Feb. 4, 1936. B. PÅLSSON 2,029,336

FIRE EXTINGUISHING APPARATUS

Filed Aug. 15, 1934 2 Sheets-Sheet 1

Fig. 1

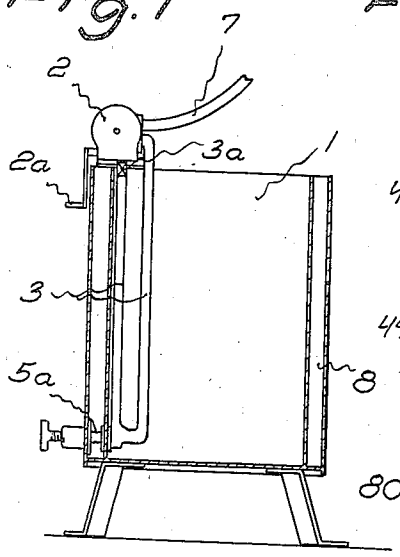

Fig. 3

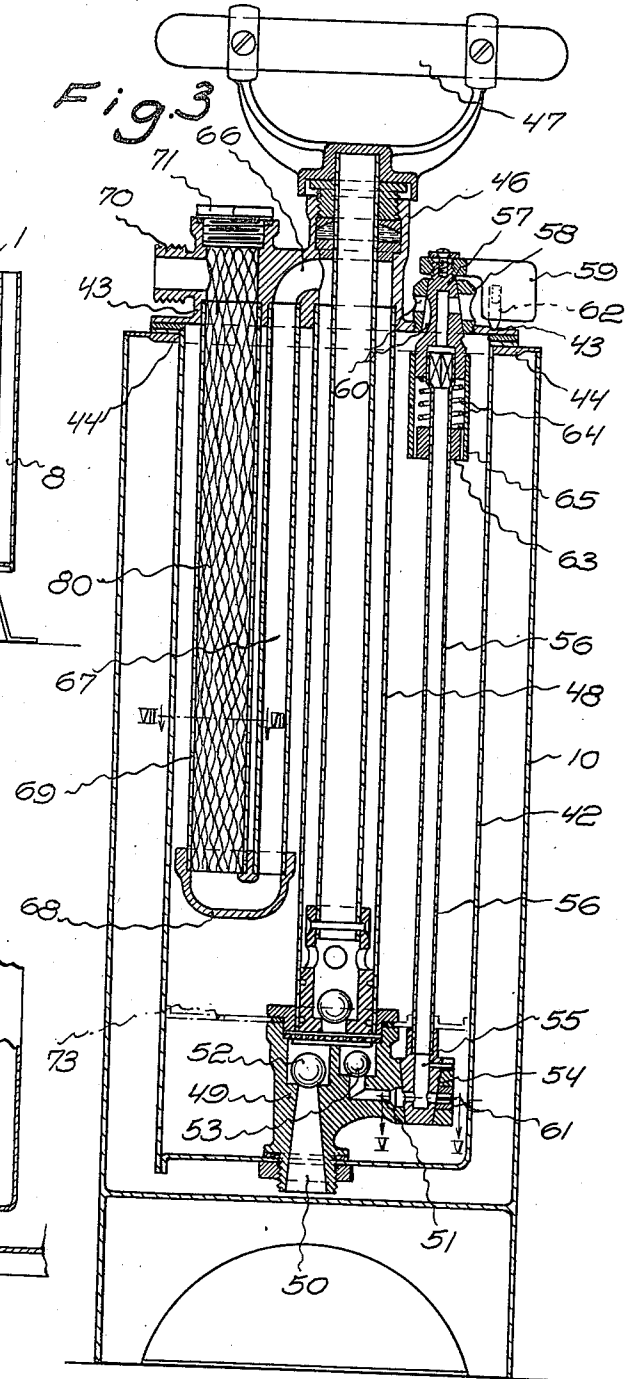

Fig. 2

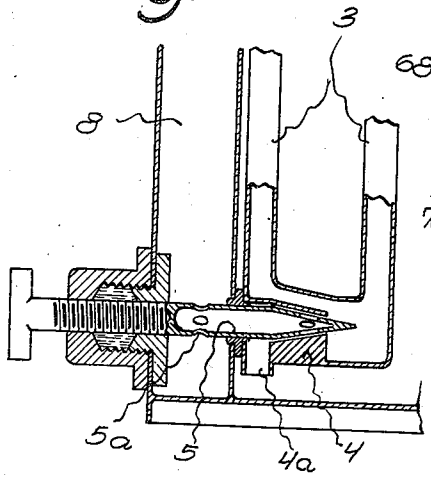

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Fig. 4

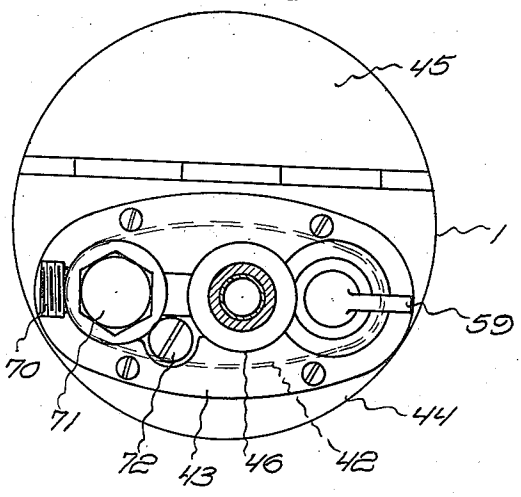


Fig. 7

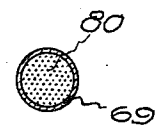


Fig. 8

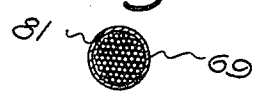


Fig. 5

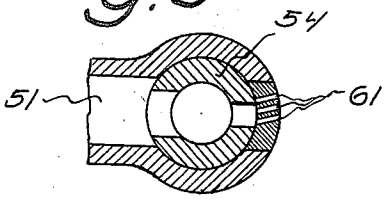


Fig. 9

Fig. 6

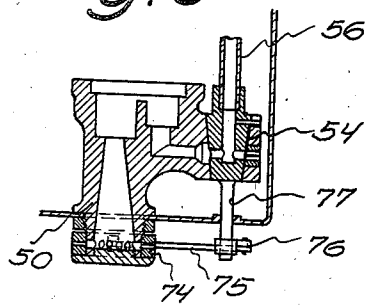
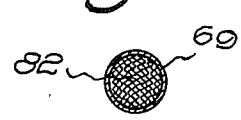


Fig. 10



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Patented Feb. 4, 1936 2,029,336

UNITED STATES PATENT OFFICE

2,029,336

FIRE EXTINGUISHING APPARATUS

Bror Pålsson, Malmo, Sweden

Application August 15, 1934, Serial No. 740,010
In Sweden August 21, 1933

6 Claims. (Cl. 261—28)

This invention relates to improvements in apparatus for extinguishing fire, or for protecting furniture or parts of buildings etc. against fire, by throwing foam thereon, which is produced mechanically by working air into a foaming liquid by means of a pump which is drawing in both the air and the foaming liquid.

The invention is designed more particularly for the production of a simple and efficient apparatus of the self-contained type, which can be readily transported manually and which is normally in condition for service operation and which can be operated by hand or, as the case may be, by a small motor such as an electric motor adapted to be connected by means of a flexible cable and a wall plug to a wall socket. In addition the apparatus is of a character that can be charged separately and independently with a relatively