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Oct. 13, 1959 J. J. DUGGAN ET AL 2,908,334

PROCESS AND APPARATUS FOR GENERATING AND DISCHARGING FOAM

Filed March 14, 1957 2 Sheets-Sheet 1

Fig. 1.

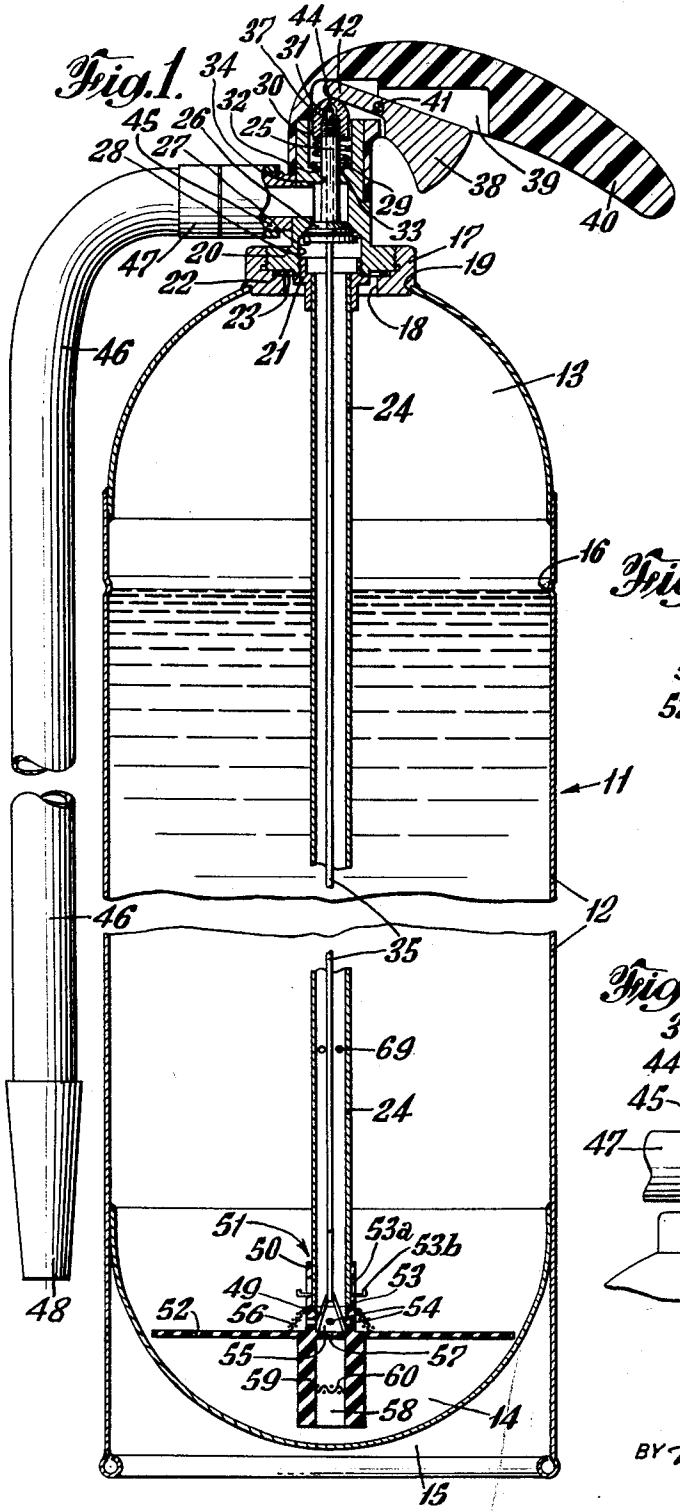


Fig. 2.

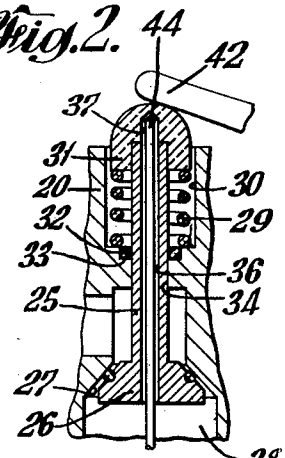


Fig. 3.

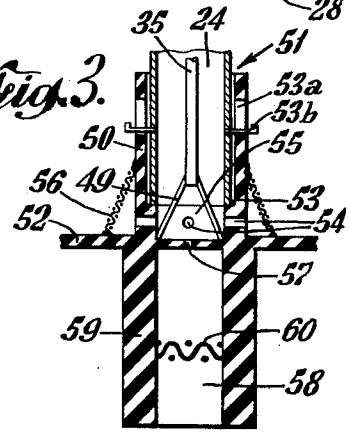
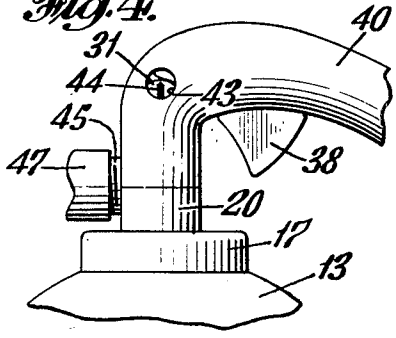


Fig. 4.



