

4700-9918

Nov. 29, 1932.

B. A. MOELLER

1,889,101

FOAM DISTRIBUTING MEANS

Filed April 10, 1931

4 Sheets-Sheet 1

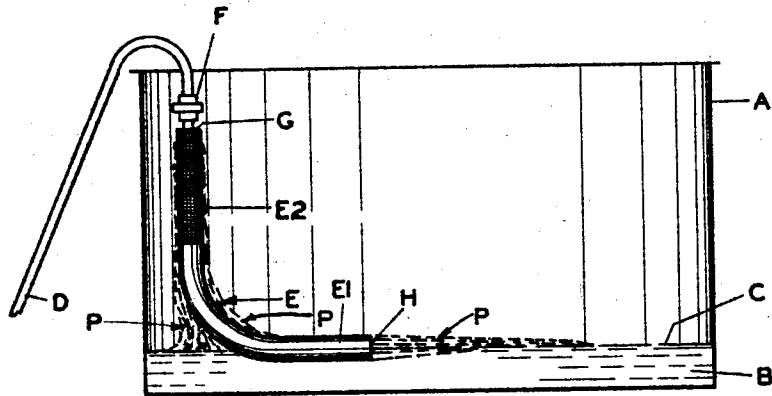


FIG. 1

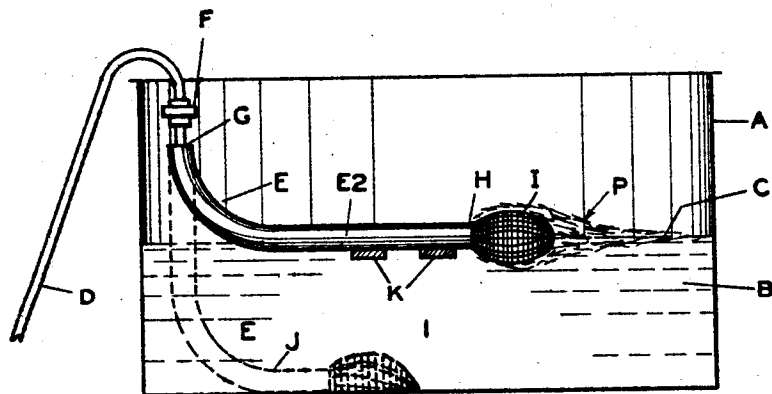


FIG. 2

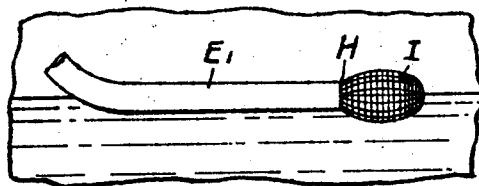


FIG. 2A

BENJAMIN A. MOELLER
INVENTOR
Paul W. Huganir
ATTORNEY

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4 Sheets-Sheet 2

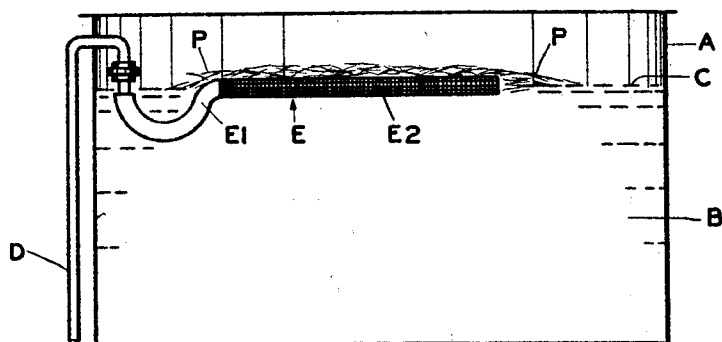


FIG. 3

