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METHOD OF PRODUCING FINE BUBBLE FOAM

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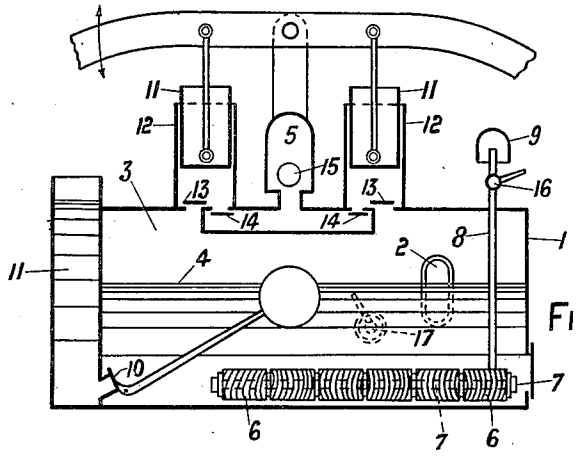

FIG. 1.

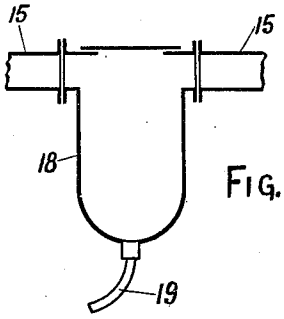

FIG. 2.

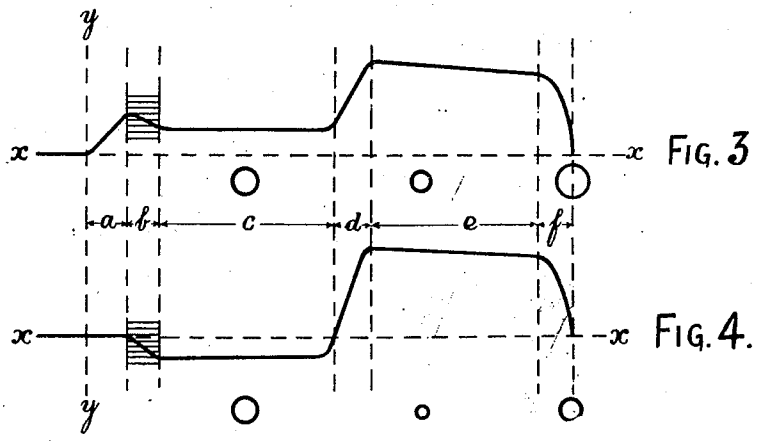

FIG. 3

FIG. 4.

Inventor
Nikolaus Sandor
By
Pennie Davis Marvin & Edmonds
Attys

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NIKOLAUS SANDOR, OF LONDON, ENGLAND

METHOD OF PRODUCING FINE BUBBLE FOAM

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This invention relates to an improved method for producing fine bubbles foam for fire extinguishing purposes and is concerned more particularly with apparatus of the kind consisting of a closed vessel containing a foam-forming liquid into which air or other gas is forced by means of atmospheric pressure by way of a distributor consisting of a body with fine pores arranged at the bottom of the vessel. In a known foam-forming apparatus of this kind air is forced under pressure into the closed vessel or container by means of the pump through the distributor consisting of bodies having fine pores so that the foam is produced under pressure within the vessel or container. The foam is then subjected by means of a second pump to a higher pressure and delivered by this pump to the place where it is to be used.

In Fig. 3 of the accompanying drawings this known method is illustrated diagrammatically. In this diagram the axis of the abscissa x—x represents the atmospheric air pressure, its direction from left to right expressing the result at any time of the operation while the dimensions parallel to the axis of the ordinates y—y correspond to the pressures at any time. The axis of the abscissa is divided into the sections a, b, c, d, e, f.

In the section a air is subjected to pressure by means of the pump in order that it can be forced through the fine porous body. In section b the air flows through the porous body which is indicated by shading and a fall in pressure due to the resistance of the porous body occurs, while in the section c foam formation takes place in the closed vessel. The interior of this vessel is under the same pressure as that of the air forced through the porous bodies and that under which foam formation occurs. In the section d the foam formed is subjected to a higher pressure by means of a second pump while section e shows the course of the foam subjected to higher pressure to the place of use. The section f indicates the drop in pressure on discharge of the foam formed into the atmosphere.

In this known method the foam is formed in the chamber under a certain pressure and the disadvantage arises that on passage of the foam into the atmosphere the foam is partly destroyed by bursting of the bubbles and becomes watery and the air under pressure and enclosed in the remaining bubbles produces by expansion an enlargement of the bubbles as a result of which the foam becomes large-bubbled. This is unsatisfactory with foam used for fire extinguishing purposes as a fine-bubbled relatively dry foam encloses and seals the surface of burning liquid for example petrol, much better from the air than a large-bubbled watery foam.

In accordance with the present invention this disadvantage is avoided by forming the foam, not as heretofore in a vessel under pressure, but in a vessel within which exists a pressure beneath that of the atmosphere.