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PROCESS AND APPARATUS FOR GENERATING AND DISCHARGING FOAM

Filed March 14, 1957 2 Sheets-Sheet 2

Fig. 5.

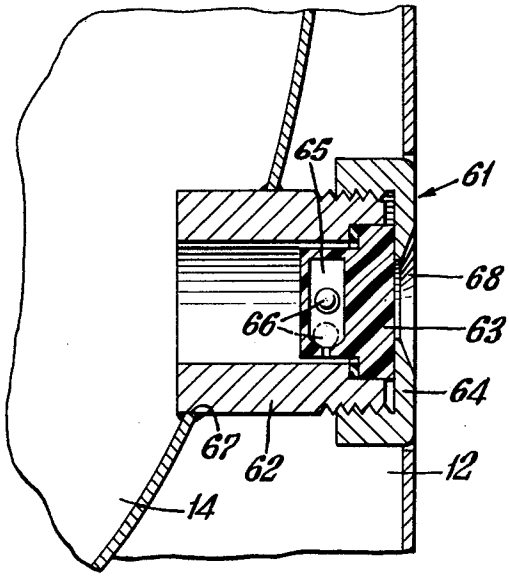
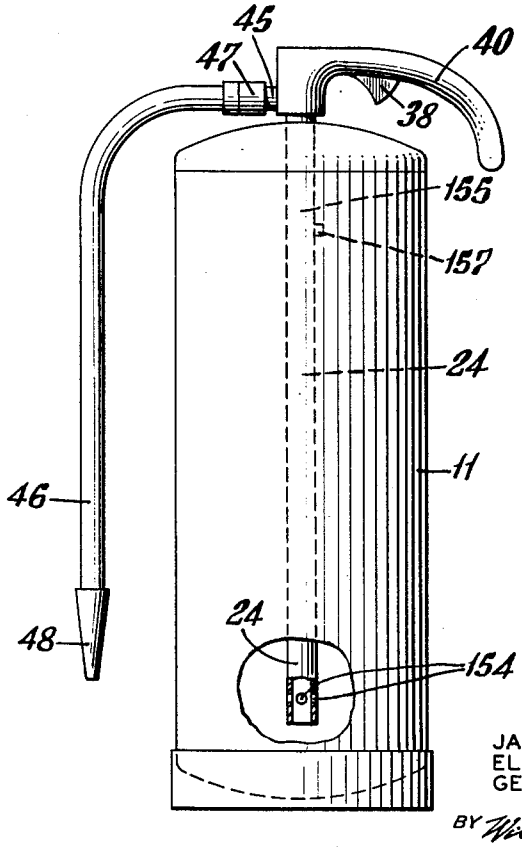


Fig. 6.



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2,908,334

PROCESS AND APPARATUS FOR GENERATING AND DISCHARGING FOAM

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Application March 14, 1957, Serial No. 645,965

27 Claims. (Cl. 169—32)

This invention relates to novel process and apparatus for generating and discharging foam, by way of example, for extinguishing fires, shampooing human hair and rugs, as well as for shaving purposes.

An ideal foam generation and discharge system should be lightweight and small in size for easy storage and handling, simple to operate, and low in initial cost. Furthermore, the system should be relatively simple from the mechanical standpoint to minimize maintenance expenses.

An object of this invention is to provide a foam generating and discharging system meeting these requirements.

Another object of this invention is to provide a process and apparatus for providing foam from a foam generating solution and a propellant present in both the liquid and gaseous phases, the propellant being substantially immiscible with and of greater density than the foam generating solution.

Still another object of the present invention is to provide a simple combination foam generating-liquid level indicating device.

In the present invention, a foam generating solution and a propellant are charged into a container, the propellant being present in both the liquid and gaseous phases, as well as being substantially immiscible with and of greater density than the foam generating solution. Valve means and an eductor tube are provided in the container for discharging the foam, and in one embodiment of the invention a foam generator slideably mounted to the eductor tube floats between the immiscible liquids. Indicator means associated with the movement of the foam generator along said eductor tube permit visual determination of the propellant liquid level. The floating foam generator has a chamber communicating with the eductor tube for passage of foam therethrough. Orifices are located in the generator walls to meter the foam generating solution and the propellant into this chamber at proportional rates sufficient to generate the foam. The foam generating solution orifices are preferably positioned substantially oposite each other and slightly above the propellant orifice to provide maximum mixing turbulence in the chamber.