concentrated solution of a foaming agent such as saponine or the like and with water, the foaming liquid into which the air is worked for producing the foam being formed at the operation of the apparatus by continuously bringing together into commixing relation in a controllable manner a relatively small proportion of the concentrated solution of the foaming agent with a relatively large proportion of the water, whereby the portable apparatus may contain a sufficient charge of the liquid foaming agent for making the apparatus capable of service operation for throwing foam during a relatively long period of time by repeatedly recharging the apparatus with water only, and for throwing water when the charge of the foaming agent is exhausted, or when desired, by turning off the inlet for the foaming agent and the inlet for the air to the pump, while leaving the inlet for the water open.

To these and other ends, the nature of which will be readily understood as the invention is hereinafter disclosed, the invention consists in the improved construction and combination of parts hereinafter fully described, illustrated in the accompanying drawings, and more particularly pointed out in the appended claims.

In the accompanying drawings:

Fig. 1 is a diagrammatic view partly in side elevation and partly in section showing an embodiment of the invention.

Fig. 2 is an enlarged sectional fragmentary view showing more particularly the arrangement of certain parts of the apparatus according to Fig. 1.

Fig. 3 is a view in vertical section showing another and preferred embodiment of the invention.

Fig. 4 is a top plan view of the apparatus according to Fig. 3.

Fig. 5 is an enlarged detail section on the line V—V in Fig. 3.