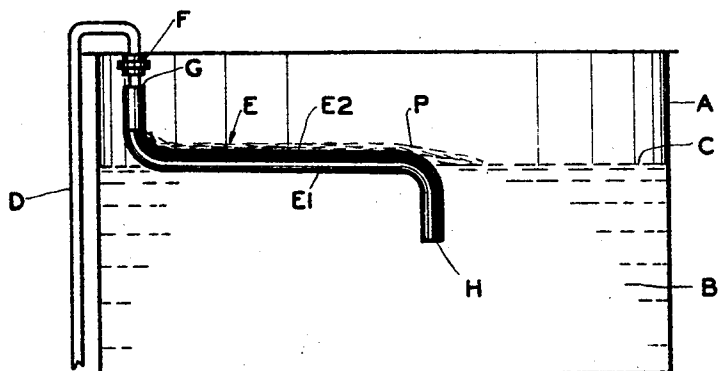


FIG. 4

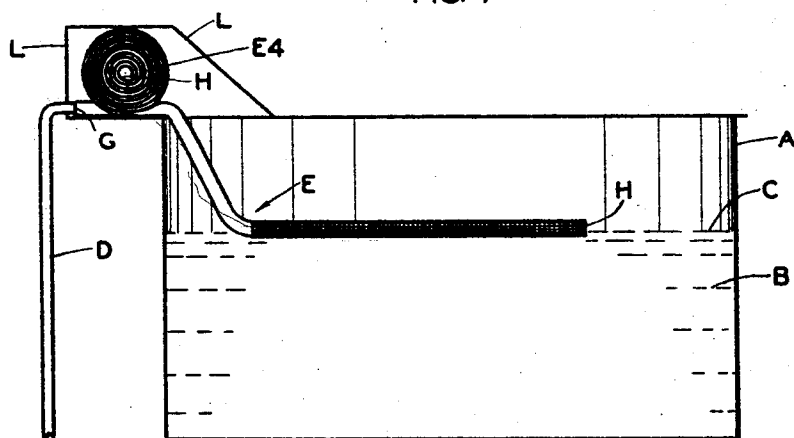


FIG. 5

BENJAMIN A. MOELLER
INVENTOR

Paul W. Hugman
ATTORNEY

Nov. 29, 1932.

B. A. MOELLER

1,889,101

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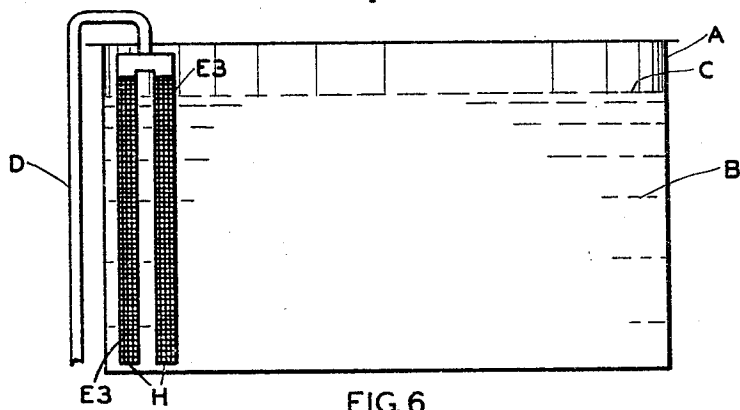


FIG. 6

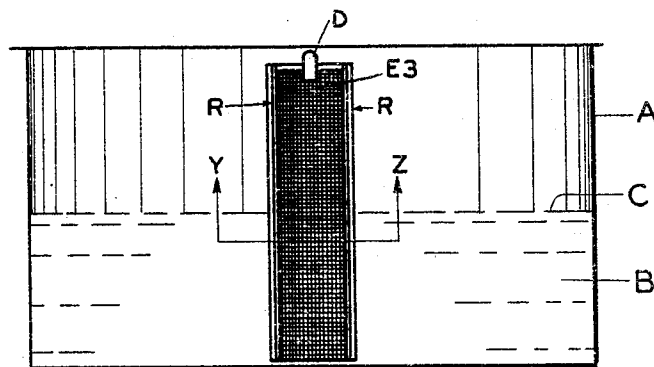


FIG. 7

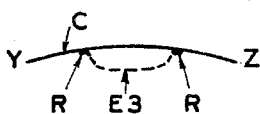


FIG. 8

BENJAMIN A. MOELLER

INVENTOR

Paul W. Rigney
ATTORNEY

Nov. 29, 1932.

