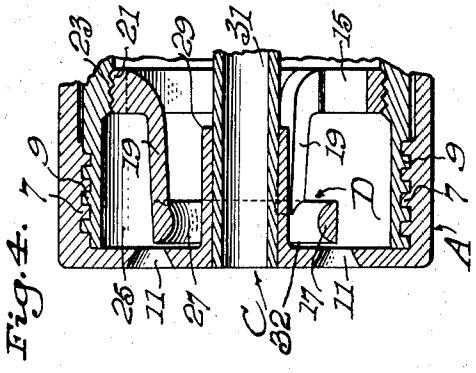


Fig. 4.

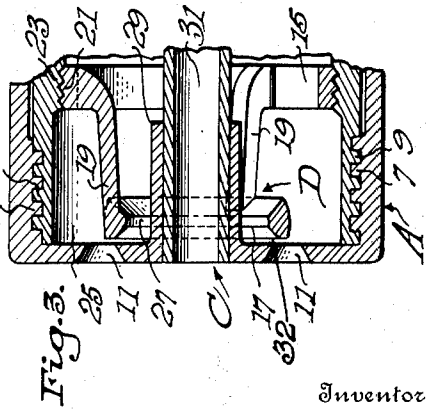


Fig. 3.

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## FOG-PRODUCING ATTACHMENT FOR FIRE-FIGHTING NOZZLES

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7 Claims. (Cl. 299—143)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without payment to me of any royalty thereon.

The present invention relates to an improved nozzle construction for fire-fighting purposes.

It is well known that fires resulting from the combustion of many types of combustible materials produce amounts of radiant heat which render impossible the approach of fire-fighting personnel to within effective fire-fighting distances relative to the site of the combustion. Thus, when gasoline, fuel oil or lubricants become ignited, or, in the case of fires resulting from electrical causes, or, from the intense combustion of incendiary chemical mixtures, a great amount of radiant heat is produced by the rapidity of the combustion. Frequently also in such instances the directing of large volumes of water or other fire-extinguishing liquids tends to cause a scattering of flaming combustibles both from force of impact of the liquids on the combustibles, and also in many instances, from explosive decomposition of the water by the high temperature of combustion of the burning materials.

The production of a coolant curtain or atmosphere between fire-fighting personnel and the fire being extinguished becomes of importance in such instances, and also the application of water in the form of a finely-divided spray or mist to extremely hot flames rather than in the form of heavy streams, are frequent essentials in fire-fighting operations. In many instances, however, a combined spray and solid stream of extinguishing liquid applied to a fire is a desirable expedient, both from the standpoint of personnel protection and also from the standpoint of increased extinguishing efficiency.

The present invention is directed to an improved attachment for fire-fighting nozzles which will produce a combined spray and solid stream of fire-extinguishing liquid which will act in the double capacity of an efficient fire-extinguishing medium and an effective protection for personnel in such instances where the use of a solid stream of extinguishing liquid will not be harmful, the attachment of the present invention producing a fine spray or mist for the establishment of a protective coolant curtain for personnel in combination with a solid stream of liquid for the extinguishing medium, the accompanying spray or mist cooperating with the solid stream as a smothering agent for the fire.

The present invention has for one of its objects the provision of an attachment for fire-

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fighting nozzles, which is simple in construction, and which can be made to discharge a closely controlled pattern and reach of spray or fog produced by the device of the invention.

Further objects of the invention will become apparent as the description proceeds, and the features of novelty will be pointed out in particularity in the appended claims.

The invention will be understood more readily by reference to the accompanying drawings, wherein

Fig. 1 is an end elevation of a nozzle attachment embodying the principles of the present invention;

Fig. 2 is a fragmentary sectional longitudinal elevation through one form of attachment and a part of a nozzle to which the attachment is applied; and

Fig. 3, 4 and 5 are fragmentary views of modified forms of the attachment which may be used interchangeably to produce fog or mist discharges of predetermined pattern and reach.

The invention, as shown in the various illustrative embodiments disclosed in the drawings, comprises an attachment in the nature of a fog head A that is adapted to be threaded on the end of a nozzle B, which includes in turn the discharge outlet C for discharging fire-fighting liquid in a solid stream. The invention also includes a spider cone D which is threadedly mounted in the nozzle B and cooperates with the fog head A to produce a desired character of discharge.

The fog head A is cup shaped and is provided internally with suitable threads 7 which are adapted to register with complementary threads 9 on the outside of the nozzle B. The fog head A comprises a discharge end which forms a closure for the nozzle B, and which is provided with a plurality of discharge holes 11, which are outwardly diverging and evenly spaced within a circle around the center of the head A. An even or an odd number of holes 11 may be provided, there being preferably an odd number, however. The threads 7 may be V-shaped or square, and register with the complementary threads 9 on the outside of the nozzle B for adjusting the head A relative to the nozzle B. A compressible, resilient packing seal 13 may be provided between the head A and the nozzle B. The threads 7 and 9 permit adjustment of the fog head A relative to the nozzle B and the spider cone D.

