Oct. 25, 1949. N. A. FITZGERALD 2,485,723

FIRE FIGHTING APPARATUS

Filed Oct. 7, 1946 2 Sheets-Sheet 1

Fig. 1.

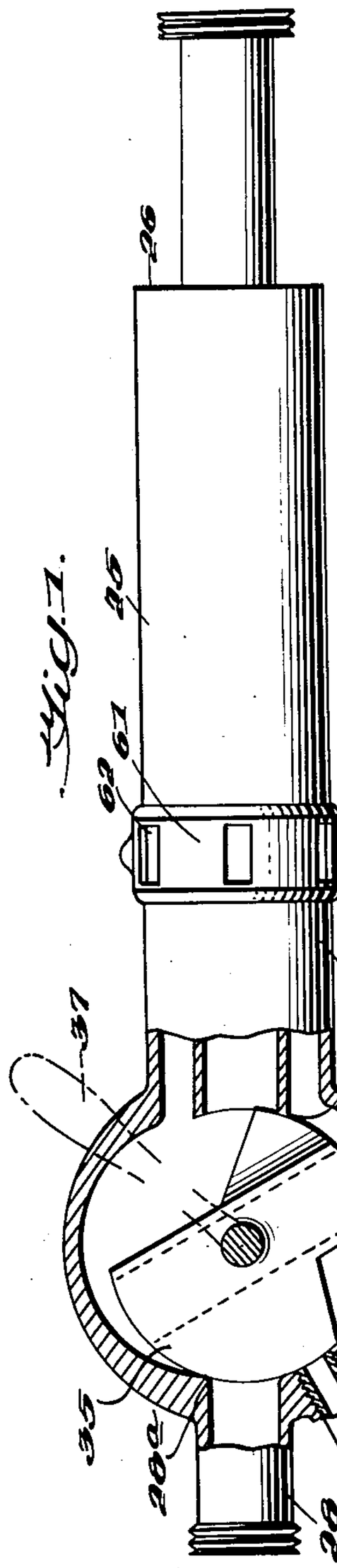

Fig. 2.

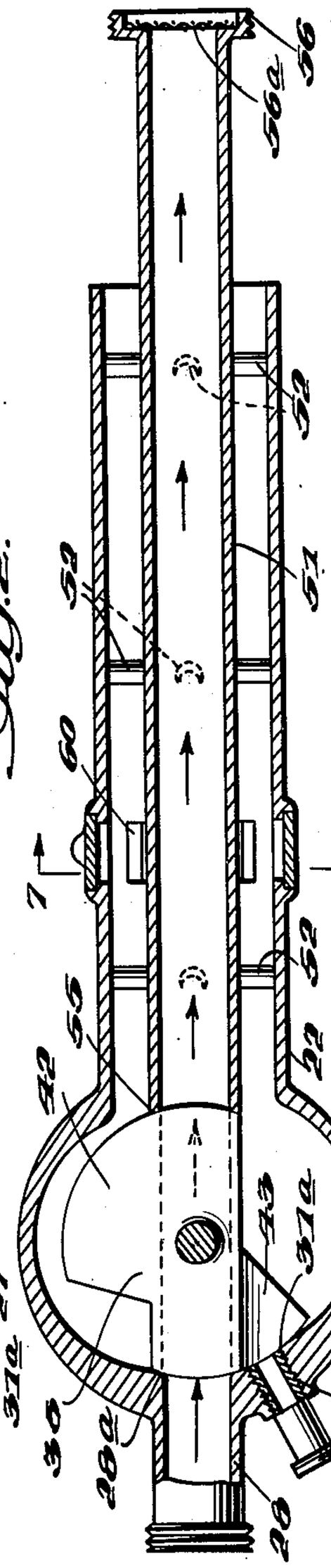

Fig. 3.