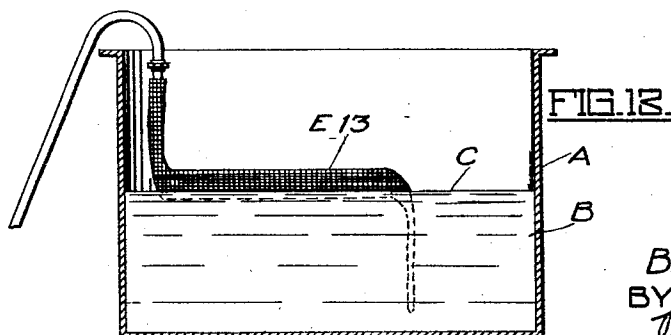
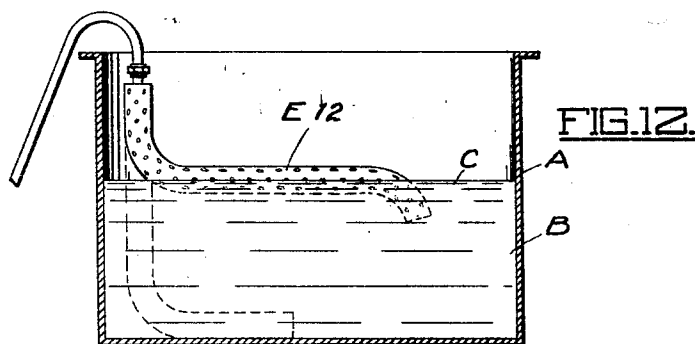
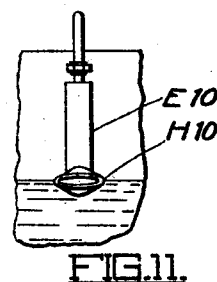
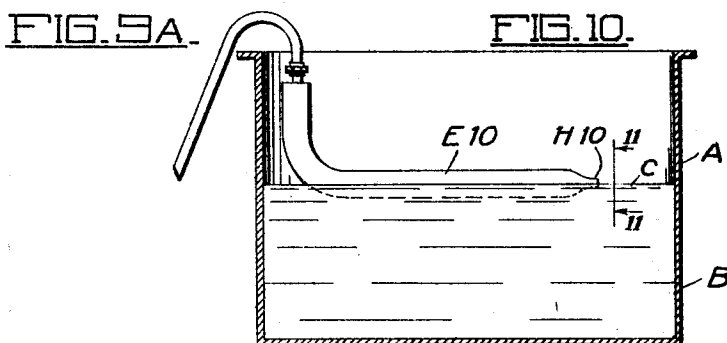
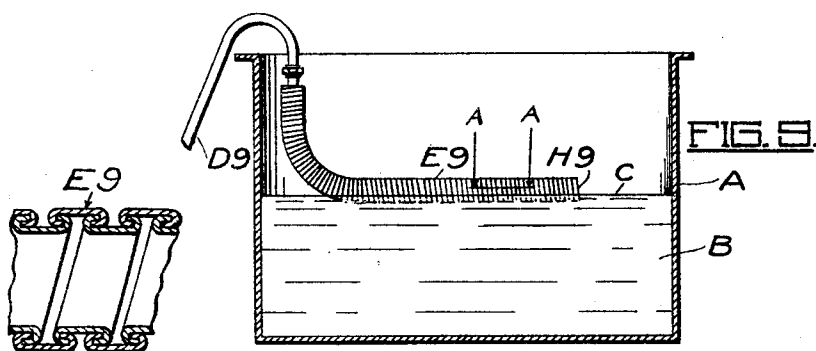
B. A. MOELLER

1,889,101

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4 Sheets-Sheet 4



INVENTOR
BENJAMIN A. MOELLER
BY *Paul W. Newman*
ATTORNEY

Patented Nov. 29, 1932

1,889,101

UNITED STATES PATENT OFFICE

BENJAMIN A. MOELLER, OF PALOS VERDES ESTATES, CALIFORNIA

FOAM DISTRIBUTING MEANS

Application filed April 10, 1931. Serial No. 529,090.

