

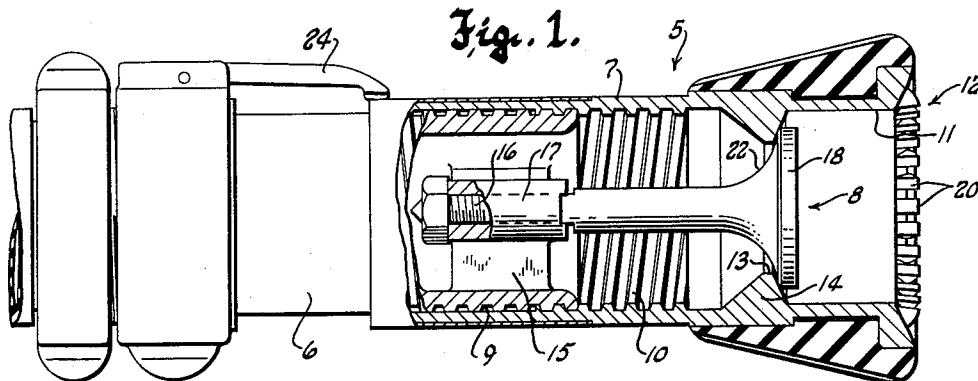
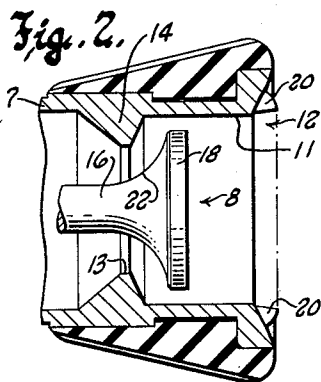
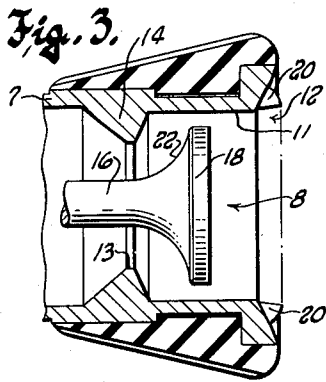
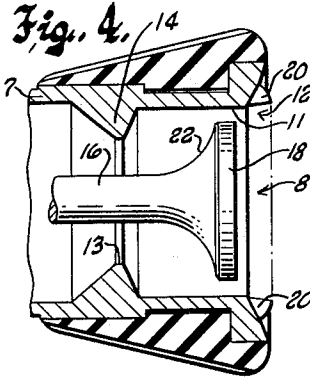
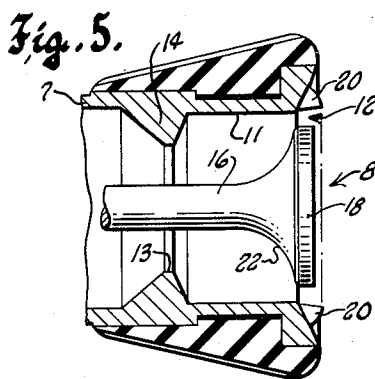
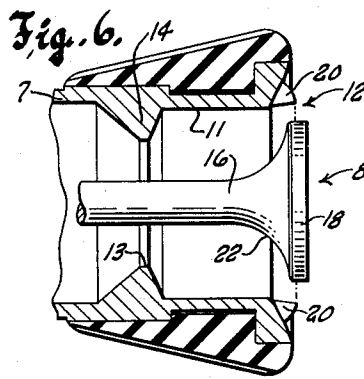
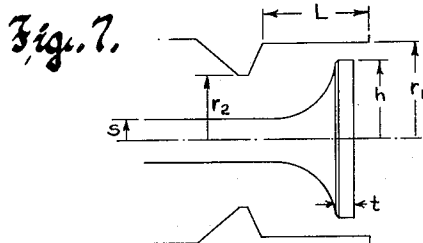
May 17, 1960

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2,936,960

COMBINATION ADJUSTABLE STRAIGHT STREAM AND FOG NOZZLE

Filed Jan. 7, 1959



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COMBINATION ADJUSTABLE STRAIGHT STREAM AND FOG NOZZLE

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Application January 7, 1959, Serial No. 785,380

2 Claims. (Cl. 239—458)

This invention relates to fire fighting apparatus and refers more particularly to fire hose nozzles of the peripheral jet type capable of delivering either a solid stream or a fine fog-like spray.

