Jan. 27, 1931. J. R. HAMILTON 1,790,621

FOAM PRODUCING FIRE EXTINGUISHING APPARATUS

Filed Jan. 17, 1923

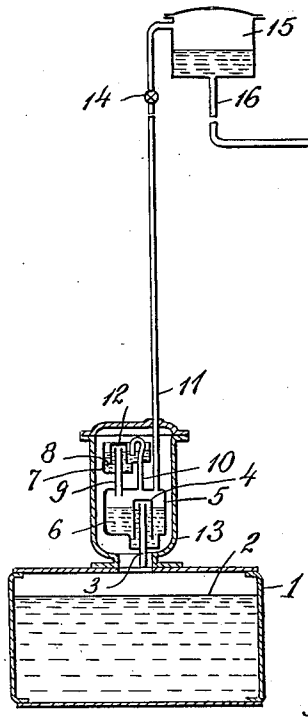


Fig. 1.

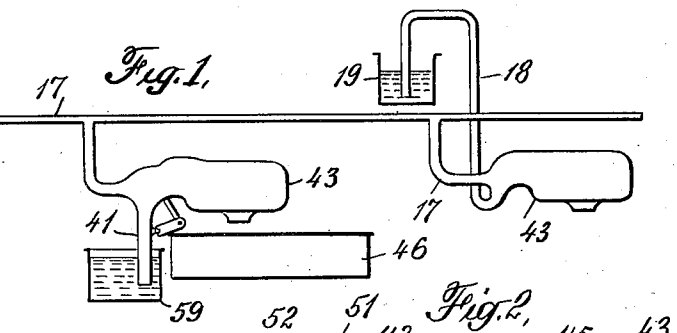


Fig. 2.

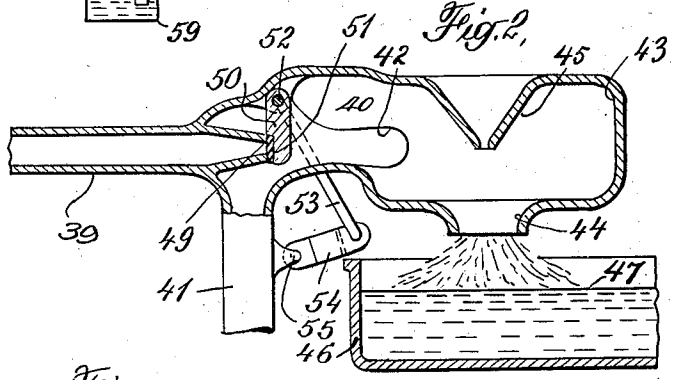


Fig. 3

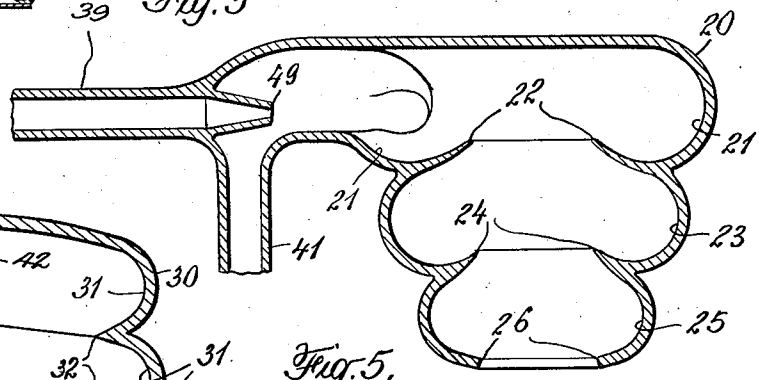


Fig. 4.

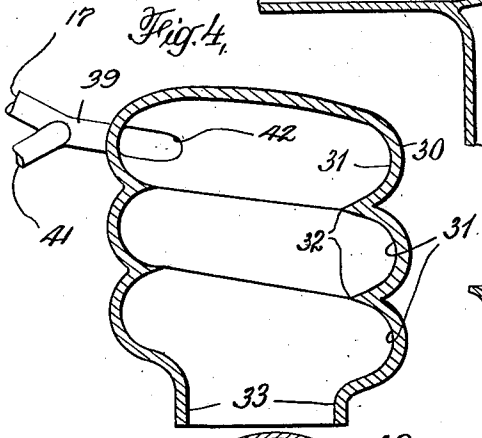


Fig. 5.

