Aug. 21, 1945. T. W. BURNAM 2,383,433

NOZZLE

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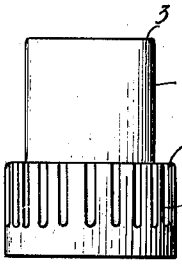


Fig. 1

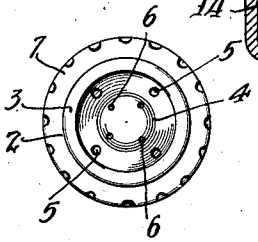


Fig. 2

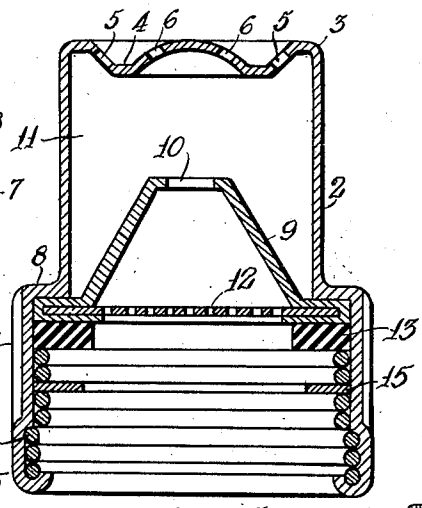


Fig. 3

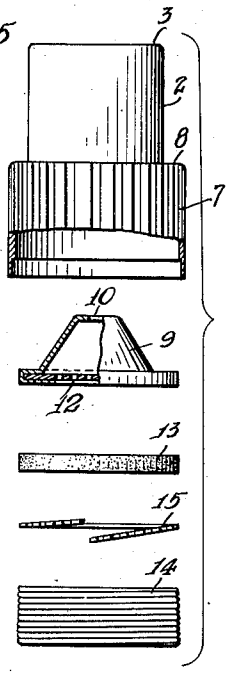


Fig. 4

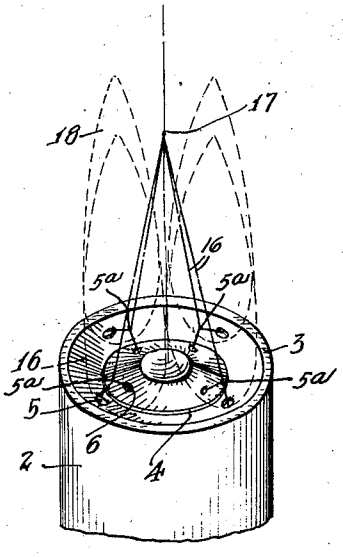


Fig. 5

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NOZZLE

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8 Claims. (Cl. 299—143)

This invention relates to a nozzle of the type intended for creating a fog of liquid particles.

One of the objects of the present invention is to provide a nozzle adapted for use on low pressure fluid sources, as for example in homes and factories, which nozzle is capable of extinguishing or controlling fires and for combating incendiary bombs.

The nozzle of the present invention employs a limited volume of water and has the advantage that it is capable of quickly extinguishing large areas of fires adjacent an incendiary bomb fire without the necessity of using a solid or straight water stream for such purpose. The nozzle of the present invention thereby avoids the danger which accompanies the application of a straight or solid stream of water to a magnesium fire. The nozzle of the present invention produces a water spray of fog in which the water particles are distributed substantially uniformly throughout the spray pattern in front of the nozzle, avoiding the possibility of pockets of combustible gases accumulating within the water spray. With the nozzle of the present invention there is, therefore, no danger to the operator of explosive backfires.

The nozzle of the present invention is furthermore so designed as to project the water a considerable distance in advance of the nozzle, even when the nozzle is operating at low pressures, and at the same time is capable of spreading out the water sufficiently to provide a water curtain between the operator and the fire which protects the operator against excessive heat.

The foregoing advantages of the nozzle of the present invention result from certain discoveries made relative to the action of impinging fluid jets. When a nozzle is provided with orifices so arranged as to form jets which impinge one against the other at a proper position in advance of the nozzle, the fluid may be broken up into a fog or spray in a manner best described, for example, in the United States Patent to Jones, No. 2,235,258. Previous to the present invention, the impinging jet type of nozzle is operated satisfactorily only where the fluid pressure available for application of the nozzle is higher than pressures normally available in homes. The nozzle of the present invention utilizes certain discoveries made concerning the action of impinging fluid jets where the impinging jets are produced by orifices of relatively different diameters. By employing orifices of relatively different diameters in an impinging jet nozzle, I have discovered, among other things, that the nozzle may be made to operate satisfactorily at greatly reduced pressures, while at the same time the projection of the spray created by the nozzle may be very materially increased while still retaining the property of properly subdividing the water or other fluid. The discoveries made, together with various additional advantages thereof, will be more fully understood from a description of a preferred from or example of a nozzle embodying the invention. I have, therefore, described a preferred example of such nozzle in connection with the accompanying drawing, in which

Figure 1 is a side elevation.

