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APPARATUS FOR EXTINGUISHING OIL FIRES

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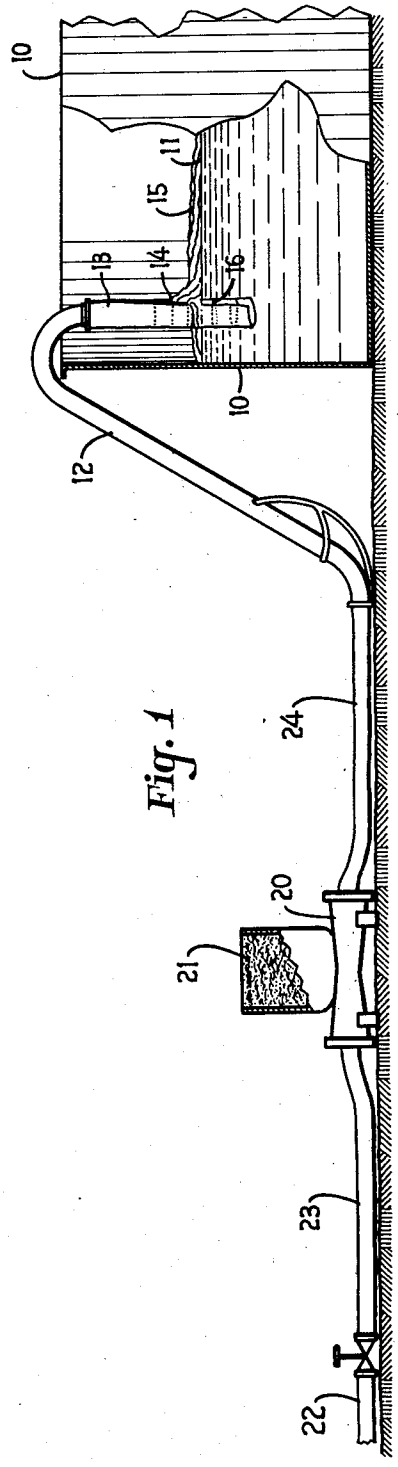

Fig. 1

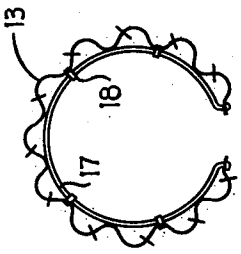

Fig. 4

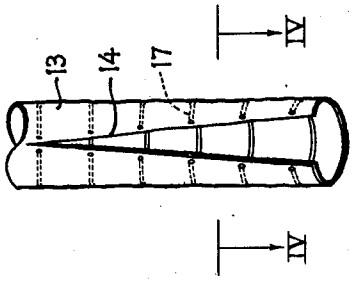

Fig. 3

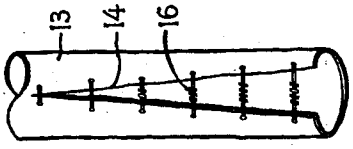

Fig. 2

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APPARATUS FOR EXTINGUISHING OIL FIRES

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8 Claims. (Cl. 169—4)

This invention relates to improvements in apparatus for introducing a fire extinguishing foam over the rim of an oil tank, in such a manner that the foam will be conveyed to and discharged substantially horizontally over the surface of the oil with a minimum of disturbance to the foam or to the oil surface, and a maximum flow of the foam through and out of the apparatus.

The so-called fire-foam commonly used to extinguish oil fires is a resilient, adhesive mass of small gas bubbles usually formed by the chemical reaction of a gas-forming powdered solid in water, or one or more aqueous solutions. In some types compressed gas or atmospheric air may be used, together with some form of mechanical agitation. The aqueous film covering the bubbles is particularly designed and intended to be tenacious, sticky, and persistent over a period of hours or even days, as well as being quite resistant to heat, as from the burning gases overlying a body of oil. The foam is quite capable of adhering to vertical surfaces and, after its formation, can be flowed through conduits only with some difficulty and for relatively short distances as compared with water, probably because of its low density, usually less than one-fifth that of water, and also because of its adhesive, spongy, and gelatinous nature, which is believed to cause a stationary layer to form on the walls of the conduit, reducing the effective area of the latter and providing a high flow coefficient. These properties make it difficult rapidly to convey and distribute the foam to the surface of the oil in a burning tank, for example.