The spider cone D comprises a large annulus which forms the large end or base of the cone, this end being designated at 15, the small end

of the cone or apex being a small annulus, designated at 17, the apex 17 and the base 15 of the cone being interconnected by spaced arms 19, which are integral with the ends 15 and 17, the cone D being an integral casting. The base annulus 15 is threaded externally, as is indicated at 21, for meshing with threads 23 in the nozzle B, thereby securing the cone D in place. The apex annulus 17 divides the flow of liquid through the nozzle B, producing two streams, one of which passes between the arms 19 and into the chamber 25 and thence through the discharge holes 11 in the fog head A; and the second stream passes through the annular passage 27 between the apex annular 17 and sleeve 29 which slidingly encloses the discharge tube 31 adjacent to the discharge end thereof, and mounts the fog head A on this tube, which discharges a solid stream from the fog head, the tube 31 having a discharge opening at substantially the center of the fog head, the tube 31 extending axially through the nozzle B. This apex annulus 17 also governs the direction and quantity of flow of the said two streams prior to impingement and discharge through the holes 11. As will be seen from Figs. 3, 4 and 5, the apex annulus may be machined so as to cause almost any relative quantity flow and impingement angle between the outer and inner streams. Examples of the manner in which the forward cone 17 may be finished are shown in Figs. 3, 4 and 5. However, it is found in practice that a superior pattern and quality of fog for fire-fighting are obtained when the apex annulus 17 is machined so as to obtain the following conditions:

1. The outer flow should be of equal or greater quantity than the inner flow and the direction of flow should be approximately in line with the axis of the barrel.

2. The inner flow should be of equal or less quantity than the outer flow and the direction of flow should be at an angle of approximately 70° with the axis of the nozzle B.

However, the relative quantities and directions of flow of the two streams may be varied without departing from the scope of the invention.

When the fog head A and spider cone D are assembled, the forward cone 17 divides the flow of liquid in the nozzle B and causes impingement between the streams as they are discharged through the holes 11. This impingement breaks the liquid (e. g. water) into a fine spray or fog. Secondary impingement of the spray streams from the plurality of holes 11 causes still further break-up of the water, the pattern and reach of the spray stream being controlled by adjusting the distance of the fog head A relative to the apex annulus 17 of spider cone D, this adjustment being effected by a predetermined turning of the fog head A on the threads 9. This distance of the fog head from the apex annulus of the spider cone determines the angle of impingement between the two streams, the closer the fog head is to the apex annulus of the spider cone, the greater is the angle of impingement and the broader is the pattern; whereas, conversely, the farther the head A is away from the apex annulus of the cone D, the less is the angle of impingement and the greater the reach, until if the head is moved a sufficiently far distance away from the apex annulus of the cone, the flow of the two streams converges before being discharged, and each hole produces an individual solid stream.



It will be seen from the drawings that the apex annulus 17 is spaced substantially concentrically around the sleeve 29, the annular opening or passage 27 allowing inwardly deflected streams of liquid to pass from the nozzle into a restricted space or chamber 32 between the annulus 17 and the discharge end of fog head A. At the same time, outer streams of liquid are flowing through the chamber 25 and outlets 11, this action creating a suction in the chamber 32, this action, coupled with the expansion of liquid in the chamber 32 as it passes through passage 27, serving to accelerate the rate of passage of the liquid through passage 27, the chamber 32 thereby being a Venturi chamber for accelerating impingement between the outer and inner streams of liquid. In each of the illustrated forms, the annulus 17 is interiorly oppositely tapered for deflecting inner streams of liquid into the passage 27, and allowing expansion of the liquid into and out of the chamber 32 as it passes through the passage 27.

From the various structural modifications shown in the drawings, it will be apparent that the details of the invention may be modified within relatively wide limits without departing from the scope of the invention. The assembly of the fog head A on the nozzle B may be made without provisions for the solid stream through the central pipe 31 in the nozzle. It accordingly will be understood that it is intended and desired to embrace within the scope of the invention such modification and changes as may be necessary to adapt it to varying conditions and uses, as defined in the appended claims.

Having thus described my invention, what I claim and wish to secure by Letters Patent is:

1. A nozzle assembly for discharging liquid from a supply thereof, which comprises, in combination, a nozzle, a fog head adjustably mounted on the nozzle and having a discharge end for the liquid, a tube extending through the nozzle and having a discharge opening in the fog head for discharging a solid stream of liquid from the fog head, a sleeve extending inwardly from the discharge end of the fog head for receiving and mounting the tube, conical means mounted in the nozzle and extending into the fog head to a zone adjacent to the discharge end and including an annulus positioned adjacent to the discharge end of the fog head and concentrically spaced around the said sleeve and tube received therein, the said annulus dividing liquid flowing through the nozzle and fog head into inner and outer streams, the said annulus being interiorly oppositely tapered to deflect inner streams of liquid inwardly towards the sleeve and then outwardly therefrom for producing impingement between the inner and outer streams, the discharge end of the fog head being provided with a plurality of discharge openings concentrically disposed around the tube opening and being partially covered by the said annulus, and means for adjusting the fog head relative to the nozzle for varying positions and angles of impingement between the streams for selectively varying the resulting pattern of the discharge.