Combination straight stream-fog nozzles heretofore available for fire fighting have been adjustable to provide a fog spray of various angles or a straight stream having a predetermined discharge rate, but in their straight stream discharge positions they have not been adjustable to afford different rates of output. Moreover, such combination straight stream-fog nozzles heretofore available for use on 2½ in. hand lines have not been capable of discharging 250 g.p.m. in their straight stream position of adjustment. This was a serious disadvantage because it is an underwriter's requirement that every piece of fire fighting apparatus carry one nozzle capable of discharging 250 g.p.m. in a straight stream for each 250 g.p.m. of pumper capacity. For example, with available pumping capacity of 1,000 g.p.m. fire trucks have heretofore had to carry four straight stream nozzles in addition to any combination straight stream-fog nozzles they were equipped with.

The 250 g.p.m. straight stream nozzles heretofore employed were supplied with interchangeable tips of various size and rate capacities in order to meet various conditions and situations encountered in fire fighting. For example, if a drop in water flow rate occurred, due to additional pumps being connected to the fire main or additional lines being laid from the source pumper, or if there was a substantial change in fire intensity, the nozzleman had to shut down his hose and return to the truck for a different nozzle tip. The usual assortment of straight stream nozzle tips carried on a fire truck included nozzles having ⅞ in., 1 in., and 1½ in. outlets.

From the above, it will be readily appreciated that it was heretofore not only necessary to provide fire fighting trucks with a multiplicity of nozzles of various sizes, but that the practice of shutting down hoses in order to change nozzle tips in accordance with varying conditions was particularly objectionable.

With these disadvantages of prior fire fighting nozzles in mind, it is a general object of the present invention to provide a versatile fire hose nozzle which, in a size adapted for installation on a 2½ in. hand line, not only provides straight stream flow at an acceptably high discharge rate, but which may also be adjusted to provide straight stream flow at discharge rates corresponding to those of a plurality of smaller diameter straight stream nozzles, or to provide a highly effective fog spray in another position of adjustment.

Another object of this invention resides in the provision of a combination straight stream and fog nozzle for fire fighting apparatus which is adjustable to provide, in addition to various fog sprays, straight stream discharge at adjustably variable rates ranging from complete shut-off to the maximum required straight stream discharge rate.

It is thus another general object of this invention to pro-

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vide a fire hose nozzle of the character described which the nozzleman can very readily adjust, during use of the nozzle, to meet any of a wide variety of fire fighting situations and conditions.

Another object of this invention resides in the provision of a fire hose nozzle of the type which is adjustable to provide an "off" position, and a plurality of "straight stream" and "fog" positions, wherein the members comprising the nozzle are so proportioned as to insure the versatility described in the preceding statements of object.

It is also an object of this invention to provide a combination straight stream-fog nozzle of the character described wherein change in the adjustment of the nozzle from a full straight stream position to a 30° fog position results in a flow rate increase of less than ten percent, so that the pressure at the pumper does not vary so much as to necessitate any change in pump operation when the nozzle is so adjusted.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a view partly in side elevation and partly in longitudinal section, showing a fire hose nozzle embodying the principles of this invention, with the nozzle adjusted to its "off" position;

Figure 2 is a fragmentary sectional view similar to Figure 1 but showing the nozzle adjusted to a position at which it produces a straight stream of substantially minimum output;

Figure 3 is a view similar to Figure 2 but showing the nozzle in another position of adjustment giving a straight stream output at an increased rate;

Figure 4 is a view similar to Figures 2 and 3, but showing the nozzle adjusted to give a straight stream output of maximum rate;

Figure 5 is a view similar to Figure 4 but showing the nozzle adjusted to provide a fog spray having a 30° angle of dispersal;

Figure 6 is a view similar to Figure 5 but showing the nozzle adjusted to provide a fog spray having an angle of dispersal of about 90°; and

Figure 7 is a diagrammatic view showing the dimensional relationships of the nozzle outlet portion and valve element in the nozzle of this invention.

Referring now more particularly to the accompanying drawings, in which like parts in the several views have like reference characters applied thereto, the numeral 5 designates generally a peripheral jet type combination straight stream and fog nozzle embodying the principles of this invention, and of a size adaptable for connection to a 2½ in. hand line. The nozzle comprises, in general, a body provided by concentric inner and outer inlet and outlet members 6 and 7, respectively, of tubular construction, and a mushroom shaped valve element 8 carried by the inlet member 6 and cooperating with the outlet member 7 to determine the output characteristics of the nozzle.