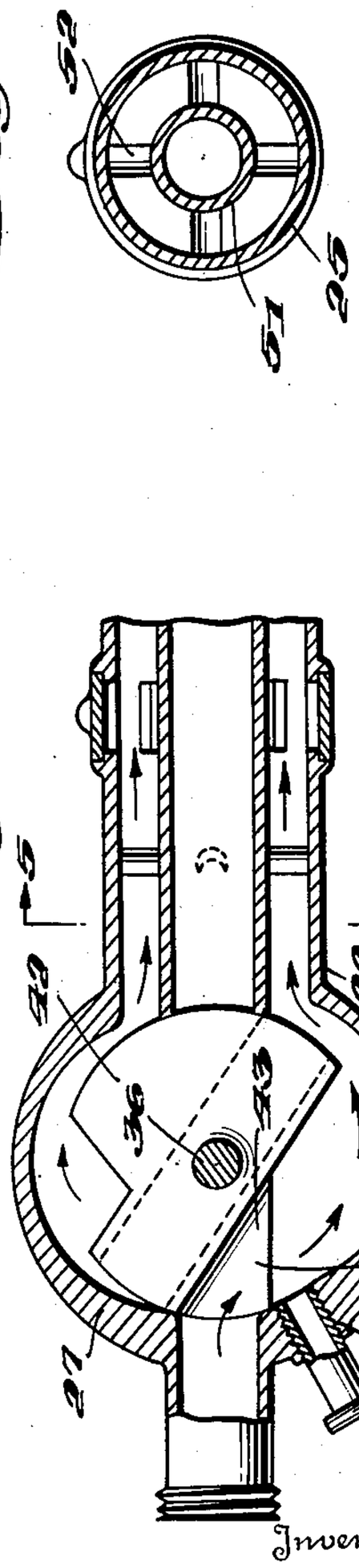

Fig. 4.

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FIRE FIGHTING APPARATUS

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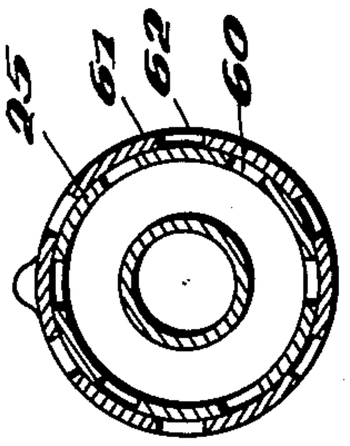

Fig. 7.

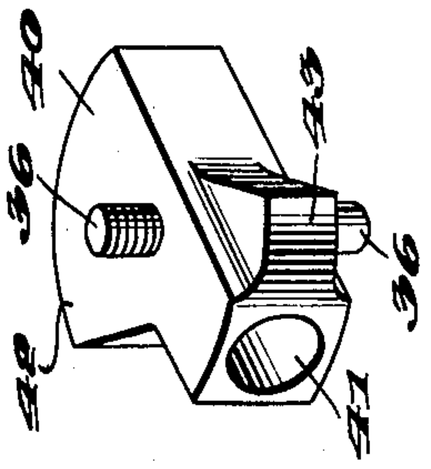

Fig. 6.

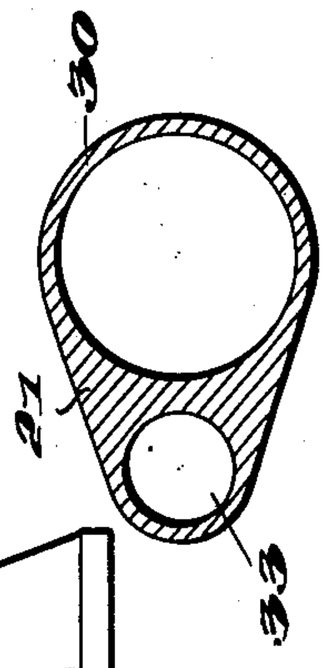

Fig. 9.