Fig. 6 is a sectional fragmentary view showing modified details.

Fig. 7 is an enlarged detail section on line VII—VII in Fig. 3.

Figs. 8 to 10 inclusive are corresponding enlarged detail sections showing modifications.

Referring first to the embodiment of the invention shown in Figs. 1 and 2 on the drawings, 1 represents a portable receptacle having mounted thereon a pump 2 which may be a rotary or centrifugal pump or a pump of any other suitable type such as a piston pump or a diaphragm pump. In the example shown the pump is a rotary or centrifugal pump adapted to be driven by means of a crank handle 2a through a worm or other gear operatively connecting the rotary member of the pump to the shaft of the handle. Instead of operating the pump by hand, the pump may also be driven by means of a small motor such as an electric motor adapted to be connected by means of a flexible cable and a wall plug to a wall socket. The receptacle 1 is provided with an outer and an inner wall leaving between them a space or compartment 8 adapted to contain a charge of a relatively concentrated solution of a foaming agent such as saponine or the like, while the inner space or compartment of the receptacle 1 is adapted to be filled with water. The pump 2 is provided with an air intake pipe 3 extending from a point above the highest possible level of the liquid in the receptacle to, or substantially to, the bottom of the receptacle and then to the pump. Near the bottom of the receptacle 1 this intake pipe 3 is provided with an inlet for water from the inner compartment of the receptacle as well as for the liquid foaming agent from the outer compartment of the receptacle. In the example shown this inlet is in the form of a spreading or atomizing nozzle 4 projecting into the air stream which, at the operation of the pump, is drawn in through the said pipe 3. The nozzle 4 can be shut off and controlled by a needle valve 5 which is adjustable from the outside of the receptacle 1 and is made hollow and provided with holes 5a in its wall for providing a passage for the liquid foaming agent in the outer compartment of the receptacle to the nozzle 4 which is provided with a lateral inlet opening 4a for the water from the inner compartment of the receptacle. At the operation of the pump, the water from the inner compartment of the receptacle and the liquid foaming agent from the outer compartment of the receptacle are drawn in through the nozzle 4 and thereby brought into commixing relation with each other and with the air which is drawn in by the pump through the pipe 3. By providing a shut off valve 3a on the pipe 3 and by shutting off this valve the apparatus may be useful for throwing water only, for instance when the charge of the liquid foaming

agent is exhausted. A hose 7 or the like having a suitable outlet nozzle is attached to the pressure outlet of the pump 2 for directing the jet of foam or water on to the fire, or on to the object to be protected against fire. In the outlet of the pump or in the hose or the like attached thereto there may be provided suitable means, preferably of a character to be particularly described in the following with reference to Figs. 7, 8, 9 and 10, for improving the quality of the foam before it leaves the nozzle at the outer end of the hose in the form of a continuous jet.

Referring now to the preferred embodiment of the invention shown in Figs. 3, 4 and 5 on the drawings, the compartment for containing the charge of the liquid foaming agent consists of an inner container 42 placed in an outer receptacle 10 adapted to be filled with water. Preferably the outer receptacle or container 10 is of circular and the inner container 42 of oval cross section. The outer container 10 is closed at its top with a head 43 secured to a cover plate 44 on the top of the outer container or receptacle 10. One portion 45 (Fig. 4) of the cover plate 44 is hinged. The inner container 42 has its bottom lying above the bottom of the outer receptacle 10 to leave a free space therebetween. In the inner container 42 and coaxial therewith is the cylinder 48 of a piston pump, the tubular piston rod of which extends through a packing box 46 in the head 43 and is provided with a handle 47. The pump cylinder 48 is secured at its upper end in the head 43 and is provided at its lower end with a suction valve casing 49 formed with two hollow inlet studs 50 and 51 each provided with a check valve preferably in the form of a ball 52 and 53 respectively. The inlet stud 50 extends through an opening in the bottom of the inner container 42 and is secured thereto. The other inlet stud 51 extends laterally and at its outer end forms the body of a cock, the plug 54 of which is provided with an axial passage 55 having connected thereto the lower end of a vertical air intake pipe 56 which at its upper end is connected with the rotatable plug 57 of a cock the body 58 of which is secured on the head 43. The plug 57 is provided with a handle 59, and when the plug 57 is rotated by means of this handle 59, the cock plug 54 is simultaneously rotated through the medium of the pipe 56. The cock 57, 58 controls an air inlet passage to the air intake pipe 56, and when opening the said cock 57, 58 to set the air intake pipe 56 in communication with the free air, the said cock simultaneously opens a passage 60 from the free air to the interior of the inner container 42, and at the same time the cock 54 opens an inlet 61 for the foaming liquid in the container 42 to the suction side of the pump through the stud 51, so that the pump, at the operation thereof, can draw in both water through the stud 50 from the outer receptacle 10 and air through the air intake pipe 56 and liquid foaming agent from the inner container 42. The inlet 61 for the liquid foaming agent controlled by the cock plug 54 consists of a plurality of separate openings (Fig. 5), a less or greater number of which is uncovered when the handle 59 is rotated less or more in the opening direction. In order to facilitate the adjustment of the handle 59 in any one of a number of predetermined opening positions it may be provided with a spring actuated bolt 62 adapted to engage corresponding indentations in the upper surface of the cover plate or head 43. The upper end of the pipe 56 is slidable in a downwardly projecting tubular extension on the cock plug 57, and between the latter and a collar 63 which is secured on the pipe 56 there is provided a spring 64 for pressing the cock plugs 54 and 57 against their seats. This spring may be housed in a sleeve 65. The pump has a pressure outlet 66 provided in the head 43, and from this outlet 66 a pipe 67 extends downwardly to an elbow 68 from which a pipe 69 extends upwardly to an outlet opening 70 formed in the head 43, to which a hose or the like (not shown in the drawings) can be connected. In the head 43 there is also provided an opening aligned with the pipe 69 and closed with a screw plug 71, and further the head 43 is provided with an opening through which the liquid foaming agent may be filled into the inner container 42 and which is closed with a screw plug 72 (Fig. 4).