This application is a continuation in part of my copending application, Serial No. 423,975, filed January 28, 1930, and entitled "Foam conducting tube."

Both applications refer to means for introducing a fire extinguishing foam into an oil tank in such manner that the foam will be gently and positively placed on the surface of the oil with the minimum agitation of the oil body or projection of the foam beneath the surface.

It is well known that the foam produced by mixing aqueous solutions of an acid body such as aluminum sulphate, an alkaline body such as sodium bicarbonate and a so-called stabilizer such as glue or licorice, is highly efficacious as a means for extinguishing oil fires. The admixture of these materials in the proper proportions produces a very tough and fine grained froth of bubbles of carbon dioxide gas which will float on even the lightest oils and which acts to extinguish the fire by cooling the upper surface of the burning oil and at the same time shutting off the supply of air therefrom.

It is also well known that to secure the most efficient and beneficial results from the application of foam to burning oil it is necessary to place the foam gently on the upper surface of the oil body. If foam is allowed to fall onto an oil surface from an elevated point, as for instance over the upper edge of the tank when the oil level is low, portions of it are projected below the surface of the oil, leading to a very undesirable disturbance of the contents of the tank, a temporary increase in the volume of inflammable vapor given off, and the splashing about of burning oil over the foam which results in destroying much of it and greatly retards final extinguishment.

In the copending application I have described a device for gently placing the foam on the surface of the burning oil comprising a flexible tube of any fire resistant material freely permeable to foam (such as asbestos threads woven into a loose mesh cloth), one end of this tube being connected to suitable temporary or permanent piping adapted to supply the tube with foam or

foam-producing solutions. The tube is of such length as to reach at least to the bottom of the tank, and as shown and claimed in the copending application the other or free end of the tube is provided with a closure.

When this tube is placed in the tank the free end will sink below the surface of the oil, but as soon as a supply of foam is passed into the tube the extreme lightness of the foam will cause the free end of the tube to rise to the position shown in the drawing in the copending case, the free end floating partly submerged and substantially parallel to the surface of the oil. The supply of foam being continued the foam will exude from the pores in the material of which the tube is composed, the foam thus passing out of the horizontal portion of the tube onto and over the surface of the oil, while the portion which exudes from the curved and the vertical portions of the tube flows down the side of the tube and is also placed gently on the oil surface.

I have discovered that the device shown in the copending application may be materially modified and improved, as hereinbelow set forth.

An understanding of my present invention may be had from the attached drawings, in which

Fig. 1 represents the interior of a tank partly filled with oil, showing in operative position one modification of my invention including a flexible conducting tube of which the upper part is of foam-permeable material and which has an open free end.

Fig. 2 represents in a similar manner another modification having a flexible conducting tube constructed entirely of impervious material and with a foam-permeable distributing means attached to its free end.

Fig. 2A is a fragmentary view showing another form of the modification shown in Fig. 2.

Fig. 3 represents in a similar manner a modification having a flexible conducting tube of which the inner or fixed end is of impervious material and the outer or free end is of foam-permeable material.

Fig. 4 illustrates the behavior of a foam-permeable tube when supplied with an insufficient quantity of foam to cause the entire length of the tube to float on the oil.

Fig. 5 illustrates a modification in which a flexible permeable tube is permanently placed in a chamber communicating with the tank and is permanently connected to the source of foam supply.

Fig. 6 illustrates a modification in which a plurality of vertical permeable tubes are permanently fixed in the tank to be protected.

Fig. 7 illustrates in elevation a modification in which a vertical conduit is formed by attaching the edges of a sheet of permeable material to the wall of the tank.

Fig. 8 is a plan section on the plane Y—Z of Fig. 7.

Figs. 9 and 10 are elevational views illustrating modified forms of my invention.