In the method of generation of fire-foam by the introduction of prepared powders into a flowing stream of water, it is often desirable to use a mixing device in which the velocity of the flowing stream of water is momentarily increased, as by a Venturi nozzle or similar restriction, jet, or the like, so that a zone of low static pressure is created to draw the powdered material into the water stream where it will react and form the desired fire-foam. The reacting mixture may then be flowed through a conduit such as standard fire hose for only a relatively short distance to the apparatus for distributing the foam onto the liquid surface to form a dense blanket thereon so that air may be excluded and the fire extinguished. If the distributing apparatus per se introduces a large drop in pressure in the flowing foam stream, that pressure is unavoidably transmitted back to the foam generator, so that the pressure in the mixing chamber may rise to the point where the powdered reactive material will no longer feed into the water stream, or at least will not feed in the proper and predetermined proportions to provide an effective foam. Accordingly, it is quite desirable to provide a distributing device that will obstruct the passage of fire-foam as little as possible, to prevent the situation just described.

Heretofore foam has been introduced into structures such as burning oil tanks by means such as chutes or baffled conduits permanently secured to the tank wall, or by the use of flexible porous or reticulated tubes introduced into the tank over its rim and suspended from portable elongated conduits manipulated from the ground alongside the burning tank. Such old devices have proved unsatisfactory, especially because they unavoidably caused considerable agitation of the foam, and in the case of those which utilized a plurality of small apertures for distributing the foam, caused considerable deterioration of the foam by dividing it into numerous small streams which would become separated into detached flakes or masses that were ineffective to produce the coherent blanket or covering of unbroken foam that is required to extinguish oil fires. Also, in practically all types of downwardly extending conduits with a terminal opening of substantially only the area of the conduit, the foam would tend to pile up or accumulate in the lower part of the conduit, thus effectively preventing the incoming stream from reaching the open end and flowing therefrom onto the oil surface. This was particularly true in the case of the perforated or porous, flexible tubes and resulted in the lower part of the tube becoming choked with a resilient, adhesive mass of clotted viscous foam that would form a relatively impervious layer next to the tube wall so that the incoming foam was either compressed or collapsed to a thin, ineffective sloppy mass, or was only able to flow from the tube through the uppermost perforations or openings where the pressure on the incoming stream of foam was effective to drive the material outwardly. Always there was the hazard that the relatively fragile tube material would split at its juncture with its mixing and conveying conduit. The foam issuing from such a height would drop off as small detached flakes and would either be evaporated by the heat of the flames or would strike the liquid surface in the tank with considerable force, damaging and disturbing the blanket of foam that it was intended to establish.

Tests of this invention have demonstrated that improved operation, reduced deterioration and

the use of much smaller quantities of the foam can be effected by utilizing as a distributor a downwardly extending open-ended conduit which is provided with a longitudinal opening or slot at one or, in some cases, more than one point about its circumference. Desirably this opening extends for a sufficient distance along the tube so that a high oil level in the tank will not submerge it, and preferably is wider at the bottom or outlet end than at the top of the tube so that, in case the foam does pile up or adhere to the tube wall and restrict the effective area of flow it will have more opportunity to emerge from the opening near the lower portion of the conduit at the surface of the oil where the opening is widest. Also, there may be employed means for defining the width of the opening that will also serve to render the initially empty, vertically hanging tube substantially cylindrical without depending on the distending action of the incoming foam, making the flow rate more rapid and the effectiveness of the foam much more pronounced.

It is an object of this invention to provide an improved means for introducing fire-foam into a structure, such as a tank, to discharge the foam substantially horizontally and gently at the level of the liquid in the tank to extinguish a fire therein.

Another object is to provide an improved means for handling and applying a stream of fire-foam which is of much stiffer consistency than that heretofore used in this art.