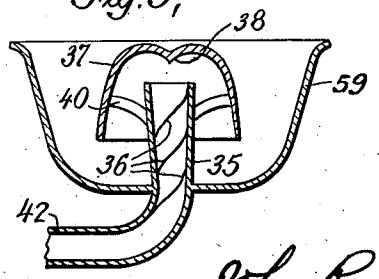
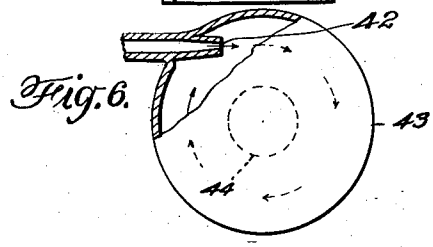


Fig. 6.



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UNITED STATES PATENT OFFICE

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FOAM-PRODUCING FIRE-EXTINGUISHING APPARATUS

Application filed January 17, 1923. Serial No. 613,081.

This application is in part for a specific combination or apparatus disclosed but not specifically claimed in my copending case Serial No. 281,048, filed March 16, 1919, Patent Number 1,467,377 and in part for certain improvements in the form of an element of the apparatus described therein.

The invention herein claimed embodies as an element thereof the specific form of mixing chamber described as the whirl chamber and shown in Fig. 3 of the said application.

The invention herein claimed further consists in certain improvements in said whirl chamber as hereinafter more particularly described.

This invention relates especially to apparatus for producing foam of a fire extinguishing character and for this purpose one or more high pressure supply tanks or devices may be used connected to the distributing or mixing devices located at various parts of the building so as to supply thereto an emulsifying liquid which may advantageously be incorporated with dissolved bicarbonate or other carbonate or pressure producing material. These distributing devices may comprise a venturi or other mixing device and may be connected to individual or relatively small supply tanks or devices containing cooperating acidifying or other pressure producing liquid adapted when mixed with the liquid from the high pressure tank to produce large quantities of fire extinguishing foam which may be delivered or disseminated at the place where the fire starts. For this purpose the distributing device may have a thermal or other automatic releasing control device adapted to be otherwise released in any desired way as by the automatic action of an adjacent starting fire so that the mixing action can then take place, and if desired the high pressure liquid may automatically suck or withdraw the cooperating acid reacting liquid from the adjacent supply tanks so that the two may be thoroughly and energetically mixed as by injector venturi mixing action before being delivered and more or less disseminated adjacent the fire. The reacting liquids before or after they have been mixed by such injector action may advantageously be directed into or through a whirl chamber or passage in which they are more or less thoroughly mixed and the resulting foam discharged as through a central or axial orifice, for instance.

In the accompanying drawing showing in a somewhat diagrammatic way an illustrative embodiment of this invention,

Fig. 1 is a vertical sectional view.

Fig. 2 is an enlarged vertical section through one of the injector mixing devices and cooperating whirl chambers.

Figs. 3 and 4 show other illustrative whirl chamber constructions, and

Fig. 5 is still another form of whirl chamber or mixing passage.

Fig. 6 is a plan illustrating diagrammatically the arrangement of the inlet pipe whereby the mixed liquids are delivered tangentially to the whirl chamber.

As diagrammatically indicated in Fig. 1, the apparatus may comprise a high pressure supply tank of any desired size and construction, such as 15, which may contain a charge of any suitable carbonated licorice extract or other suitable emulsifying pressure producing liquid which preferably comprises dissolved carbonate material such as sodium bicarbonate, for instance. This supply tank may be arranged to deliver the liquid at relatively high pressure to the various distributing devices and this may be conveniently effected by maintaining compressed air at the desired pressure above the liquid in the tank or by having the tank when its flanged cover is removed or as it is otherwise vented, at a sufficient height above the distributing devices so that the gravity pressure of the liquid is ample to secure in this way the discharge pressure of fifteen to twenty-five pounds per square inch more or less. An advantageous method of securing the desired high pressure delivery of this liquid during fire emergency extinguishing operation of the apparatus is to have the tank sufficiently elevated or under a sufficient air pressure to exert through the delivery pipe 16 a moderate delivery pressure on the distributing devices, such as 20, arranged at suitable intervals around the building and have the tank connected with a

chemical mixing pressure generating device or tank 6 automatically brought into operation when liquid is first delivered from the supply tank so that thereupon the chemically generated pressure is exerted on the supply tank to discharge liquid therefrom at the desired high pressure.