Fig. 11 is a sectional view taken in a plane represented by the line 11 in Fig. 10, and

Figs. 12 and 13 are elevational views showing still other modified forms of my invention. Fig. 9A is an enlarged sectional view taken in a plane represented by the line A—A in Fig. 9.

Referring to all the drawings: A is a tank containing oil B up to a variable level indicated at C. D is a pipe or pipes conveying a foam or foam-solution supply to the foam distributing member E. These pipes may be temporarily or permanently placed at the tank, the manner of conveying foam or foam-solution to the member E being no part of my invention.

The member E, which is the essential part of my invention, serves two purposes. The first is to convey the foam from the upper edge of the tank to the surface of the oil, this surface being, of course, at a variable and indeterminate level as the tank is filled and emptied. The second is to cause the foam to exude gently onto and over and not materially below the oil surface, wherever that surface may be.

In the modifications shown in Figs. 1 to 5 inclusive the member E is composed of fire resistant material which must be flexible and which may be wholly of material permeable to foam or partly of such material and partly of material impervious to foam. In this connection, it is to be understood that the term "flexible", as used here, is not to be interpreted as meaning a collapsible tube, but refers only to tubes of sufficient longitudinal flexibility to accommodate different levels of oil in the tanks. In the modifications shown in Figs. 6 to 8 inclusive the member E is composed of fire resistant material which must be permeable to foam throughout its length (not necessarily for its entire circumference) and which may be freely flexible or more or less rigid. We thus have three possible materials,

the nature and limitations of which may be as follows.

The flexible impervious material indicated in the drawings by the symbol E1 may be a more or less tightly woven fabric of asbestos threads which for strength may be reinforced with fine wires. Its chief requirement is that it shall be fire resistant and sufficiently flexible to fold or roll without damage. It need not be entirely impervious but it should not permit any material quantity of foam to escape through its pores. Under some conditions of placement it may be a flexible or multijointed metallic tube of the type shown in Fig. 9 though such materials are ordinarily disadvantageous because of their weight.

The flexible, foam-permeable material indicated in the drawings by the symbol E2 has much more strict requirements and so far as I am now aware the only material from which it can be made is asbestos or a similar fire resistant fibre formed into threads and woven into an open mesh cloth, which is an article of commerce.

It is very important that this cloth have meshes of the proper size, that is to say, of a size which will cause the tube to at least partially fill with foam, thus floating at the oil surface when the foam is to be gently deposited, while not offering sufficient resistance to break down the bubble-structure of the foam. It is well known that if these fire foams are forced under high pressure through small orifices they are to a material extent broken down and decreased in volume and to such extent their usefulness is decreased. On the other hand the openings must not be sufficiently large to permit unimpeded flow of foam as such free flow would cause the escape of the foam supply within a too restricted area and the tube would not be floated to the oil surface.

It is impossible to fix arbitrary limits to the size of openings permissible in any given case, but I prefer to use a narrow opening and a sufficient area of tube surface to so multiply the number of such openings as to permit the desired supply of foam to pass through under a low head. For example, a single $\frac{1}{16}$ " opening would permit only a minute quantity of foam to ooze through without going to a destructive pressure but a great number of such openings will permit a correspondingly great quantity of foam to pass. As an example, a tube 10 inches in diameter, of asbestos cloth having threads approximately $\frac{1}{16}$ inch in diameter spaced 7 threads per inch each way, when supplied with the foam resulting from 540 gallons per minute total of standard fire foam solutions, floated and gently exuded foam for 12 feet of its length. Within limits the pores or openings might have been larger or smaller but an approximation to this size of opening appears to be suitable for general use.

A longer tube of less diameter or with smaller openings would distribute the same quantity of foam over a greater area. On the other hand, materially larger openings are permissible (up to perhaps $\frac{1}{4}$ inch or perhaps even greater) particularly in such modifications as that shown in Fig. 4, in which the portion of the tube reaching downward to the oil surface is impervious and the dripping of foam from the tube to the oil surface is thus prevented, or in the case of a multiplicity of tubes as in the modification shown in Fig. 6.