Another object is to provide an improved arrangement of a flexible conduit which may be suspended or placed vertically in a tank, such as a burning oil tank, and will discharge fire-foam from the lowest point in a vertical opening in said conduit so that the foam will issue quietly onto the liquid surface onto which it is to be applied, and will form an ever-widening smooth blanket on the said liquid.

Another object is to provide a distributor which is particularly, although not necessarily, adapted to the recently developed fire-foams using organic compounds known as wetting agents or detergents which substantially reduce the surface tension of the water used and also act as stabilizers of the foam, these foams being characterized by a consistency somewhat similar to that of stiffly whipped cream, and an increased tenacity and resistance to disintegration which is reflected in their flowing properties. Tests of such foams with flexible and porous distributors heretofore used show such means to be unsuited to successful operation and led to the present invention.

These and other objects of the invention will be further apparent from the following description and from the accompanying drawing which forms a part of this specification and illustrates a preferred embodiment of the apparatus of this invention as well as an alternative form.

In the drawing,

Figure 1 is a vertical sectional view of a tank partially filled with liquid in which a flexible conduit embodying this invention is in place and discharging foam onto the surface of the liquid.

Figure 2 is a front elevational view of one form of tube in which a single vertical slot or opening is defined by means of tie members extending thereacross.

Figure 3 is a front elevational view of an alternative form of flexible conduit in which the vertical slot is defined by spacing members which extend backwardly from the edges of the slot and around the circumference of the conduit.

Figure 4 is a vertical sectional view on the line IV—IV of Figure 3 showing one mode of arrangement of resilient spacers to define the edges of the vertical opening.

Referring to the drawing, reference numeral 10 designates a tank in which is an inflammable liquid 11 on the surface of which it is desired to introduce a foam known as "fire-foam" which may be of any well-known type and produced in any desired manner. An elongated foam mixing and conducting tube 12, usually portable and of light metal, is adapted to be placed over the rim of tank 10 and may terminate in a bend which extends downwardly inside the tank for a short distance. At the inner end of tube 12 is connected a flexible conduit 13 which may be temporarily secured in a bundle and selectively released to extend downwardly preferably to a point at or below the level of the liquid 11 in tank 10. This conduit is usually made of a fire-resistant material such as woven asbestos reinforced with wire although it could be of rigid material, such as steel or a heat resisting alloy, which would necessitate raising the tubes 12 and 13 to a greater height when introducing them into tank 10. At one side of tube 13 and extending for the desired portion of its length is a longitudinal slot or opening 14 through which the foam 15 may emerge and flow gently over the surface of the liquid 11.

As pointed out heretofore, the foam 15 may be of the consistency of stiffly whipped cream, tenacious, and adherent, as well as low in density, so that it tends to build up a layer on the inside of tube 13 rather than pass longitudinally through it. It has been found that when tube 13 is of the perforated or porous type such as that heretofore used, the foam will pile up or accumulate in the lower part, possibly by a sort of "jelling" or "congealing" action, so that the lowest perforations are closed by a thick, adherent layer of foam and hence are not effective to release the foam freely and horizontally. This may be due, in part, to its light weight and consequent lack of effective hydrostatic head. The general result is that the foam only emerges from such a reticulated tube at an increasing higher level until it reaches a zone of sufficiently high pressure or until the tube is greatly stretched or distended, sometimes resulting in actual bursting of the asbestos fabric. Foam falling from such a height has a relatively high velocity so that it tends to agitate the liquid in the tank and also to mix with it. In addition, it becomes separated into fine flakes or small masses which do not readily merge with the spreading blanket of foam which it is desired to establish on liquid 11.