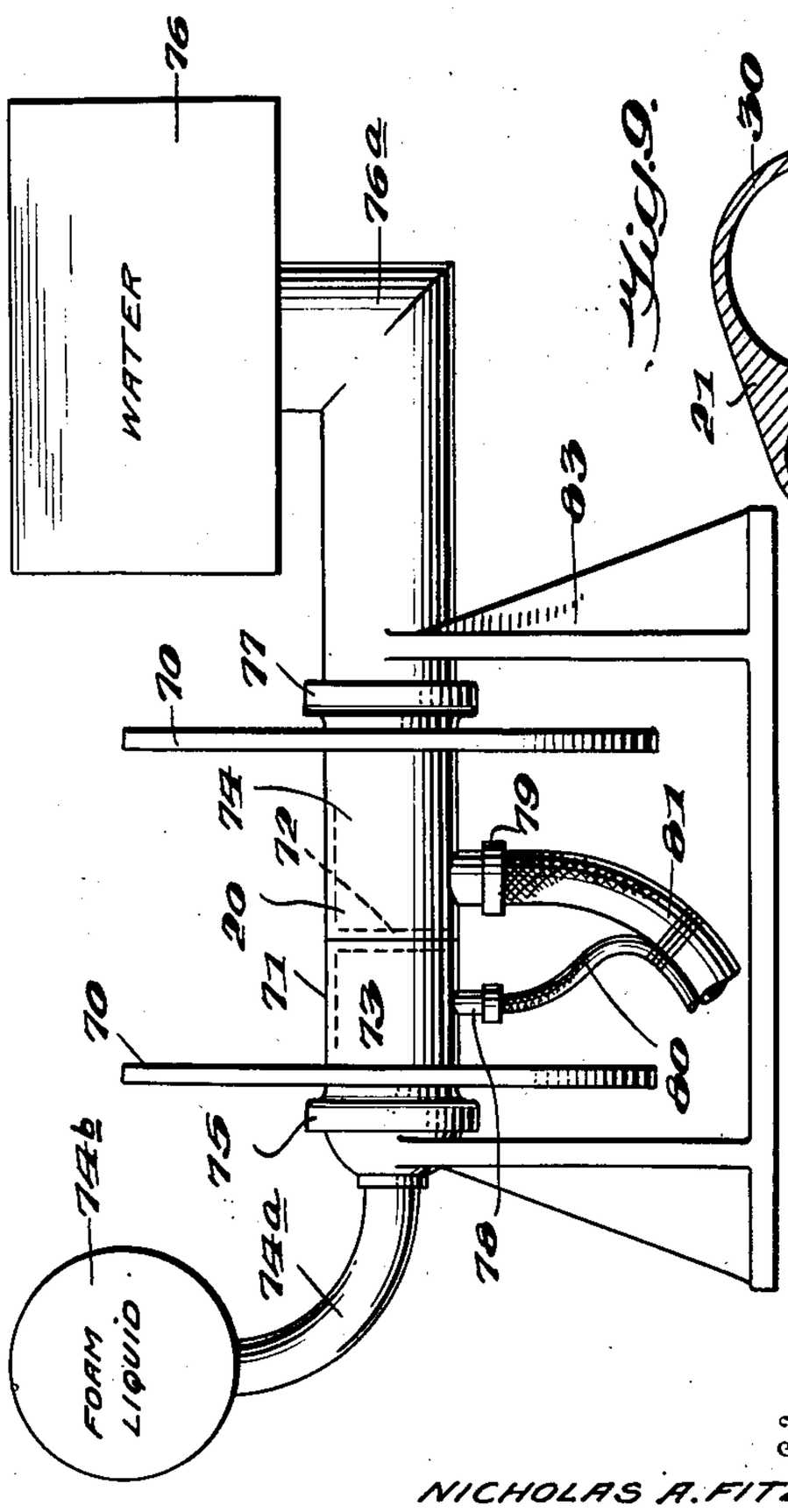

Fig. 8.

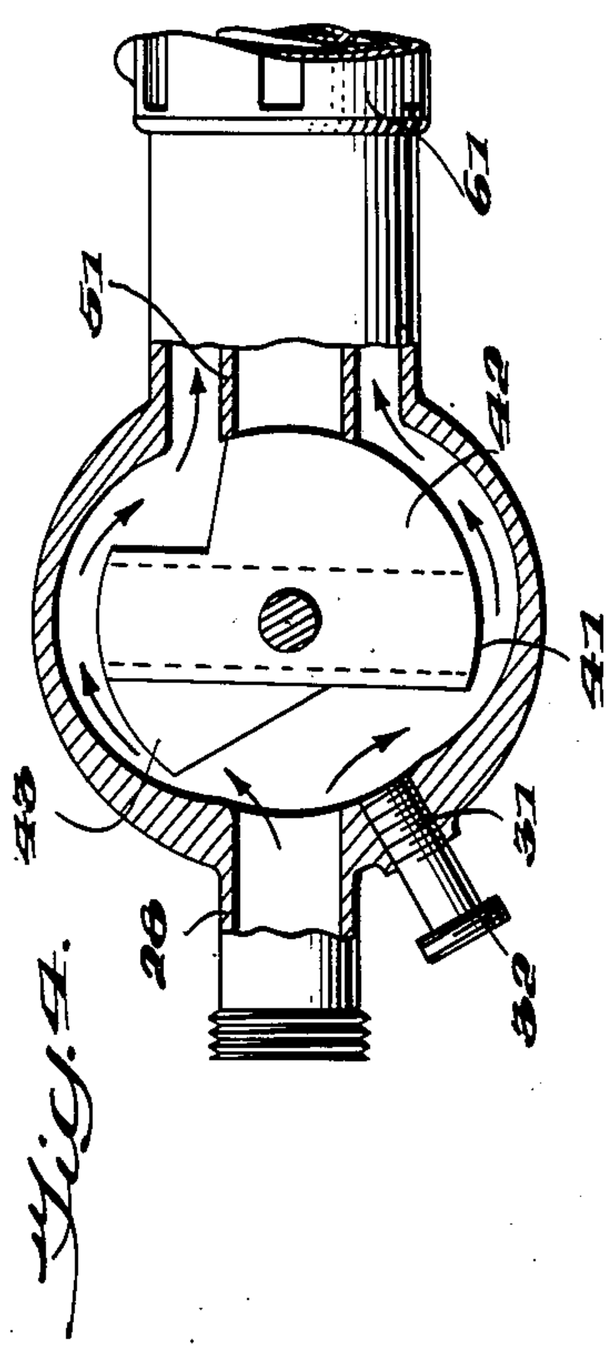

Fig. 4.