The permeable material of the stationary devices indicated at E3 in Figs. 6, 7 and 8 has the same requirements as the foregoing in regard to the size of mesh. Being fixed in position they need not be flexible and metallic screen, either in the form of wire mesh or of finely punched or slotted sheet may be used, but if the latter the punched holes must have one very narrow dimension, preferably not to exceed $\frac{1}{4}$ inch.

The simplest modification of my invention is that shown in Fig. 1, in which the tube E is attached to the means of foam supply D in any convenient manner, as by a union F. The upper end G of the tube may be open or closed as preferred. The tube is flexible and of sufficient length that in case the oil in the tank is at a very low level, as illustrated in the figure, the lower end of the tube may still assume a horizontal position when buoyed up by being filled with foam.

The upper portion E2 of the tube may be of permeable mesh cloth as indicated and the lower portion E1 of impermeable fabric. When so constructed a portion of the foam will escape through the upper portion of the tube and flow down the outside while any excess quantity will be delivered from the lower end H which should be left open. The course of the foam emerging from the various parts of the device is indicated (in all of the drawings) by the broken lines P—P.

If preferred the entire length of the tube may be of impervious material in which case all of the foam will emerge from the end H. When this course is pursued the lower end of the tube may advantageously be flared to reduce the velocity of the issuing foam. It may also be provided with a spreader, as for instance a binding of stiff wire, to draw the tube end into the shape of a flat and relatively narrow opening lying parallel to and in contact with the oil surface.

In the modification shown in Fig. 2 the tube E may be entirely of impervious material as at E1 and the open end H of the tube is provided with a spreading device I consisting of a bag or cage of open mesh asbestos or wire fabric. This bag serves the same purpose as that served by making a portion of the tube permeable and is a mere variant of the structures shown in Figs. 1 and 3. This bag must

not materially impede the passage of foam and the end H is thus substantially open even when the bag is in place.

Fig. 2 also illustrates the position J which the tube would assume when not in use. At such times it would not contain foam and would lie on the bottom of the tank in such parts as its length permitted. On the intersection of foam into the tube it rises spontaneously to the upper or floating position as shown in Fig. 2A.

In case (and only in case) the material of the tube is sufficiently heavy to prevent its being lifted to operative position at the oil surface by the buoyancy of the foam, suitable floats K may be provided. These floats will never be necessary with a tube of suitable weight asbestos fabric, either of open or closed weave. Figs. 9 and 10 illustrate impervious open ended tubes which are used without these floats.

Fig. 3 illustrates a modification in which the greater part E2 of the tube is of open mesh permeable material while a smaller portion E1 at the upper end is impervious. This modification has the advantage of ensuring that no foam can be driven below the oil surface, in case the tank is almost full of oil, by the inlet connections submerging the upper end of the tube where the pressure of foam is at the maximum.

Fig. 4 illustrates the behavior of any open mesh flexible tube when supplied with an insufficient quantity of foam to reach its end. Foam emerges from the first openings reached and progresses along the length of the tube, simultaneously raising it to the surface, until sufficient area of opening is uncovered to permit the entire supply of foam to escape, the remainder of the tube dangling below the surface and the end H being sealed off by the oil.

This figure also shows a modified form of tube in which that portion E1 of the periphery which contacts with the oil as the tube lies extended is of impervious material and the portion which lies immediately above the oil surface is of open mesh. This modification will positively prevent the ejection of foam beneath the oil surface and will also prevent the more or less forceful ejection of a portion of the foam through the outer portion of the bend in the tube in case the foam falls freely from a height within the vertical portion.

Fig. 5 illustrates a permanent method of mounting a flexible tube, either permeable or impermeable, in such manner that it is instantly available for use. A dog house L may be provided above the maximum oil level and the supply means D fixed in its wall. The upper end G of the tube must be closed and connected tightly to D. The flexible tube E is then flattened and rolled into a coil with the open end H at its center and

the roll placed in the position indicated at E4. It is desirable that at least a small part of the tube adjacent to G should be impervious.