In the pipe 69 there is inserted (through the opening normally closed with the screw plug 71) a bundle of substantially parallel rods or wires 80 (compare also Fig. 7) extending in the longitudinal direction of the pipe 69 and suitably spaced from each other (for which purpose the said rods or wires preferably are corrugated) so as to leave between themselves a large number of substantially parallel, narrow channels. The subdivision of the interior of the pipe 69 in such narrow channels extending in the direction of flow through the said pipe 69, can also be obtained with an insertion of tubes 81 of small diameter (Fig. 8), or of spaced plates 82 (Fig. 9) which may be corrugated (Fig. 10). By means of this device, that is the subdivision of part of the conduit for the commixed air, water and foaming agent in relatively well defined narrow channels extending in the direction of flow through said part of the conduit, the mixture of air, water and foaming agent is converted into a foam of high quality with a minimum of work; that is to say, this device offers but a relatively low resistance to the flow of the air and foaming liquid and the foam produced thereby. It should be noted that the said channels are not so narrow as to be comparable with the pores of porous or spongy bodies which heretofore have been proposed and which offer a very high resistance making a correspondingly high pressure necessary for forcing the mixture of air and foaming liquid therethrough. In fact, the channels should not be narrower than that the liquid can spread in thin layers on the walls of the channels and still leave room for the air to sweep the thin layers of liquid on the surfaces of said walls. When this is the case the flowing air catches or seizes the liquid adhering to the said wall surfaces and pulls it into thin films against the surface tension of the liquid, which films inclose the air, thus forming interwoven foam bubbles. The total cross sectional area of the said channels may be as great as, or nearly as great as, or even greater than the normal cross sectional area of the conduit (the hose) through which the foam is forced out to the point of use. The low resistance against the pumping action thus obtained is important for the production of a hand operated apparatus of relatively great capacity, which at the same time is capable of producing a foam of high quality for fire-extinguishing purposes. I wish it to be understood, however, that the specific method of forming films of the liquid by subdividing the foam conduit at a portion of the length thereof in a large number of longitudinal channels as hereinbefore described, as well as the means for subdividing a portion of the foam

conduit in this manner, is not claimed per se in this application, an application for a separate patent on this specific method and means having been filed by me on Aug. 21, 1933 and given Ser. No. 11,149.

The inner container 42 is filled with a relatively concentrated solution of saponine or the like, and the outer receptacle 10 is filled with water. When the apparatus is to be used the handle 59 is turned in an opening position, and when then actuating the pump water is drawn in through the inlet 50 and air and liquid foaming agent through the inlet 51. The relative proportions of water, air and foaming agent can be controlled or adjusted for varying or adjusting the quality of the foam produced, by setting the handle 59 in different opening positions. The proportion of foaming agent is small in relation to the proportion of water which in turn is small in relation to the volumetric proportion of air drawn in for the production of foam. Therefore, in actual use, the apparatus can be refilled with water repeatedly before the charge of the foaming agent is exhausted. When desired, for instance when the charge of the foaming agent is exhausted, the apparatus can be used for throwing water only by shutting of the inlet for the air and the foaming agent to the pump by turning the handle 59 to closed position. When the apparatus is not in use the foaming agent is hermetically enclosed in the container 42 to prevent evaporation and contamination of the foaming agent.