A chemical mixing pressure generating apparatus of this character which is somewhat diagrammatically illustrated in Fig. 1 may be of the general type described and covered by the Everett L. Thompson, Jr., Patent 1,206,173 of November 28, 1916. A cooperating casing 13 which may have a removable cover is adapted to deliver sulphuric acid or other cooperating pressure producing chemical into the tank 1 under the emergency operating condition of the apparatus. For this purpose the acid container 5 may be arranged within the casing 13 and be provided with a siphon discharge device 3, 4, adapted to deliver this charge 6 of acid into the tank below when the level of the acid rises above the top of the siphon delivery pipe 3 which may be effected by the starting siphon device comprising the starting acid container 7 containing a charge 8 of similar acid with which cooperate one or more siphon delivery devices, such as 10 and 9, 12 which are normally in the inoperative condition shown in the drawing. A suction actuating pipe, such as 11, may be connected in any desired way with the interior of the acid chamber 5 and with the upper part of the supply tank 15. Thus when one of the distributing devices comes into operation and liquid flows from the tank 15 through its connected discharge pipe 16 the upper part of this tank which may be formed with one or more pin-hole or small area equalizing passages where a gravity pressure tank is used is substantially closed and cannot allow such ingress of air as would be necessary to equalize the pressure change caused by the discharge of liquid. This causes a pressure reduction or suction impulse in the upper part of this tank and the connected suction actuating pipe 11 so that this suction impulse when communicated to the acid chamber 5 draws additional acid into the same through one or more of the starting siphons 9, 10. These continue to deliver acid to the chamber 5 until the acid level reaches the top of the siphon discharge pipe 3 whereupon this entire charge 6 of acid is quickly delivered into the carbonate liquid 2 in the mixing tank below, generating through the chemical action of these two liquids the desired high gas pressure which is promptly transmitted through the pipe 11 to the upper part of the supply tank 15 so as to be effective in causing the fire emergency delivery of the emulsifying carbonate or other liquid therefrom. If desired, however, the chemical mixing pressure tank 1 may be cut off at any time by closing the hand valve 14 in the pipe 11 and then the supply tank 15 may be operated by maintaining suitable air pressure above the liquid therein.

The supply pipe 16 may extend throughout the building and have at intervals the supply connections 17 with the distributing devices which may be of any desired type and construction preferably automatically operating in the event of a neighboring fire so as to effect the mixing action necessary to produce this fire extinguishing foamy material. These distributing devices may be of the venturi or injector type so that the high pressure liquid automatically operates to mix or incorporate and also draw in if desired additional acidifying liquid from individual or neighboring supply tanks thereof, such as 19, which may be connected with the distributing device through siphon or other connections 18 which may automatically effect the delivery of this liquid to the mixing devices in the event of fire. By having these feeding connections 18 extend upward to a slight extent at least above the normal level of the acidified or other chemical pressure producing liquid in the adjacent tanks 19 these pipes are normally empty and yet as soon as the emergency injecting or mixing action of the distributing device takes place, sufficient suction may be caused in these feeding connections to draw up the liquid into the same, whereupon the siphon action of these pipes continues to supply liquid to the distributing device as long as any such liquid remains in the individual tank 19.

In some cases a very effective production of fire extinguishing foam may be secured by delivering the foam producing liquid into a mixing and separating device of the general type indicated in Fig. 2. The two cooperating foam producing liquids may be mixed in any desired way as by injector action, the high pressure liquid supply communicating for instance through the connection 17 with the nozzle pipe 39, for instance, while the feeding connection 41 from the supply 59 for example may feed the cooperating acidifying liquid into the injector chamber 43. As shown more in detail in Fig. 2, the nozzle passage 39 terminates in the nozzle 49 with which may cooperate a movable valve or closing device 50 which may be provided with a leather or other yieldable seat 51. This valve may be rigidly mounted upon the pivot 52 which may have the extended arm 53 normally held in this closed position shown in Fig. 2 by a thermally releasable member, such as the fusible link 54 which may have its other end secured to the pin or support 55 on the pipe 41. When, for example, the liquid in the dipping tank 46 ignites, this fusible link melts and the arm 53 being no longer restrained, permits the valve to open under the liquid pressure on the valve seat assisted,