This invention, however, utilizes as the principal outlet from the tube the substantially unobstructed vertical opening 14 along one side of tube 13, which does not unduly restrict the horizontal flow of foam 15 onto liquid 11. If desired the width of slot 14 may be defined by means of spaced tie members 16 so that the tube will retain its conduit nature and not completely flatten out, as might be the case if tie members 16 were not provided. One alternative arrangement to define the width of slot 14 along the length of tube 13 is shown in Figures 3 and 4 and may comprise resilient semi-circular ele-

ments 17 either inside or outside of tube 13 and secured thereto by means of fasteners 18. These act automatically to distend tube 13 from its usual flat condition and render it a better conductor for the first foam to enter from tube 12. Also the lower elements 17 may be made of less stiffness than the upper ones so that they will distort more readily and permit the lower end of slot 14 to open widely under the small horizontal component of force exerted by any accumulation of the low-density foam. Tie members 16 may likewise be variably resilient in the same manner and for the same purpose. A further advantage of flexible or resilient means to define the edges of slot 14, is that as the foam 15 tends to accumulate in tube 13 at the surface of the liquid 11 due to its low density and its coherent nature it will expand slot 14 and thus facilitate flow outwardly onto the liquid. Desirably the means used to define the width of slot 14 should be of such nature that if tube 13 is of a flexible material it may be folded or rolled at the top of delivery tube 12 to facilitate its introduction into tank 10.

In this example the means for producing the fire-foam are illustrated diagrammatically in Figure 1, and include a mixer 20 into which a powdered material 21 may be poured and through which a high-pressure stream of water from any suitable source 22 is conducted by means of a hose 23. Hose 24 leads from the outlet of mixer 20 to the lower end of tube 12, and, by the use of this invention, may be much longer than those heretofore used. The decreased pressure drop in the flowing foam stream between mixer 20 and the outlet 14 from flexible conduit 13, due primarily to the improvement described for the latter, not only delivers the foam to the oil surface 11 at a more rapid rate but also results in improved operation and more accurate proportioning of liquid to powder in mixer 20, so that the whole system is benefitted thereby. When other types of foam generators or systems of producing foam are used, such as mechanical agitators or the use of two reactive aqueous solutions, the advantages of the invention will be realized in generally improved operation and rapidity of foam application, it being distinctly understood that the application of the invention is not limited to the powder generator of this example.

Although it is obvious that many changes and modifications could be made in the arrangement shown it is considered that the invention resides in an improved method of handling a stiff fire-foam and in apparatus therefor, including the provision of a substantially unobstructed vertical slot or opening in a conduit adapted to be placed vertically in a tank to introduce fire-foam therein, said slot extending throughout at least part of the length of the conduit and preferably but not necessarily increasing in width downwardly so that said foam may be selectively confined in its outward flow and discharged under a low pressure substantially only at a point above the surface of the said liquid, the edges of said opening desirably being defined by resilient means, for the purpose specified.

I claim:

1. A fire-foam distributing device comprising a tube of fire-resistant material having a single longitudinal opening in the wall thereof for only a portion of its length, said opening increasing in width toward the outlet end of said tube.

2. A fire-foam distributing device comprising a flexible tube of fire-resistant material having a single longitudinal opening therein extending from the outlet part way to the inlet of said tube, and increasing in width toward the outer end of said tube and circumferentially acting means cooperating with the edges of said opening to define the width thereof.

3. A fire-foam distributing device according to claim 2 in which said edge-defining means for said opening are expansible to permit widening of said opening under internal pressure in said tube.

4. A fire-foam distributing device according to claim 2 in which said edge defining means for said opening are effective to hold said tube in a distended position when it is empty and hanging in a vertical position.

5. A fire-foam distributing device according to claim 2 in which said edge defining means for said opening are expansible and extend backwardly from said opening around said tube wall

6. A fire-foam distributing device according to claim 2 in which edge defining means extend across said opening and are spaced to leave a substantially unrestricted passage outwardly throughout the length of said opening.

7. A fire-foam distributing device comprising a flexible tube of substantially impervious fire-resistant material, part of the length of said tube being provided with only a single longitudinal opening, and circumferentially acting means defining the width of said opening, the length of said opening being substantially greater than the diameter of said tube, said opening being widest at the outlet end of said tube.

8. A fire-foam distributing device comprising a tube of fire-resistant material having a single longitudinal opening in the wall thereof for only a portion of its length, so constructed and arranged that said opening will increase in width toward the outlet end of said tube during the passage of fire-foam through said tube.

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