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UNITED STATES PATENT OFFICE

2,485,723

FIRE-FIGHTING APPARATUS

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Application October 7, 1946, Serial No. 701,763

20 Claims. (Cl. 169—14)

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This invention relates to fire fighting apparatus, and more particularly to the type of apparatus used in combating fires in burning aircraft, ships, or other similar fires where both foam and fog must be available.

In fighting fires accompanying airplane crashes, two types of fire combating agents are now commonly used. These are fog and foam. The former is simply a man made fog of water droplets suspended in air while the foam consists of minute air bubbles suspended in a soap-like foaming agent. The fog is used to extinguish the fire while the foam is used to blanket extinguished areas to prevent their being re-ignited.

Such fires must be brought under control very quickly if men trapped within the wreckage are to be saved and if substantial damage to the ship's deck is to be prevented in the case of a crash on an aircraft carrier. The bringing of the fire under control should be accomplished within 30 to 50 seconds in order to accomplish these purposes.

At present, each firefighting crew on air fields and on aircraft carriers comprises 7 or 8 men who do nothing but fight fires which ensue after aircraft crashes. These men use foam and fog, but with the present equipment, either separate groups are assigned to the foam and fog equipment, or else a different nozzle must be placed on the equipment each time it is desired to change from foam to fog or vice versa.

The crew members using fog usually advance into the fire first to extinguish the fire with the fog after which the crew men using foam blanket the area with foam. Thus those advancing with fog must often walk through "spills" of gasoline which, although not afire, are open to the air and are not blanketed with foam. These "spills" may become ignited at any minute with disastrous results for the "fogman" standing in the midst of the gasoline.

Where the same equipment is used with interchangeable nozzles, the fire is first extinguished in an area by fog after which the fog nozzle is removed and the foam nozzle placed on the equipment. This requires time and places the crew at a disadvantage, often fraught with considerable danger, as in the case where an area which has been extinguished and which is about to be blanketed with foam, suddenly becomes re-ignited, requiring return to the fog nozzle in order to reextinguish the fire.

The crew members using fog carry liquid foam in "hip packs" which must be replenished by

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crew members who carry fresh packs to them when needed. The heavy "hip packs" are unwieldy and bulky and greatly hinder the crew men who carry them.

It must now be apparent that the present equipment is hopelessly inadequate and is not at all conducive to the rapid extinguishing of fires, to the safety of the firefighters, or to the most efficient utilization of personnel which is vitally necessary on warships and about crowded airfields.

Accordingly it is a primary object of the invention to provide fire fighting equipment which obviates the above enumerated difficulties.

Another object of the invention is to provide fire fighting equipment which immediately provides fog or foam from the same device at the will of the operator and without removal or replacement of parts. Fog is produced by the equipment at high pressure, while if foam is desired, the mere turn of a lever delivers high or low pressure foam, or turns off the device.

A further object of the invention is the provision of a novel valve and nozzle arrangement which by a very simple operation can supply fog at high pressure, high or low pressure foam, or can turn off the flow altogether.

Another object of the invention is to provide a novel reel having foam liquid and water supplies and particularly adapted for use with the valve and nozzle arrangement of the invention.

A further object of the invention is to provide a novel type of hose for use with the apparatus.

These and other objects of the invention will be apparent from the following specification and the accompanying drawings, in which

Fig. 1 is a side elevational view of the nozzle with a portion of the valve casing broken away to show the valve in the off position;

Fig. 2 is a longitudinal sectional view of the nozzle showing the valve in the fog position;

Fig. 3 is a view similar to Fig. 2 but with the valve in the low pressure foam position and the forward portion of the nozzle broken away;

Fig. 4 is a view similar to Fig. 3 but with the valve in the high pressure foam position and a portion of the nozzle shown in elevation;

Fig. 5 is a cross sectional view taken on line 5—5 of Fig. 3;

Fig. 6 is a perspective view of the rotatable portion of the valve;

Fig. 7 is a cross sectional view taken on line 7—7 of Fig. 2 through the adjustable air inlet and showing the air supply openings entirely closed;

Fig. 8 is a partly schematic front elevational view of the reel for use with the nozzle shown in the preceding views; and

Fig. 9 is a cross sectional view of the hose used with the apparatus.

In a preferred embodiment of the invention as shown in the drawings, the fire fighting apparatus comprises, in general, a reel 20 shown in Fig. 8 which supplies foam liquid and water through a two channel hose 21 (Fig. 9) to a nozzle 22 where the flow is controlled by a valve designated generally by the numeral 23.

Nozzle

Nozzle 22 comprises an elongated tube 25 open at its front end 26 and enlarged at its rear end to form a bulbous valve housing 27. The extreme rear end 28 of the nozzle comprises a water inlet and is of reduced diameter. The water inlet 28 is fitted in any conventional manner such as by threads 29 to be attached to the water carrying channel 30 of hose 21. Reduced rear end 28 of the nozzle is axially aligned with the forward portion of the nozzle.