As is conventional, the inlet member 6 has a screw threaded counterbore in its rear to enable a fire hose to be connected thereto, and a coarse external thread 9 on the front portion of the inlet member cooperates with a

mating internal thread 10 in a medial portion of the outlet member 7 to provide for shifting the outlet member 7 axially forwardly or rearwardly relative to the inlet member as a consequence of rotation of the outlet member in one direction or the other. In other words, relative rotation of the members effects adjustment of their relative axial positions. In all positions of adjustment of the two tubular members, a substantial portion of the outlet member projects forwardly beyond the front end of the inlet member, and water issuing from the latter flows into an outlet throat 11 in the outlet member, adjacent to the mouth 12 of the nozzle, through a restricted passage 13 defined by an annular valve seat member 14 in the outlet member, spaced inwardly from the mouth of the nozzle.

Fixed in the front portion of the inlet member is a spider 15 by which the valve element 8 is coaxially supported with its stem 16 anchored in the hub 17 of the spider. The stem projects forwardly through the restricted passage 13 in the valve seat to dispose the head 18 of the valve in the outlet throat 11 where it determines the different types of discharge upon rotation of the outlet member from one position to another relative to the inlet member.

The outlet throat 11 in the front portion of the outlet member is provided by a uniform diameter bore of substantially greater length than the corresponding outlet portions of prior fog nozzles. The inlet to the throat, of course, is defined by the restricted passage 13 in the annular valve seat 14, the latter being formed integrally with the outlet member and being engageable by the head 18 of the valve element to block flow of water into the throat when the outlet member is moved to its most forward or "off" position, shown in Figure 1.

Adjustment of the nozzle of this invention to provide a wide range of straight stream output rates is provided for by reason of the substantial length of the throat of the outlet member, in front of the valve seat 14. As the outlet member is moved rearwardly relative to the head 18 of the valve element by relative rotation of the body members away from the "off" position, through the successive positions shown in Figures 2, 3 and 4, the throat provides for increasing rates of straight stream output up to the point where the front face of the valve element head is nearly even with the front end of the uniform diameter bore that defines the throat. Thereafter further rearward movement of the outlet member relative to the valve, to a position (shown in Figure 5) in which the widely divergent mouth at the front end portion of the outlet member is substantially in radial alignment with the valve head, adjusts the nozzle for a fog spray output having a relatively narrow angle of divergence, on the order of 30°. In the most rearward position of the inlet member, shown in Figure 6, the valve element head is projected slightly forwardly out of the mouth of the nozzle, and its output takes the form of a fog spray having a substantially wide angle of divergence, in the neighborhood of 90°.

The two fog spray positions are conventional, as is the manner in which the valve element head cooperates with the front end portion of the outlet member to provide these two types of fog discharge. Also conventional are the tooth-like deflectors 20 around the mouth of the nozzle, by which the stream issuing from the nozzle in its fog positions is partially broken up and deflected radially inwardly so that the cone of fog spray produced by the nozzle has a substantially uniform intensity across its entire cross-sectional area.

The high output capacity of 250 g.p.m. in the straight stream condition illustrated in Figure 4 is achieved in a 2½ in. hand line nozzle embodying the principles of this invention by reason of the proportioning of the throat 11, the valve element head 18 and the inlet orifice 13; and the relationship of these elements also accounts for the wide range of adjustability of the discharge rate of

the nozzle in its straight stream condition. Specifically, the uniform diameter bore providing the throat 11 should have an axial length which is at least equal to the radius of the head 18 of the valve element plus the axial dimension or thickness of the valve head. The length of the throat should also be equal to at least five times the radial distance between the periphery of the valve element head and the wall of the throat. It will be seen that with this dimensional relationship, the head 18 can have a substantial amount of relative travel along the throat, through a wide range of positions in which a straight stream discharge is produced, each position of the valve head producing a different discharge rate and the lowest rates of discharge occurring when the valve element head is nearest its seat 14.

It is also important that the effective area of the throat be substantially less than the effective area of the inlet 13 to the throat; that is, the area of the annular space between the periphery of the valve head 18 and the wall of the throat should be at least about 80% of the area of the annular space between the valve element stem 16 and the wall of the restriction 13.