2. A nozzle assembly for discharging liquid from a supply thereof, which comprises a nozzle, a fog head adjustably mounted on the nozzle and having a discharge end for the liquid, a tube carried by the fog head and extending into the nozzle and having a discharge opening in the discharge end of the fog head for discharging a solid stream of liquid from the fog head, liquid-deflecting

means mounted in the nozzle and extending to a zone adjacent to the discharge end of the fog head and defining therewith a restricted Venturi chamber while permitting flow of remaining liquid in unchanged direction around the restricted chamber, this chamber communicating with the liquid flowing in unchanged direction, this liquid creating a suction in the Venturi chamber for drawing liquid therethrough and impinging the liquid from the chamber with liquid flowing thereabout, the said discharge end of the fog head having discharge openings adjacent to the liquid-deflecting means, and means for adjusting the fog head relative to the said deflecting means for selectively controlling location and angle of impingement between the liquid streams for selectively varying the resulting pattern of liquid discharged from the fog head.

3. A nozzle assembly for discharging liquid from a supply thereof, which comprises a nozzle, a fog head adjustably mounted on the nozzle and having a discharge end defining a closure for the nozzle, a liquid discharge tube opening through the discharge end of the fog head, means on the fog head supportingly receiving the said tube, the tube extending into the nozzle, means mounted in the nozzle and extending to a zone adjacent to the discharge end of the fog head and carrying an annular member for dividing liquid flowing through the nozzle into separate streams, the annular member having an oppositely tapered internal contour for effecting impingement between the said separate streams, the discharge end of the fog head being provided with a plurality of discharge openings, and means for adjusting the fog head relative to the nozzle and to the annular member for controlling the angle of impingement between the said separate streams, the discharge end of the fog head being provided with a plurality of discharge openings, and means for adjusting the fog head relative to the nozzle and to the annular member for controlling the angle of impingement between the streams and the pattern of the resulting discharged liquid.

4. A nozzle assembly for discharging liquid from a supply thereof, which comprises in combination a nozzle, a fog head mounted on the nozzle having a discharge end forming a closure for the nozzle, the discharge end being provided with a plurality of substantially circularly disposed discharge openings, and a spider cone mounted on the nozzle interiorly thereof and having an apex annulus disposed adjacent to the said discharge openings and partially covering the same, the apex annulus being interiorly oppositely tapered for first dividing liquid flowing through the nozzle into separate streams and then impinging the separate streams adjacent to the discharge openings for producing a discharge as a spray.

5. A nozzle assembly for discharging liquid from a supply thereof, which comprises, in combination, a nozzle, a fog head adjustably mounted on the nozzle and having a discharge end forming a closure for the nozzle, the discharge end being provided with a plurality of substantially circularly disposed discharge openings, a spider cone



mounted on the nozzle interiorly thereof and having an apex annulus disposed adjacent to the said discharge openings and partially covering the same, the apex annulus being interiorly oppositely tapered to first divide liquid flowing through the nozzle into separate streams and then impinging the separate streams adjacent to the discharge openings for producing a discharge as a spray, and means enabling selective advancing and retracting of the fog head relative to the nozzle for controlling location and angles of impingement between the said streams.

6. A fire-fighting nozzle assembly comprising a nozzle, a fog head mounted on the nozzle and having a discharge end defining a closure for the nozzle, the discharge end of the fog head being provided with a plurality of discharge openings, and liquid-dividing means mounted on the nozzle and extending to a zone adjacent to the discharge openings, the said means being positioned in liquid flowing through the nozzle and dividing the liquid into an outer stream and an inner stream, the said means including instrumentalities having a contour effecting impingement of the streams adjacent to the said discharge apertures.

7. A fire-fighting nozzle assembly comprising a nozzle, a fog head mounted on the nozzle and having a discharge end defining a closure for the nozzle, the discharge end of the fog head being provided with a plurality of discharge openings positioned concentrically with respect to the center of the discharge end, and conical liquid dividing means mounted in the nozzle and extending to a zone adjacent to the discharge openings, the said means including a base annulus secured to the nozzle interiorly thereof, an apex annulus positioned adjacent to the discharge openings, and spaced arms interconnecting the base annulus and the apex annulus, the said apex annulus dividing liquid flowing through the nozzle into an inner stream and an outer stream and being tapered interiorly for effecting impingement between the streams adjacent to the discharge openings, these openings being outwardly diverging for producing additional impingement between the resulting discharged spray streams beyond the discharge end of the fog head, thereby further converting the discharged streams into a finely divided spray.

EDWARD D. BALLARD.


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