An opening 31 considerably smaller in diameter than water inlet 28 is provided in the bulbous valve housing 27 near the water inlet 28 and disposed at an acute angle with respect to the water inlet and the axis of the nozzle. Opening 31 comprises a foam liquid inlet and is provided with an attachment 32 for receiving foam liquid from the smaller channel 33 of the hose 21.

A movable valve member 35 is rotatably mounted within valve housing 27 on pivot rods 36 which extend from each side of the member at right angles to the plane in which water inlet 28 and foam liquid inlet 31 are disposed. One end of one of the pivot rods 36 extends through a liquid tight packing (not shown) to the exterior of the valve housing 27 where it carries a valve operating handle 37 (Fig. 1). By moving handle 37, the pivot rods 36 and movable valve member 35 are rotated within the valve housing. The other pivot rod 36 may conveniently be received by a suitable bearing (not shown) in the inner surface of the valve casing.

The movable valve member 35 is of novel construction and as shown in perspective in Fig. 6 comprises for convenience of description a portion of a flat sided disk, one flat surface of which is shown at 40. Portions of the disk are cut away and a hole 41 substantially the diameter of the water inlet 28 extends diametrically through the member. Pivot rods 36 extend from the flat surfaces 40 of the disk and are located at the exact center of the disk. The thickness of the disk is only sufficiently larger than inlet 28 to provide a thin wall about hole 41.

The cut away portions of the disk leave extending portions 42 and 43 on opposite sides of the central disk portion through which hole 41 extends, the peripheries of each portion comprising extensions of the peripheral portions of member 35 lying at opposite ends of hole 41. Portion 42 occupies a considerably larger portion of the periphery of the movable valve member than does portion 43 and is of the same thickness as the original disk. The arcuate length of portion 42, exclusive of course of the adjacent part of member 35 occupied by hole 41, is greater than the distance taken from edge 28*a* of water inlet 28 to the remote edge 31*a* of foam liquid inlet 31 so that portion 42 when in the totally closed position of Fig. 1 closes both inlets. The length of the periphery of portion 43 is roughly equal to the inner diameter of water inlet 28. Portion 43 is of reduced thickness, being only wide enough to close foam liquid inlet 31 when portion 43 lies over the inner opening of that inlet. It should now be clear that portion 43 only partly closes inlet 28 when it is positioned over that inlet.

From the drawings it will be clear that the inner surface of valve housing 27 is dimensioned to provide substantial clearance about the periphery of movable valve member 35 except adjacent inlets 28 and 31 where only sufficient clearance is provided between the peripheral surface of member 35 and the inner surface of the valve housing to permit rotation of movable valve member 35. The last mentioned portion of the inner surface of the valve housing is therefore formed as a portion of the periphery of a circle having the axis of rods 36 as its center, and having a radius only slightly larger than the radius of valve member 35.

From the area of the internal surface of valve housing 27 surrounding inlets 28 and 31, the internal radius of housing 27 increases gradually so that when the valve is in the high pressure foam position (Fig. 4) which will be discussed in greater detail presently, a Venturi action is produced about both the upper and lower surfaces of valve 35 as viewed in Fig. 4. The radius of the remaining area of the inner surface of housing 27 is substantially larger than the radius of the portion about inlets 28 and 31.

A fog tube 51 of approximately the inner diameter of water inlet 28 and hole 41 is positioned within the forward tubular portion 25 of the nozzle. Tube 51 which is considerably smaller in diameter than tube 25 is concentric with tube 25 and is therefore axially aligned with water inlet 28. Spiders 52 fixed to the outer periphery of tube 51 and to the inner periphery of tube 25 hold tube 51 in place. The arms of spiders 52 are crescent shaped in cross section with the concave surfaces facing toward the rear portion of the nozzle. This configuration and disposition of the spider arms causes turbulency in liquid passing between the two tubes for a purpose which will be explained presently.

The rear end 55 of tube 51 is concave when viewed in longitudinal section as in Figs. 1–4, the radius of the concave surface being substantially the same as the radius of the portion of the inner wall of valve housing 27 adjacent openings 28 and 31 and being taken about a center comprising the axis of pivot rods 36. The forward end 56 of tube 51 extends well beyond the forward end 26 of tube 25 and is threaded or otherwise adapted to receive a fog nozzle of conventional construction. A screen 56*a* is shown in the forward end of tube 51 to represent schematically a fog producer.

The forward tubular part 25 of the nozzle has a provision for admitting air into the space between tubes 25 and 51. This provision consists of a series of openings 60 angularly spaced about the periphery of tube 25 a short distance forward of valve housing 27. A band 61 having a like number of similar openings 62 is rotatably mounted about tube 25 adjacent openings 60 so that openings 60 may be covered or uncovered to any desired degree to regulate the amount of air admitted to the space between outer tube 25 and inner tube 51.

