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M. BETZLER

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APPARATUS AND METHOD FOR PRODUCING FIRE EXTINGUISHING FOAM

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FIG.1.

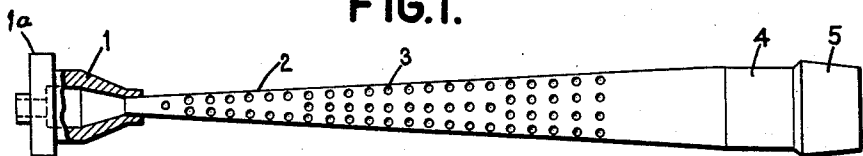


FIG.2.

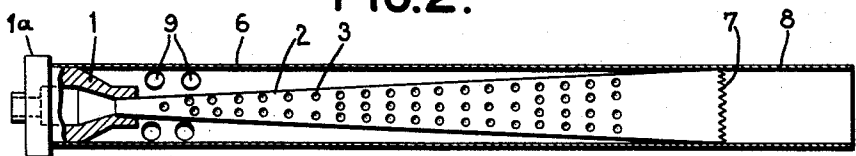


FIG.3.

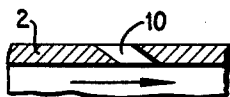


FIG.4.

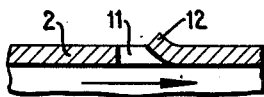


FIG.5.

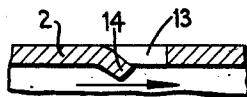
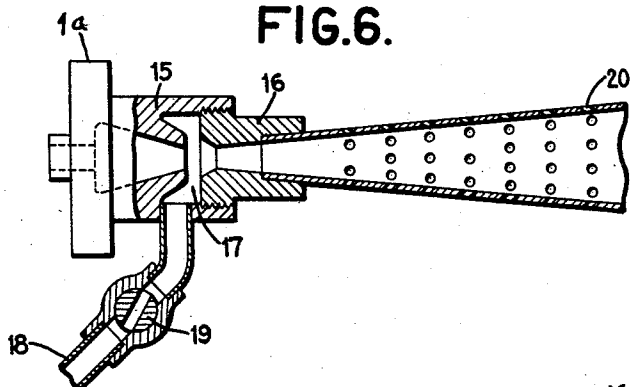


FIG.6.



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APPARATUS AND METHOD FOR PRODUCING
FIRE EXTINGUISHING FOAM

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6 Claims. (Cl. 261—76)

This invention relates to method and apparatus for producing fire extinguishing foam in which air or other gas is mixed with a foam producing liquid or fluid under pressure by aspiration. In apparatus which has been heretofore known for the production of so-called air foam, the air or other gas is mixed with the liquid at only one place. In order to incorporate a relatively large amount of air with the fluid in such prior devices it has generally been considered necessary to finely subdivide the fluid to obtain an intimate mixture of air and fluid. The division of the fluid stream materially increases the volume of foam but also results in very considerable pressure losses, thus cutting down the throwing power of the resultant mixture.

Devices of this character which have been heretofore employed also have the disadvantage of being complicated, cumbersome and rather expensive to make.

My invention overcomes these disadvantages and provides simplified apparatus and method in which air is introduced and mixed with the liquid at a number of different points without breaking up the stream of liquid.

A further object of the invention is to provide foam forming apparatus of the character mentioned which can be easily attached to a pipe line or a hose, such as a fire hose, and may either be inserted at a convenient point in the line or placed at the end as a nozzle.

A feature of the invention is the provision of a tube or casing having a plurality of openings disposed along its length for the introduction of air as the water or foam producing fluid flows through the tube. This provides a very simple form of apparatus in which air is introduced to the fluid stream at a number of spaced points and is intimately mixed therewith in transit, the air content of the fluid increasing as it progresses along the tube.

The foam-producing casing is preferably flared or enlarged in the direction of flow of the stream. Thus any tendency to develop back pressure is overcome, because the stream which is increasing in volume, in accordance with the number and frequency of air inlet openings, is allowed an opportunity to expand.

It is a further object of my invention to provide openings in the casing which are so formed and arranged that the form will not be forced out through them but, on the contrary, they will permit air to be aspirated or drawn into the stream.

Further objects and advantages of my invention will be more apparent from a consideration of the embodiments thereof disclosed in the drawing, in which

Figure 1 illustrates in side elevation one form of a tube or casing for producing foam, the fluid

inlet nozzle attached to the casing being illustrated in section.

Figure 2 illustrates a modification of the apparatus shown in Fig. 1 and includes an outer shell illustrated in section and an inner casing illustrated in side elevation.

Figures 3, 4, and 5 illustrate three types of openings which may be satisfactorily employed in the casing.

Figure 6 shows a longitudinal cross section of a modified apparatus for producing fire-extinguishing foam, including means for aspirating foam-forming materials into the main liquid stream.

In the drawing, numeral 1 indicates a nozzle which may be provided with a suitable coupling member 1a for attachment to a pipe line, hose or other source of water, under pressure, containing any suitable form of foam stabilizer. Fixed to said nozzle in any suitable manner is a casing 2 provided with a plurality of openings 3. The casing is preferably flared or uniformly enlarged in cross section in the direction of flow of the stream, thus allowing the stream to draw in air and expand as it moves towards the section 4, which serves to straighten the stream of foam prior to its emergence or passage into another conduit. If desired, a coupling member 5 of any suitable construction may be provided at the end of the casing whereby other conduits or hoses may be connected to the casing 2 for carrying the foam formed therein to the seat of the fire.