if desired, by a releasing spring not shown. This opens the nozzle 49 so that this high pressure liquid flows into the injector chamber, drawing up the cooperating liquid through the pipe or connection 41. The mixed liquids may be injected into a suitable whirl chamber such as 43 and may enter the same through a substantially tangential entrance passage 42. The mixed liquids may whirl rapidly around the chamber, thus promoting the mixture thereof and allow the development of gas by the chemical reaction of these liquids which produces foam of a relatively lighter character. By centrifugal action these moving liquids tend to hug the outer wall of the whirl chamber, while the resulting foam is displaced through one or more generally axial or central discharge openings 44 so that the lighter foam produced is continuously discharged with a correspondingly less proportion of the heavier more solid liquid components. If desired a deflector member, such as 45, may extend more or less into the whirl chamber from one side which promotes the progressive discharge of the lighter foam from the other side of the chamber. The foam may as indicated be directly delivered into an oil receptacle, pan or tank, such as 46, so as to spread or flow over the oily liquid 47 therein in case of fire; or any other distributing or disseminating devices or arrangements may be employed to suit any other special circumstances.

Another form of mixing or whirl chamber is shown in Fig. 3 as comprising a superimposed series of communicating whirl chambers through which the mixed liquids pass while the resulting foam may be discharged through one or more axial openings, if desired. The metallic casing or casting 20 with which the nozzle passage 39 and nozzle 49 may be connected integrally or otherwise may be formed with a series of whirl chambers 21, 23 and 25 which may be substantially coaxial, if desired, and may in some cases be of different size, the larger chambers being illustrated as above and first receiving the foam producing liquids which are directed into the same in a more or less tangential direction. These liquids thus circle or whirl around this initial chamber, thereby becoming mixed and the incoming liquids force parts of this material inward over the partition or separating flange 22 which may advantageously be upturned for some purposes. This material then whirls around in the lower chamber 23 until it falls or is forced down past the partition 24 into the chamber 25 from which it may be discharged through the opening 26. This action also promotes the separation of the foam produced which, because it is lighter, is forced in toward the axis of the whirl chamber so that it can be continuously discharged through the lower axial opening 26.

Fig. 4 shows another form of whirl chamber 30 which may be cast with a spiral whirl passage or channel 31 extending several times around the chamber, the various portions of this channel being separated by the inwardly projecting partitions 32. The liquids, which may be mixed in any desired way, may be injected tangentially into this chamber through the passage 42 with which may communicate a pipe 39 having, if desired, the separated supply pipes 17 and 41 for the different fluids which may, in some cases, be advantageously arranged to deliver their liquids more or less in a direction inclined to the axis of the pipe 39 as indicated. In this way each of these fluids may be given a spiral movement about the other in passing through this pipe 39 and passage 42 so that the stream or column of liquids are whirling around each other as they enter the whirl chamber, and if desired this may be employed in the other illustrated forms of the device by making one or more of the liquid inlets substantially tangent to the inlet passage employed. By regulating the height of the partition and the number of turns made by the spiral channel around the chamber, the ample mixing of the liquids may be effected before being discharged from the aperture 33. Fig. 5 shows another illustrative arrangement in which an inlet pipe 42 to which the two liquids are supplied together in any suitable way merge into a pipe or passage 35 which is preferably flaring or expanding and provided with a spiral guide vane 36 so as to give the liquids a spiral motion as they are discharged therefrom. An inner distributor at 37, which may have the central conical or diffusing portion 38 in line with the passage 35, may be arranged in connection therewith as indicated and supported as by the braces 40 within the outer distributor 59 which again reverses the direction of the whirling liquids before they are discharged so that ample mixing can thus be secured.

This invention has been described in connection with a number of illustrative forms, parts, devices, proportions, arrangements and methods of manufacture, assembly and use, to the details of which disclosure the invention is not of course to be limited, since what is claimed as new and what is desired to be secured by Letters Patent is set forth in the appended claims.