It will now be apparent that the rear end 55 of tube 51 can be connected directly to water inlet 28 by opening 41 in movable valve member 35 when member 35 is in the position shown in

Fig. 2, that is, the fog position. The rear end of tube 51 can also be completely closed by portion 42 of member 35 when member 35 is in the low or high pressure fog positions as shown in Figs. 3 and 4.

Operation of valve and nozzle

As shown in Figs. 1–4, the position of movable member 35 of the valve under the control of handle 37 controls the emission of foam and fog from the nozzle. When member 35 is in the position shown in Fig. 1, both inlets 28 and 31 are closed by portion 42 being positioned so as to cover the inner ends of these inlets. This is the completely closed position which means that neither foam nor fog is coming out of the nozzle.

When it is desired to spray fog from the nozzle, member 35 is turned to the position shown in Fig. 2 in which hole 41 in member 35 connects water inlet 28 directly with the rear end of inner tube 51 and portion 43 of member 35 lies over the inner end of inlet 31 so as to prevent foam liquid from entering the valve and nozzle. Water passing under pressure into tube 51 passes through the fog nozzle where it is turned into a fog which is highly efficient in extinguishing fires.

A low pressure foam may be supplied by the nozzle by turning valve member 35 to the position shown in Fig. 3 in which portion 43 of member 35 is moved clear of foam liquid inlet 31 and is positioned over water inlet 28. Because of the reduced thickness of portion 43, only a portion of the water pressure enters the valve to mix with and force out foam liquid which enters through open inlet 31. In this position of member 35, portion 42 closes the rear end 55 of tube 51 so that the mixture of water and foam liquid passes into the space between tubes 51 and 25 and past spider arms 52 which, because of their crescent shaped cross sectional configuration, cause turbulence of the liquid. Air is admitted as desired through openings 60 by adjusting the position of band 61. As a result, a mixture of foam liquid, low pressure water, and air is thoroughly mixed within tube 25 and issues from the forward end 26 of tube 25 as a foam which when placed over a flammable substance excludes the atmosphere and prevents ignition of the substance.

A high pressure supply of foam is obtained by turning member 35 to the position shown in Fig. 4 in which both inlets 28 and 31 are completely uncovered while the relatively long periphery of portion 42 of member 35 permits movement of member 35 to this position while still closing rear end 55 of tube 51 by means of portion 42. In this position of member 35, the gradually widening space between the inner surface of housing 27 and the periphery of member 35 produces a venturi action which increases the efficiency of the arrangement. The increased velocity of the liquid mixture through the gradually widening space causes a drop in pressure which draws additional foam liquid into the valve through the foam inlet. As in the case of the low pressure foam production as explained above, water (now at full pressure), foam liquid and air are mixed in tube 25 and issue from tube 25 as a high pressure foam. In this case, it may be necessary to move band 61 so as to increase the supply of air to the mixture of foam liquid and water.

Suitable indicia (not shown) may be placed on the exterior of the valve casing to indicate the various valve handle positions.

Reel

In Fig. 8 is shown partly schematically a reel 20 for use with the nozzle previously described. The reel comprises a central rotatable portion in which spaced disks 70 are mounted on a hollow axle 71. The interior of the axle has a transverse liquid tight partition 72 which divides the axle into two interior conduit portions 73 and 74.

Conduit 73 is adapted to receive foam liquid from a supply tank 74*b* through tube 74*a* and a liquid tight rotatable end bearing 75 for axle 71, while conduit 74 receives water under pressure from a supply such as tank 76 through tube 76*a* and a similar bearing 77. Outlets 78 and 79 communicating with conduits 73 and 74, respectively, and extending radially outwardly from the axle have conventional fittings for receiving a flexible liquid foam tube 80 and a larger water tube 81.

Tubes 80 and 81 may continue to the water and foam inlets 28 and 31 of nozzle 23 as separate tubes wrapped together at spaced intervals along their length as shown in Fig. 8 or they may be fused into a single unit as shown at 21 in Fig. 9, in which case tube 80 becomes channel 33 and tube 81 becomes channel 30. The reel may be positioned conveniently on a suitable stand 83 which may be located on any suitable vehicle or on whatever support is desired.

It should now be apparent that I have provided a novel and highly efficient fire fighting apparatus including a novel nozzle and valve which is well adapted to standardization for both hand line use and turret use, thus eliminating the multiplicity of types now used.

By using this nozzle, the entire water supply of a crash fire fighting truck may be utilized for making foam inasmuch as the same supply is used for both foam and fog. This is impossible with present hand carried equipment unless a supply of two gallon cans of liquid foam are carried on the truck.