5 On forcing foam into the closed end of the tube, that end which lies farthest from the center of the tank is expanded and the coil is thus projected over the edge of the tank and onto the oil where, when the extension
10 is complete, it assumes the position E—H of Fig. 5 or the position shown in Fig. 4.

The automatic arrangement described is highly desirable because of its simplicity and effectiveness, but obviously numerous other
15 ways for projecting the tube into the tank are available.

The location of the coiled tube as regards the tank is immaterial, so long as the extension of the tube by internal pressure or other
20 means will project it onto the oil surface.

In the modification shown in Fig. 6 the tubes E3 are of open mesh material which, as said, may be flexible asbestos or more or less rigid wire mesh, and are fixed in the tank
25 in a vertical or inclined position with their lower ends H submerged. As the greater part of the tube may be beneath the surface when the tank is nearly full a large area of opening per unit of length is required. Tubes
30 used in this manner would preferably be built of a coarser mesh material than would be used in tubes which depend for their action on the buoyant effect of foam. On the
35 other hand foam falling freely in vertical tubes of large diameter strikes the oil within the tube so forcibly as to become submerged and also to seriously disturb the foam layer forming outside it and thus negates the advantage inherent in my method of placing
40 foam gently on the surface of the oil. If placed vertically each tube should be of sufficiently small diameter to prevent free falling of the foam by causing its adherence to the side walls. A multiplicity of small tubes or
45 other means of providing a large surface area while preventing free falling of the foam would be suitable in a vertical position but obviously an inclined position is an alternate means for obtaining a similar effect when
50 practical to employ it.

In the modification shown in Figs. 7 and 8 the mesh material E3 is formed into the form of a trough which is placed vertically against the wall of the tank C and is joined to the
55 tank at its side edges as at R—R.

In this modification, which is advantageous because of its entire freedom from interference with anything within the tank, the tank wall forms one side of the tube and the mesh material the other. The area of the passage thus produced should be sufficiently restricted to cause the foam to collect and subside in the passage rather than to fall freely to the oil level within it, and the area necessary to convey large supplies of foam into large tanks

should be created by increasing the width of the passage, the distance R—R in Fig. 8, rather than the distance from the mesh to the tank wall.

It was mentioned above that a non-collapsible, flexible or multi-jointed metallic tube might be employed in accomplishing the objects contemplated by this invention, also that the entire length of the tube may be made of an impervious material. Fig. 9 illustrates a
75 modified form of my invention in which the tube E9 is in the form of a flexible metallic tube impervious, throughout its length, from which the foam which is fed to the tube from pipe D9 is delivered to the surface of the oil
80 through opening H9.

In Fig. 10, I show another form of impervious tube E10, which has a flared or flattened opening H10 more clearly illustrated in
85 Fig. 11.

It will be observed that in Figs. 1 to 5 inclusive I have shown and described the tube as having a perforated section and an imperforate section, but, in this connection, it is to be understood that my invention may be advantageously practiced with a tube which is
90 entirely composed of a perforated material.

In Fig. 12, I show a tube E12 which is formed of a non-collapsible material perforated throughout its entire length, and in
95 Fig. 13, I show a tube E13 formed entirely of a collapsible open mesh material which is, of course, perforated throughout its entire length.

In the form shown in Fig. 12, the normal or inoperative position of the tube is shown in dotted lines, and the form shown in Fig. 13 may be suspended in this same manner, or it may be normally supported in a roll, as shown in Fig. 5. When the foam is delivered to either of these types of tubes, the tube will be gradually lifted to the surface of the oil by the buoyancy of the foam contained therein, as the foam progresses through the length of the tube until the tube assumes a position where the foam, exuding from the perforations exposed above the oil, is equal to that being delivered into the tube. This position may be one in which the free end of the tube projects down into the oil, as shown in Figs. 4, 12 and 13, or the tube may be floated throughout its entire length, as shown in Figs. 3 and 5, depending upon the length of the tube, the area of perforations per unit of length, and the rate of foam delivery.