To this end the suction side of the pump connected with the vessel or container is in communication with the space above the foam-forming liquid and the delivery side of the pump is connected with the foam discharge pipe and the distributor connected by a suction pipe with the atmosphere.

As a result the advantage is obtained that the air contained in the foam bubbles is, when formed, under a lower pressure than atmospheric pressure so that on discharge of a foam so formed from the delivery nozzle or the like the wetting of the foam by bursting of the bubbles is avoided and a comparatively dry fine-bubbled foam is produced suited for fire extinguishing purposes since it seals the burning object airtight. Moreover the advantage over the known foam forming apparatus is obtained that it is necessary to provide only one pump which serves both for supplying air to the vessel in order to form the foam as also for delivery of the foam to the fire.

The diagram of Fig. 4 illustrates the process of foam formation in an apparatus according to the invention.

In the section b the air or the gas is drawn through the porous body indicated by the shaded surface, a fall in pressure due to the resistance of the porous body occurring down to the negative pressure existing in the section c during the formation of the foam.

The foam thus formed is subjected to pressure in section *d* by the same pump. The section *e* shows the course of the foam to the point of consumption. Section *f* shows the discharge of the foam formed into the atmosphere.

In the diagrams Figs. 3 and 4 the sizes of the bubbles during the formation, travel and discharge of the foam are illustrated comparatively beneath the respective sections, the thickness of the lines of the bubbles indicating the thickness of the film of the bubbles. From these figures it will be seen that applicant's method of producing foam has the advantage over prior methods in that the size of the individual bubbles, when discharged into the atmosphere, is smaller than when formed and consequently the bubbles have a thicker wall and are more stable. In the prior methods the size of the bubbles when discharged into the atmosphere increases with a consequent reduction in the thickness of the walls of the bubbles which renders them less stable than when originally formed.

Fig. 1 of the accompanying drawings shows one embodiment of foam forming apparatus in accordance with the invention in vertical longitudinal section while Fig. 2 shows a detail of the apparatus.

Referring to these figures of the drawings, 1 denotes a closed vessel having a closed inspection opening 2. Surmounting the vessel 1 is a two-cylinder suction pump adapted to draw from the foam-collecting space 3 above the foam-forming liquid indicated at 4 within the vessel 1, and being adapted to discharge into an air chamber 5. Located at the bottom of the vessel 1 are porous bodies 6 which consist of wood blocks strung on a perforated tube 7. The direction of the fibres of the wood blocks 6 runs transversely of the tube 7 and the natural bundles of vessels cut by boring the blocks act as fine jets disposed parallel to one another which allow the air or other gas flowing through the tube 7 to enter the foam forming solution contained in the vessel in an extremely fine state of division. 8 denotes a vertical air suction pipe which serves for the supply of the air to the tube 7, there being mounted over the upper end of said pipe a dome-shaped cap 9. Adjoining the vessel 1 and communicating therewith by way of a float-controlled flap valve 10 is an open reservoir 11 for foam-forming liquid. Fall of level of the foam-forming liquid within the vessel 1 is accompanied by descent of the float and opening of the valve 10 so that fresh liquid flows into the vessel 1 from the reservoir 11 until the level is restored, accompanied by closure of the valve 10. The removal of the foam from the space 3 and the necessary reduction of pressure to form the foam is effected by the pistons 11 of the pump which pistons operate in cylinders 12 equipped with suction and discharge valves 13, 14, respectively, the valves 14 opening into the air chamber 5 from which leads a foam delivery pipe 15.

The apparatus can be used also for spraying water. For this purpose it is only necessary to close a cock 16 in the air pipe 8 and to connect to a suitable point of the container or vessel 1 say at 17 a water supply pipe. By actuating the pump the air is first driven off until the water fills the vessel whereupon the pump will deliver water.

As foam standing under pressure for a long time reverts to water it is preferable to interpose in the delivery pipe 15 of the fire extinguisher a water separator which may consist as shown in Fig. 2 simply of a water box 18 to the bottom of which is connected a return pipe 19 leading to the vessel 1.

I claim:—

1. The method of forming foam which comprises maintaining a foam-forming liquid under sub-atmospheric pressure, inducing an aeroform fluid to flow therethrough by means of said sub-atmospheric pressure, and then projecting said foam into the atmosphere whereby the increased pressure of the atmosphere causes the individual bubbles of the foam to decrease in size and the walls thereof to increase in thickness.

2. The method of forming foam which comprises maintaining a foam-forming liquid under sub-atmospheric pressure, inducing an aeroform fluid to flow therethrough from the atmosphere by means of said sub-atmospheric pressure, and then projecting said foam into the atmosphere whereby the increased pressure of the atmosphere causes the individual bubbles of the foam to decrease in size and the walls thereof to increase in thickness.

3. The method of forming foam which comprises maintaining a foam-forming liquid in a container and drawing aeroform fluid into and through said liquid by applying suction to the container above the level of the foam-forming liquid, and then projecting said foam into the atmosphere whereby the increased pressure of the atmosphere causes the individual bubbles of the foam to decrease in size and the walls thereof to increase in thickness.

In testimony whereof I have signed my name to this specification.

NIKOLAUS SANDOR.