Most important, I have provided a single selector valve which provides shut off, high pressure fog, low pressure foam and high pressure foam.

I have described a preferred embodiment of the invention and I realize that the invention is susceptible of numerous modifications without departing from the inventive concept. For instance, valve casing 27 may be made of two portions screwed together at a central point and pumps (not shown) may be inserted in tubes 74*a* and 76*a*. It is my intention to cover all such modifications coming within the scope of the appended claims.

I claim:

1. Apparatus for fire fighting and the like comprising a nozzle member, a valve housing comprising a rearward continuation of the rear end of said nozzle and having two separate fluid inlets, and a movable valve member having at least three different positions, said nozzle member, valve housing, and valve member being constructed and arranged to emit selectively only one of said fluids in one position of the valve member, a mixture of said fluids in another position of the valve member, and to shut off in a third position of said valve member.

2. Apparatus as set forth in claim 1 in which said valve member has at least four positions, and said valve member has a portion for diminishing the volume of one of said fluids in said fourth position, whereby the mixture of said fluids is emitted at two different pressures, selectively, in said second and fourth positions.

3. Fire fighting apparatus comprising concentric nozzle members, a valve housing connected to said nozzle members and having inlets for water and foam liquid, fog producing means associated with said nozzle, and a movable valve member associated with said nozzle member and having at least three positions, said valve member being constructed and arranged to close both of said inlets in one position, to connect said water inlet with said fog producing means in another position, and to permit mixture of water and foam liquid in a third position to provide foam.

4. Apparatus as set forth in claim 3, in which said nozzle member has a tubular wall, an air inlet means comprising at least one opening in the side wall of said nozzle member for supplying air to said water and foam liquid mixture.

5. Fire fighting apparatus as set forth in claim 3 in which said fog producing means includes a conduit mounted in spaced relation with said nozzle, means having a turbulence producing configuration for positioning said conduit relative to said nozzle, said valve member having a portion constructed and arranged to close said conduit to cause said mixed water and foam liquid to pass into the space between said conduit and said nozzle member and past said positioning means when the valve member is in said third position, whereby intimate mixture of said water and foam liquid is produced.

6. Fire fighting apparatus comprising a tubular nozzle member having inlets for water and foam liquid, a fog tube mounted within said tubular nozzle member in spaced relation thereto, turbulence producing means positioning said tube within said tubular nozzle member, and a movable valve member associated with said nozzle member and having at least three positions, said valve member being constructed and arranged to close both of said inlets in one position, to connect said water inlet with said tube and to close said foam liquid inlet, in another position, and in a third position to cause passage of a mixture of foam liquid and water into the space between said tubular nozzle member and said fog tube where said turbulence producing means effect intimate mixing of said water and foam liquid.

7. Fire fighting apparatus as set forth in claim 6 in which air inlet means is provided in said tubular nozzle member to admit air for admixture with said mixture of water and foam liquid.

8. Fire fighting apparatus as set forth in claim 6 in which said tubular nozzle member has at least one air inlet opening into the space between said tubular nozzle member and said fog tube, and an adjustable member cooperating with said air inlet for varying the amount of air admitted to said space.

9. Fire fighting apparatus including a valve having water and foam liquid inlets, and a movable valve member having at least three positions, said movable member having a plurality of separate inlet blocking portions, one of said portions being dimensioned to close both of said inlets in one position of the member, and another portion being dimensioned to close said foam liquid inlet opening in a second position of said movable valve member, said last mentioned portion being positioned and dimensioned to uncover said foam liquid inlet and partially close said water inlet in a third position of said movable member.

10. Fire fighting apparatus as set forth in claim 9 in which a combined mixing chamber and valve casing surrounds said movable valve member, said

movable member having a fourth position in which both of said inlets are uncovered and in which a venturi action takes place between said movable member and said casing to cause foam liquid to be drawn from said foam liquid inlet.

11. Fire fighting apparatus comprising a tubular nozzle member, a valve associated with said nozzle member and having water and foam liquid inlets, a fog tube within said nozzle member in spaced relation thereto, a rotatable valve member having an opening therethrough and having large and small portions, said rotatable valve member having at least three positions, said large and small valve member portions being constructed and arranged so that said large portion closes both of said inlets in one position of said valve member, said opening connects said water inlet with said fog tube to produce fog and said small valve member portion closes said foam liquid inlet in a second position, and said inlets are exposed and said large valve member portion closes said fog tube causing passage of a mixture of water and foam liquid into the space between said tubular nozzle member and said fog tube to produce foam in a third position.

12. Fire fighting apparatus as set forth in claim 11, said movable valve member having a fourth position in which said foam liquid inlet is exposed, said small portion partially closes said water inlet and said large portion closes said fog tube causing passage of relatively low pressure foam into the space between said tubular nozzle member and said fog tube, said water inlet being substantially completely exposed in said second position to provide foam at relatively high pressure.