Referring to the Figure 7 diagram, if

L = length of throat
 r_1 = radius of throat bore
 r_2 = radius of restricted throat inlet
 s = radius of valve stem
 t = thickness of valve head
 h = radius of valve head

then:

$$L = \text{or} > h + t$$

and

$$\frac{\pi r_1^2 - \pi h^2}{\pi r_2^2 - \pi s^2} = \text{about } 85\%$$

A contributing factor to the versatility and superior performance of the valve of this invention is the substantially large fillet 22 at the junction of the stem and head of the valve element. The radius of this fillet is at least substantially equal to the radius of the valve head less that of the valve stem.

As a specific example, a nozzle embodying the principles of this invention and intended for connection to a 2½ in. hand line was provided with a uniformly bored throat 11 that was 2" in diameter and 1½" long, and a valve element having a head 1⅞" in. diameter. The valve head was ⅜ in. thick, measured at its periphery. The diameter of the orifice 13 defining the inlet to the throat was 1½½" and the stem 16 of the valve element had a diameter of ⅞". With these proportions it will be observed that the length of the uniform diameter throat was slightly greater than the radius of the valve element head plus its thickness, and the effective area of the space around the periphery of the valve head was on the order of about 85% of the effective area of the inlet 13 to the throat.

With the nozzle so proportioned, its straight stream output rate was adjustable from "off" to 250 g.p.m., with an infinity of adjustments between those limits being available. However, it may be desirable to define positions at which the outputs of the nozzle correspond to those of ⅞ in., 1 in. and 1½ in. straight stream nozzles, so that the nozzle man, when making adjustments, will have a ready standard of reference with which he is familiar. In that case, a finger 24 mounted on the rear of the inlet member 6, with its free end bearing upon the exterior of the outlet member 7 may be cooperable with indicia thereon, or with a combination of indicia and detent defining means (not shown) on the outlet member to precisely indicate to the nozzle man when any of the aforementioned settings have been attained.

It was also found that with a nozzle having the dimensions described, change in the nozzle adjustment from the nominal 1⅞ in. straight stream position to the 30°

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fog position resulted in an increase of only about 10% in the rate of output, as compared with previous fog nozzles in which the output rate usually objectionably increased by about 25% when the nozzle was shifted from straight stream to fog position. Hence with the nozzle of this invention change of adjustment from straight stream to fog, or vice versa, does not necessitate adjustment at the pumper, as was the case with fog nozzles heretofore known. It was also observed that the nozzle of this invention produced a straight stream which had no tendency to break up at high pressures and which therefore had very substantial reach.

From the foregoing description taken together with the accompanying drawings it will be apparent that this invention provides a fog nozzle for fire fighting equipment which is unusually versatile because it provides not only the fog spray adjustments heretofore found on fog nozzles, but also provides a number of straight stream adjustments corresponding to those of various standard straight stream outlet nozzles, thus eliminating the need for carrying a number of other nozzles on a fire truck equipped with the nozzle of this invention.

What I claim as my invention is:

1. A fire hose nozzle of the type which is adjustable to provide either a fog spray or a straight stream and comprising a mushroom shaped valve element having a stem and an enlarged head on the outer end of the stem, a tubular member which is axially adjustable relative to the head of the valve element, said tubular member having a concentric throat portion at its front in which the head of the valve element is coaxially disposed, and a coaxial restricted bore portion spaced from its front end defining the inlet to said throat portion and providing

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a valve seat engageable with the head of the valve element in one position of axial adjustment of the tubular member to block flow of water into the throat portion, the stem of the valve element passing through said restricted bore portion: said fire hose nozzle being characterized by the fact that its throat portion is provided by a uniform diameter bore, and the length of said throat portion is not less than the radius of the head of the valve element plus the axial thickness of the head; said fire hose nozzle being further characterized by the fact that with the valve unseated the area of the annular space between the wall of the throat bore and the head of the valve element is equal to approximately 85% of the area of the annular space between the valve stem and the wall of the restricted inlet to the throat portion.

2. The fire hose nozzle of claim 1, further characterized by a concave fillet connecting the rear of the valve element head with the stem of the valve element, said fillet having a radius of curvature substantially equal to the radius of the valve element head less that of the valve element stem.

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