A horizontal partition shown in dotted lines at 73 in Fig. 3 can be arranged in the container 42, such partition being provided with limited openings in order to compensate for the difference in head pressure of the liquid in the container as the level of the liquid sinks at the use of the apparatus.

In the modification shown in Fig. 6 the water inlet 50 to the pump is provided with a control valve member in the form of a rotatable ring 74 having lateral openings in registry with corresponding lateral openings in the inlet member 50 in the open position of the said valve member 74. The valve ring 74 is connected by means of a link 75 to an arm 76 secured to the lower end of an extension 77 on the cock plug 54 so that the valve ring 74 is rotated at the rotation of the plug 54.

While I have herein shown and described a preferred embodiment of the invention in detail, it will be understood that many of the details can be varied to meet various practical demands or individual preferences, and I reserve the right to make any and all such changes or modifications as may be found desirable or essential, in so far as they fall within the spirit and scope of the invention as expressed in the following claims.

What I claim and desire to secure by Letters Patent is:—

1. In fire-extinguishing apparatus of the character described and in combination, a portable receptacle having separate compartments to normally carry a relatively concentrated solution of a foaming agent and water respectively, a pump associated with said receptacle, and air intake pipe leading to the suction side of said pump and extending substantially to the bottom of said receptacle, and inlets for the liquid foaming agent and the water from the separate compartments of the receptacle to the suction side of the pump, said last mentioned inlets being arranged and connected with each other and with the air intake pipe near the bottom of the receptacle.

2. In fire-extinguishing apparatus of the character described and in combination a manually transportable receptacle having inner and outer compartments one of which is adapted to contain a liquid foaming agent while the other is adapted to contain water, a pump associated with said receptacle, an air intake conduit extending from a point above the highest possible level of the liquid in the receptacle downwardly in the container substantially to the bottom thereof and then to the suction side of the pump, and inlets for the water and the liquid foaming agent from the separate compartments of the receptacle, which inlets open into the said conduit near the bottom of the receptacle.

3. A fire-extinguishing apparatus as claimed in claim 2 in which the inlets for the water and the liquid foaming agent into the said air conduit are in the form of a valve controlled atomizing nozzle projecting into the said conduit.

4. In fire-extinguishing apparatus of the character described and in combination, outer and inner receptacles for carrying water and a liquid foaming agent respectively, a hand operable piston pump arranged vertically in the inner receptacle, a suction valve structure connected to the lower end of the cylinder of the said pump and having one inlet leading from the outer receptacle near the bottom and another inlet leading from the inner receptacle near the bottom thereof, an air intake pipe extending into said receptacle and leading to said suction valve structure, and adjustable valve means for controlling said last-mentioned inlet and air intake pipe.

5. A fire-extinguishing apparatus as claimed in claim 4 in which the air intake pipe is connected to the suction valve structure through a cock plug rotatably mounted in said valve structure and serving the purpose of controlling the inlet for the liquid foaming agent from the inner receptacle to the pump, the air intake pipe at its upper end being connected to the plug of a cock serving the purpose of controlling an air inlet to said air intake pipe and being provided with a handle through which not only the last mentioned cock plug but also the first mentioned cock plug, through the medium of the said air intake pipe, can be rotated.

6. In a fire-extinguishing apparatus of the character described and in combination, outer and inner receptacles, the outer receptacle for carrying water and the inner receptacle for carrying a charge of liquid foaming agent, a hand operable piston pump vertically arranged in the inner receptacle, a suction valve structure connected to the said pump at the lower end thereof and having an inlet for water from the outer receptacle near the bottom thereof and an inlet for liquid foaming agent from the inner receptacle near the bottom thereof, an air intake pipe extending into said receptacle and connected to said suction valve structure, a cover head for said inner receptacle at the top thereof, said head having formed therein a pressure outlet from the pump and a channel having an outlet for connection of a hose, a conduit provided within the inner receptacle and interconnecting said pressure outlet and said channel in the said cover head, and film-forming means located in said conduit.

BROR PÅLSSON.