It may be desirable in certain uses of the invention to reinforce the apparatus mechanically and for this purpose, a device as illustrated in Fig. 2 may be employed. An outer shell 6 of suitable strength is placed around the nozzle 1 and casing 2 and provides a portion 8 beyond the tapered inner casing which takes the place of the section 4 shown in Fig. 1.

A series of inwardly extending teeth 7 or fins may be employed at the end of the inner casing to improve the character of the foam by agitating it. These teeth or fins may be spirally arranged and serve as means for whirling the foam or giving it a spiral movement. Other means for accomplishing the same result or otherwise assisting in the agitation of the foam might be substituted. A series of openings 9 in the shell 6 is preferably employed fairly close to the nozzle 1 to allow for the introduction of air into the space between casing 2 and shell 6. Other arrangements for accomplishing this result might be utilized.

In Figs. 3, 4 and 5 sections of the casing 2 are shown on an enlarged scale to illustrate different types of openings which may be used to good advantage for the admittance of air to the liquid. In each figure the arrow designates the direc-

tion of flow of the liquid stream. The opening 10 is a simple hole through the casing, drilled or otherwise cut through at an angle so that the axis of the opening 10 is inclined at an acute angle to the axis of the casing 2. In order to satisfactorily introduce the air by aspiration, the axes of openings of this type should extend at such an angle to the direction of flow of the liquid that the foam will not be forced out through them unless a definite back pressure is created. No such back pressure will be developed when the tube 2 is properly tapered.

The opening 11 may be formed in any manner and the forward edge 12 bent outwardly. Thus should the liquid passing along the inner surface of the casing 2 tend to expand slightly it will strike the slanting surface provided by the edge 12 and be deflected inwardly, thereby preventing the stream from emerging through the opening.

The opening 13 may be formed in a manner similar to the one shown in Fig. 4 but in this case the rear edge 14 of the opening is bent inwardly to form a deflecting surface. By such a construction the aspiration of air and the mixing of the fluid and air are augmented due to the constriction in the passage produced by the edges 14.

A further modification of the apparatus is shown in Fig. 6 in which special means are provided for the introduction of foam-forming materials into the liquid stream by aspiration. This device includes a nozzle 15 which may be spaced from the mouth of a receiver 16, thus forming a suction chamber 17. It is preferable in such a construction to have the diameter of the passage through the receiver 16 substantially equal to the diameter of the discharge end of the nozzle 15. By reason of the suction created in the chamber 17 by the jet of water discharged by the nozzle 16, foam-forming or stabilizing materials are drawn into the chamber through the pipe 18 connected thereto and with a suitable source of the foam stabilizer which is then incorporated with the stream of fluid. A suitable valve 19 may be employed to regulate the supply of foam-forming materials.

In the operation of my improved apparatus the water, after any of the well known foam-forming or stabilizing materials have been added thereto, enters the casing 2 at a relatively high velocity. Air is incorporated in the fluid as it passes the first of the openings 3 and foam is produced immediately. As each succeeding opening is passed more air is drawn in and incorporated in the foam. The foam mixture thus increases in volume so that its velocity is not greatly decreased as it moves along the casing. This procedure takes place throughout the passage of the material through the casing 2 and as the last openings 3 are passed the foam is in a condition to be thrown directly on a fire or it may be transported thereto through a considerable length of pipe or hose. The character of the foam may be easily regulated by providing any desired number of openings 3 of the correct size. With a given apparatus the character of the foam may also be regulated by either boring new holes in the casing or stopping up some of those already formed. That the increased volume of the foam, as it acquires more air, will not substantially retard the flow and hence will not develop any appreciable back pressure.

The apparatus which I have disclosed is particularly efficient since it is simple and compact and may be connected directly to a fire hose and used to throw the foam directly on the fire. If desired, however, the apparatus may be connected to a source of water under pressure, and hose or other guiding conduits may be connected to the outlet end thereof for transporting the foam to the fire. The apparatus may, if desired, be made integral with a section of hose, although it is preferred to have it detachable.

The terms and expressions which I have employed are used as terms of description and not of limitation, and I have no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof, but recognize that various modifications are possible within the scope of the invention claimed.

I claim:

1. Apparatus for producing fire-extinguishing foam comprising a casing for surrounding a stream of liquid, said casing being flared in the direction of flow of liquid and having a plurality of openings in the walls thereof for introducing air into said stream by aspiration, and a plurality of members beyond said openings projecting towards the interior of said casing for agitating the liquid.

2. In a method of producing fire-extinguishing foam, the steps of conducting a confined stream of liquid under pressure and containing a foam stabilizing agent, and introducing and mixing air with said liquid by aspiration at a plurality of positions spaced along the path of travel of said stream.

3. The method of producing fire-extinguishing foam comprising passing a confined stream of liquid containing a foam stabilizing agent in a substantially straight path at relatively high velocity, introducing air into said stream by aspiration at a plurality of different positions spaced along the path of travel of the stream, and allowing the resultant foamy mixture to expand as air is introduced.

4. The method of producing fire-extinguishing foam comprising passing a confined stream of liquid containing a foam stabilizing agent in a substantially straight path at relatively high velocity, introducing air into said stream by aspiration at a plurality of different positions spaced along the path of travel of the stream, allowing the resultant foamy mixture to expand as air is introduced, and agitating said foamy mixture.

5. In a method of producing fire extinguishing foam, the steps of projecting a jet of liquid containing foam stabilizing material at relatively high velocity through a casing, and passing successive quantities of air through the walls of the casing into contact with said jet by the aspiration action thereof.

6. In a method of producing fire-extinguishing foam, the steps of projecting a jet of liquid containing foam stabilizing material at relatively high velocity through a casing, passing successive quantities of air through the walls of the casing into contact with said jet by the aspiration action thereof, and allowing said jet to expand as said successive quantities of air are brought into contact therewith.

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