Figure 2 is an end view.

Figure 3 is a section.

Figure 4 is an exploded view.

Figure 5 is a perspective illustrating the action of the nozzle at extremely low pressures.

Referring to the drawing, the nozzle comprises a body having a portion provided with cylindrical side walls 2 and with an end wall 3, having an annular V-shaped depression 4 providing inner and outer angled surfaces. A circumferential series of orifices 5 is provided in the outer angled surface of the end wall and a like number of orifices 6 is provided in the inner angled surface. The orifices 5 and 6 are arranged in pairs so that the jets of water or other fluid, which in operation of the nozzle are emitted from the orifices, are capable of impinging one against the other.

The body of the nozzle is also provided with an enlarged portion 7 intended for forming a socket, by means of which the nozzle may be attached to a threaded nipple or fitting, a shoulder 8 thereby being formed between the portions 2 and 7 of the body. Frusto-conical shaped member 9 is provided having a flange on its base resting against the shoulder 8 and having an aperture 10 at its apex to permit passage of water or other fluid. There is thus formed between the walls 2 and 3 of the body and the wall of the conical member 9 a chamber 11 back of the orifices. The volume of the chamber 11 back of the orifices has an effect upon the action of the nozzle. This volume should not be either too large or too small.

The frusto-conical member 9 is preferably provided with a screen 12 across its base, and is held against the shoulder by a packing ring 13 which is, in turn, engaged by a coiled wire 14 which operates as a coupling thread for attaching the nozzle to a threaded fitting. The coiled wire 14 is held in place by a spring washer 15.

The lower edge of the socket portion 7 is turned in slightly to retain the coiled wire 14 in position within the socket.

The action of the nozzle of the present invention is materially governed by the relative diameters of the orifices 5 and 6. The effect produced in the nozzle of the present invention by the use of orifices 6 of relatively smaller diameter than the diameter of the orifices 5 may be illustrated by the following data: When the diameter of the orifices 5 and 6 was made identical (i. e., both drilled with a No. 60 drill), it was found that the nozzle did not properly break up water unless the pressure on the nozzle was at least 30 pounds per square inch and the projection of the water varied from 12 to 17 feet as the pressure on the nozzle varied from 35 to 100 pounds per square inch. When a nozzle was constructed using a No. 56 drill for the orifices 5 and a No. 60 drill for the orifices 6, it was found that the nozzle would operate to break up the water at pressures as low as 20 pounds per square inch, and would project the water from 12 to 19 feet as the pressure on the nozzle varied from 25 to 100 pounds per square inch. When the orifices 5 were formed by a No. 52 drill and the orifices 6 by a No. 60 drill, proper breaking up of the water was secured with pressures as low as 5 pounds per square inch on the nozzle, and the water projected from 16 to 25 feet as the pressure varied from 20 to 100 pounds per square inch. In a nozzle constructed using a No. 48 drill for the orifices 5 and a No. 60 drill for the orifices 6 satisfactory operation was secured with pressures as low as 5 pounds, and the water was projected from 21 to 30 feet as the pressure applied to the nozzle varied from 20 to 100 pounds per square inch. Thus, by changing the relative size of the orifices 5 and 6, the minimum pressure for satisfactory operation was reduced from 30 to less than 5 pounds per square inch, whereas the projection of the water by the nozzle was increased from 17 to 30 feet when the pressure on the nozzle was 100 pounds per square inch. Further improvement by further change in the relative size of the orifices 5 and 6 might be expected from the foregoing tabulation, but in practice I do not find it possible to achieve any substantial improvement. When the area of the outer larger orifices 5 becomes greater than about three times the area of the smaller inner orifices 6, the volume of water projected from the inner orifices to impinge against the volume projected from the outer orifices becomes too small for the nozzle to any longer properly break up or fog the water emitted from the nozzle.

I believe the explanation for the improvement effected in the action of nozzles by the present invention to be as follows:

When the volume of water emitted from the inner orifices 6 is less than the volume of water emitted from the outer orifices 5, only a portion of the volume of water emitted from the outer orifices is broken up into a fog of water particles at the points 5a of impingement of the water jets. As indicated in the perspective view, Figure 5, the remainder of the water from the outer jets 5 is deflected, as indicated at 16, and these deflected portions of the water from the outer orifices 5 undergo what may be considered as a secondary impingement at the axis of the nozzle, as indicated at 17, which secondary impingement serves to insure further breaking up of the water, as well as its projection forward — the result of this action being to extend the distance to which the water is projected by the nozzle. In the particular nozzle shown, four pair of orifices 5 and 6 are arranged circumferentially of the nozzle, but for other specific designs a greater or lesser number may be employed. For best operation, the number of pairs of orifices, however, can not be arbitrarily selected, but the number to be employed should be such that the water spray produced by each individual pair of orifices properly meets and combines with the spray produced by each adjacent pair of orifices. If less than the necessary number of pairs of orifices for this purpose is employed there may be channels in the spray projected by the nozzle which are not occupied by water spray, whereas if a larger number is employed the sprays from adjacent pairs may intermingle to the extent of producing streams of water within the spray pattern. Whether or not the proper number in spacing of the pairs of orifices has been adopted can be determined by operating the nozzle at extremely low pressures. At extremely low pressures the impinging jets in place of breaking the water into fog particles immediately adjacent the point of impingement form small water leaflets, as indicated at 18 in Figure 5. The water leaflets formed by adjacent pairs of orifices should just meet at their points of maximum width. When this condition is fulfilled, the nozzle when operated at higher pressures acts as a single unit forming a spray in which the water is substantially uniformly distributed and in which there are no channels unoccupied by water particles.

The nozzle of the present invention is well adapted for extinguishing fires, and moreover is capable of accomplishing this effect while using extremely low volume of water, so that fires may be extinguished with low water damage. The nozzle of the present invention is also well adapted for handling incendiary bombs. The nozzle of the present invention is readily adapted for rapidly extinguishing fires started in the neighborhood of an incendiary bomb, while at the same time the spray from the nozzle may be applied directly to the magnesium fire itself for accelerating and controlling the burning of the magnesium fire. Furthermore, because of the distance to which the water may be projected by the nozzle of the present invention, the operator may stand at a distance from the incendiary or surrounding fires and be free from danger. The nozzle of the present invention has a further advantage in that the water spray created by the nozzle is effective for protecting the operator from the heat of the fire and enables the operator to approach fires and fight fires safely at positions where without the heat protection qualities provided by the nozzle the operator might otherwise be unable to remain.

The present invention, of course, is not limited to the specific form of nozzle herein shown, but the discoveries of the present invention are capable of being utilized in a wide variety of nozzles, and the invention includes all such modifications and changes as come within the scope of the appended claims.

I claim:

1. A fog nozzle, comprising a body having a plurality of relatively large orifices having intersecting axes and a plurality of relatively smaller orifices having axes which intersect the axes of the relatively larger orifices at points closer to the nozzle body than the point of intersection on the axes of the relatively larger orifices with each other.

2. A fog nozzle, comprising a nozzle body having a circular series of relatively large orifices positioned on axes which intersect, orifices of relatively small diameter corresponding to each

of the relatively large orifices having axes intersecting the axes of the relatively larger orifices at a point closer to the nozzle body than the points of intersection of the axes of the larger orifices with each other.

3. A fog nozzle, comprising a body having an end face with an annular arcuate-shaped groove, a series of orifices in the outer wall of said groove of relatively large diameter and a series of orifices in the inner wall of said groove of relatively small diameter in position to form jets which impinge with the jets produced with the larger orifices.

4. A fog nozzle, comprising a nozzle body having a plurality of pairs of orifices arranged circumferentially on the face of the nozzle, each pair of orifices including an outer orifice of relatively large diameter and an inner orifice of relatively small diameter, such pairs of orifices being formed on axes which intersect shortly in advance of the orifices, the pairs of orifices being arranged so that the liquid emitted from the relatively larger orifices undergoes a secondary impingement.

5. A fog nozzle, comprising a nozzle body having a plurality of pairs of orifices, each pair of orifices including an orifice of relatively large diameter and an orifice of relatively smaller diameter formed on intersecting axes to produce impinging jets, the pairs of orifices being circumferentially spaced so as to form a single liquid spray by joint action of the several pairs of orifices.

6. A fog nozzle, comprising a body having a plurality of pairs of orifices arranged in a circular series, each pair of orifices including an orifice of relatively large diameter and an orifice of relatively small diameter positioned on intersecting axes, the orifices being arranged so that the liquid emitted from the relatively larger orifices which is not broken up by the impingement with the liquid from the relatively smaller orifices undergoes a secondary impingement at a point in advance of the nozzle body, the circular spacing of the pairs of orifices being such that the plurality of pairs of orifices cooperate to produce a single fog pattern.

7. A fog nozzle, comprising a body having a plurality of pairs of orifices, each pair of orifices being adapted to form impinging jets and including an orifice of relatively large diameter and an orifice of relatively small diameter, a frusto-conical shaped member positioned within the nozzle body, and a screening member across the base of said frusto-conical member.

8. A fog nozzle, comprising a body having a socket portion and a nozzle portion, a frusto-conical member within the body and extending into the nozzle portion, the end wall of said body portion being provided with a circular series of pairs of orifices adapted to form impinging jets, the outer orifices of each pair being of relatively larger diameter than the inner orifices.

THOMPSON W. BURNAM.