13. Fire fighting apparatus as set forth in claim 11, said movable valve member having a fourth position in which said foam liquid inlet is exposed, said small portion partially closes said water inlet and said large portion closes said fog tube causing passage of relatively low pressure foam into the space between said tubular nozzle member and said fog tube, said water inlet being substantially completely exposed in said second position to provide foam at relatively high pressure, and air inlet means in said tubular nozzle member for admitting air for admixture with said mixture of foam liquid and water.

14. Fire fighting apparatus as set forth in claim 11, said movable valve member having a fourth position in which said foam liquid inlet is exposed, said small portion partially closes said water inlet and said large portion closes said fog tube causing passage of relatively low pressure foam into the space between said tubular nozzle member and said fog tube, said water inlet being substantially completely exposed in said second position to provide foam at relatively high pressure, and adjustable air inlet means in said tubular nozzle member for admitting air for admixture with said mixture of foam liquid and water, whereby the amount of air admitted may be varied in accordance with the pressure of foam being produced.

15. Fire fighting apparatus comprising a tubular nozzle member open at its front end and having a bulbous rear section provided with a water inlet and a smaller foam liquid inlet, a valve member in the form of a mutilated flat sided disk rotatably mounted in said bulbous nozzle portion for rotation about an axis substantially perpendicular to the planes of the flat sides of the valve member, said valve member having an opening extending diametrically therethrough and having two peripheral surface portions of different sizes comprising arcs of a circle having its center as the

axis of rotation of said member, the larger of said portions being of sufficient thickness to close both of said inlets while the smaller of said portions is dimensioned to close said foam liquid inlet completely and to close said water inlet partially, a fog tube associated with said nozzle member and having a rear opening aligned with said water inlet, said movable valve member having at least four positions as follows: a shut off position in which said larger valve member portion covers both of said inlets, a fog position in which the smaller valve member portion closes said foam liquid inlet and said valve member opening connects said water inlet and said fog tube, a low pressure foam position in which said foam liquid inlet is open, said water inlet is partially closed by said smaller valve member portion, and said larger valve member portion closes the rear end of said fog tube so that a mixture of water and foam liquid passes through said tubular nozzle member, and a high pressure foam position in which both of said inlets are open and in which said larger valve member portion closes the rear end of the fog tube, whereby the full pressure of the water mixes with the foam liquid to force high pressure foam through said nozzle member.

16. Fire fighting apparatus as set forth in claim 15 in which said inlets are positioned closely together, the area of the inner surface of said bulbous rear section of the nozzle member adjacent said inlets being nearer to the axis of the movable valve member than the remainder of the inner surface of said section with the remainder of the inner surface sloping inwardly to said section, said large and small portions of the valve member being so relatively positioned that when the valve member is in the high pressure foam position a peripheral end of one portion is near the part of the water inlet most remote from the foam liquid inlet and a peripheral edge of the other portion is near the part of the foam liquid inlet remote from the water inlet, whereby a venturi action is set up through channels formed between the peripheries of the valve member portions and the outwardly sloping inner surface of the bulbous rear nozzle section around the portion thereof occupied by said inlets, which venturi action causes foam liquid to be drawn from the foam liquid inlet.

17. Fire fighting apparatus as set forth in claim 15 in which said fog tube is positioned within said tubular nozzle member in concentric spaced relation thereto, said foam passing through the space surrounding said tube.

18. Fire fighting apparatus as set forth in claim 15 in which said fog tube is positioned within said tubular nozzle member in concentric spaced relation thereto by at least one spider having arms which are crescent shaped in cross section, and air inlet means in said tubular nozzle member operable to admit air into the space between said fog tube and said nozzle member, said foam passing through said space, whereby said spider arms cause turbulence of said foam mixture for producing intimate dispersion of air throughout said foam mixture.

19. A movable valve member for use in fire fighting apparatus having a tubular nozzle member, a valve casing communicating with said nozzle, water and foam inlets, and a fog tube within said nozzle axially aligned with said water inlet and spaced from the walls of said nozzle, said valve member comprising a mutilated flat sided disc, means for mounting said disc for rotation about an axis substantially perpendicular to the planes of the flat sides of the valve member, said valve member having an opening extending diametrically therethrough for connecting said water inlet with said fog tube said valve member having two peripheral surface portions comprising arcs of a circle having as its center the axis of rotation of said member, one of said portions being of sufficient thickness to close both of said inlets while the other portion is dimensioned to close said foam inlet completely and to close said water inlet partially.

20. A valve member as set forth in claim 19, said diametrically extending opening extending through both of said portions.

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Certificate of Correction

Patent No. 2,485,723 October 25, 1949

NICHOLAS A. FITZGERALD

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 7, line 14, for the words "an air" read *and air*;

and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 14th day of February, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.