I claim:

1. In foam producing fire extinguishing apparatus, a nozzle delivering foam producing liquid, a whirl chamber cooperating with said nozzle and comprising a series of superimposed communicating whirl chambers arranged about a substantially vertical axis and being of gradually reduced diameter from the primary upper chambers downward, and upwardly extending partitions

projecting inward between the upper whirl chambers, said nozzle being directed to discharge the foam producing liquid substantially tangentially into said upper whirl chamber.

2. In foam producing fire extinguishing apparatus, a nozzle for connection thereto providing liquids cooperating to produce a foam, a whirl chamber cooperating with said nozzle and comprising a series of superimposed communicating whirl chambers arranged about a substantially vertical axis, said nozzle being directed to discharge foam producing liquid substantially tangentially into said whirl chamber.

3. In foam producing fire extinguishing apparatus, a pressure supply connection for foam producing liquids, a cooperating whirl chamber comprising a series of superimposed coaxial communicating whirl passages of gradually reduced diameter downward from the initial upper receiving chamber, means for delivering said liquids into the upper chamber substantially tangentially, and upwardly bent partitions projecting inward between the upper whirl chambers.

4. In foam producing fire extinguishing apparatus, a supply connection for foam producing liquids and a cooperating whirl chamber comprising a series of superimposed coaxial communicating whirl passages of gradually different diameter from the upper initial receiving chamber, and means for delivering said liquids into the upper chamber substantially tangentially.

5. In foam producing fire extinguishing apparatus, an injector mixing device having an injector nozzle, a supply of high pressure emulsifying liquid connected with said nozzle, an adjacent supply of cooperating acidifying liquid and a connected feeding connection communicating with said injector device to draw in amounts of such acidifying liquid substantially proportional to the amount of cooperating liquid passing through said injector nozzle to produce fire extinguishing foam and a whirl chamber into which said liquids are discharged to be mixed as they whirl around said chamber, there being a substantially axial discharge opening formed in said chamber from which the centrally displaced lighter foam material is discharged.

6. In foam producing fire extinguishing apparatus, two independent sources of supply for supplying respectively different cooperating liquids capable of reacting to produce fire extinguishing foam, an injector chamber into which one of said liquids is injected, a feeding connection leading into said chamber from the source of supply for the other liquid and a chamber into which said liquids are discharged from said injector chamber tangentially to be further mixed within said latter chamber by a whirling action.

7. In foam producing fire extinguishing apparatus, a container charged with and adapted to supply acidifying liquid, an injector device having a chamber provided with a feed connection communicating with said container, a container affording a supply of high pressure emulsifying liquid, an injector nozzle connected therewith and opening into said chamber to draw into said chamber amounts of such acidifying liquid substantially proportional to the amount of cooperating liquid passing through said injector nozzle to produce fire extinguishing foam and a whirl chamber into which said liquids are discharged from said ejector chamber tangentially to be further mixed together as they whirl around in said whirl chamber.

8. In foam producing fire extinguishing apparatus, a whirl chamber device comprising a series of communicating coaxial whirl chambers of gradually differing diameter placed one above the other and having a substantially axial discharge aperture.

9. In a foam producing fire extinguishing apparatus, the combination with a whirl chamber device comprising a series of superposed communicating whirl chambers having a discharge aperture at one end of the series, means for producing in a suitable chamber a mixture of co-operating liquids adapted to co-act to produce a fire extinguishing foam and an outlet from the latter chamber adapted to deliver to the series of whirl chambers the mixture of liquids for further mixture by whirling action in said whirl chambers.

10. In foam producing fire extinguishing apparatus, a whirl chamber device having a substantially tangent inlet for the foam producing liquid and comprising a series of superposed communicating whirl chambers arranged about a substantially vertical axis, and partitions projecting inward between the upper whirl chambers.

11. In foam producing fire extinguishing apparatus, a whirl chamber device having a substantially tangent inlet for the foam producing liquid and comprising a series of superposed communicating whirl chambers, means for supplying to said tangent inlet a mixture of co-operating liquids adapted to re-act to produce a fire extinguishing foam and partitions projecting inward between some of said whirl chambers.

12. In a foam producing fire extinguishing apparatus the combination with two sources of supply of different liquids respectively of such character that when brought together they will react to produce a fire-extinguishing foam and a whirl chamber into which said liquids are discharged to be mixed as they whirl around said chamber, there being a substantially axial discharge opening formed in said chamber from which the centrally displaced lighter foam material is discharged.

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