It will be apparent from the foregoing description, that the structural details of the tube or conduit may be varied within wide limits without departing from the scope of my invention, the essence of which resides in a conduit section, (collapsible or non-collapsible), having outlet means, (wall perforations or an open end), and is adapted to be lifted either partially or entirely to the sur-
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face of the oil by the buoyancy of the foam in the conduit.

While I have referred throughout the specification and in the claims to the extinguishing of oil fires in tanks, it will be understood that it is equally applicable to use in connection with fires in sumps, pools, vats or any type of reservoir, and that the term "tanks" is intended to broadly include any receptacle for oil or other combustible fluid.

I claim as my invention:

1. Means for extinguishing oil fires in tanks, comprising: a conductor formed of fire-resistant, form-permeable mesh material arranged within said tank with its upper end in communication with an inlet for foam and so constructed that on passage of foam therethrough it becomes buoyant and causes a substantial portion of the lower part thereof to contact with the surface of the oil in said tank.

2. Means for extinguishing oil fires in tanks, comprising: a tubular conductor formed of fire-resistant, foam-permeable mesh material arranged within said tank with its upper end in communication with an inlet for foam and so constructed that on passage of foam therethrough it becomes buoyant and causes a substantial portion of the lower part thereof to contact with the surface of the oil in said tank.

3. Means for extinguishing oil fires in tanks, comprising: a flexible tube of fire-resistant material, the upper end of said tube being in communication with an inlet for foam, the lower end of said tube being substantially open and so constructed that on passage of foam therethrough it becomes buoyant and a substantial length of the lower portion of said tube contacts with the surface of the oil in said tank.

4. Means for extinguishing oil fires in tanks, comprising: a flexible tube of impermeable fire-resistant material, the upper end of said tube being in communication with an inlet for foam, the lower end of said tube being open, said tube being so constructed that on passage of foam therethrough it becomes buoyant and a substantial length of the lower portion of said tube contacts with the surface of the oil in said tank.

5. Means for extinguishing oil fires in tanks, comprising: a flexible tube of fire-resistant, foam-permeable mesh material, the upper end of said tube being in communication with an inlet for foam, the lower end of said tube being substantially open and so constructed that on passage of foam therethrough it becomes buoyant and a substantial length of the lower portion of said tube contacts with the surface of the oil in said tank.

6. Means for extinguishing oil fires in tanks, comprising: a flexible tube of fire-resistant material, a portion of the length

of said tube being of foam-permeable mesh, the upper end of said tube being in communication with an inlet for foam, the lower end of said tube being substantially open and so constructed that on passage of foam therethrough it becomes buoyant and a substantial length of the lower portion of said tube being adapted to contacts with the surface of the oil in said tank.

7. A foam conducting device for extinguishing oil fires comprising: a flexible tube having outlet openings in the walls thereof; and means for introducing foam into said tube, said tube being constructed and arranged so that a portion of said tube intermediate its ends is caused to float on the surface of the oil by the passage of foam therethrough.

8. Means for extinguishing oil fires in tanks comprising: a tube of flexible, non-collapsible, fire resistant material, the upper end of said tube being in communication with an inlet for foam, the lower end of said tube being open, said tube being so constructed that on passage of foam therethrough it becomes buoyant and a substantial length of the lower portion of said tube contacts with the surface of the oil.

9. Apparatus for supplying foam to the surface of a liquid comprising: a source of foam; an impermeable, flexible conduit connected to said source of foam; and a foam permeable conduit attached to said flexible conduit, said conduit being so constructed as to be buoyed up on the surface of the liquid during the passage of foam therethrough.

10. A foam conducting device for extinguishing oil fires in tanks comprising: a flexible, distendable tube having outlet openings in the walls thereof; and means for introducing foam into said tube under sufficient pressure to distend said walls to a degree such as to cause a portion of said tube to float on the burning oil.

11. In the method of supplying foam to the surface of a liquid: the step which consists in flowing a partially confined foam stream horizontally on the surface of said liquid.

In witness that I claim the foregoing I have hereunto subscribed my name this 1st day of April, 1931.

BENJAMIN A. MOELLER.