To generate foam in the container, the valve is opened and a pressure differential is established between the inside and the outside of the eductor tube. The floating foam generator then rises against the eductor tube bottom and provides a seal preventing passage of the solutions into the chamber except through the orifices. Preferably the foam generator has a baffle section serving to prevent passage of the propellant through the foam solution orifices. The two liquids are then forced through their respective orifices by the propellant gas phase pressure, and the foam is generated in the previously mentioned chamber. Finally, the foam is discharged through the eductor tube and valve by the propellant.

Instead of movable indicator means, a sight gage containing an indicator ball may be positioned in the container wall for determining the liquid level of the propellant. In this case, the foam generator is rigidly fastened to the bottom of the eductor tube.

The invention will be further described as particularly embodied in a process and apparatus for generating and discharging fire extinguishing foam but it is to be understood that the principles of the invention are also applicable to the generation and discharge of other foams, for example, foams suitable for shampooing and shaving.

In the accompanying drawings,

Fig. 1 is a sectional view in elevation of a fire extinguisher embodying one form of the present invention;

Fig. 2 is a fragmentary sectional view in elevation on an enlarged scale of the filling and discharging valve assembly of the fire extinguisher illustrated in Fig. 1;

Fig. 3 is a sectional view in elevation on an enlarged scale of the combination foam generating-movable propellant level assembly of the same fire extinguisher;

Fig. 4 is a view in elevation on an enlarged scale of the sight glass assembly used with the movable liquid level assembly of Fig. 3 to determine when the fire extinguisher has been filled to the proper level;

Fig. 5 is a view in elevation on an enlarged scale with parts broken away of an alternate propellant liquid level assembly comprising a sight gage containing an indicator ball; and

Fig. 6 is a schematic sectional view in elevation of a fire extinguisher similar to that illustrated in Fig. 1, but embodying another form of the invention.

Referring now to the figures, the fire extinguisher **11** includes a casing **12** leak tightly sealed at either end to upper header **13** and lower header **14**, all materials being impervious to or protected from the fluids stored therein. The lower end of casing **12** is rolled to form stiffening ring-base **15**, and indicating means such as a suitable lateral bead **16** is located at the proper longitudinal level around the inner wall of casing **12** to provide a visual means of determining the proper filling level for the foam generating solution.

In an opening **19**, in the upper header, a collar **17** has a center annulus **18** for insertion of the eductor tube and foam generator assembly into the fire extinguisher. This assembly is positioned in the center annulus **18** by upper flange **20** and lower flange **21**, the former being leak tightly attached to collar **17** by, for example, a threaded connection. An O-ring **22** positioned on shoulder **23** of collar **17** insures the maintenance of the seal. The upper end of eductor tube **24** fits inside and is metal bonded to lower flange **21**, and the latter is thread-connected to the lower end of upper flange **20**.

A filling and discharge valve assembly located inside upper flange **20** includes stem **25**, the lower portion of which comprises beveled plug section **26** which seats on inwardly beveled shoulder **27** of center boring **28** and is limited in the open position by compression of coil spring **29** (see Fig. 2). The upper end of stem **25** extends into cavity **30** in the top part of upper flange **20**, and is thread-connected to sight glass cap **31** which protrudes from the cavity **30**. Coil spring **29** is positioned in compression between sight glass cap **31** and the bottom surface of cavity **30** to close the valve, and gasket **32** in recess **33** serves as a fluid seal between stem **25** and annular central passage **34** through upper flange **20**, connecting center boring **28** and cavity **30**. The components are sized to permit stem **25** to slide longitudinally in upper flange **20**, and a substantial clearance is provided between the walls of cavity **30** and the moving components, sight glass cap **31** and coil spring **29**. Indicating rod **35** inside eductor tube **24** extends upwardly through center passageway **36** of stem **25** into a recessed central part **37** of sight glass cap **31** protruding from cavity **30** when the extinguisher contains the proper amount of

liquid propellant. The assembly is designed with sufficient clearance between indicating rod **35** and stem **25** for free movement of the rod. Trigger **38** in recess **39** of handle **40** swivels about pin **41** in the handle, and arm **42** of the trigger **38** contacts the top of sight glass cap **31**. The handle **40** fits over cap **31** and the top of upper flange **20**, and a hole **43** in the handle **40** permits visual inspection of the indicating rod tip **44** enclosed in the sight glass cap **31**. The valve, normally in the closed position, is opened by pulling trigger **38** so that arm **42** presses downwardly on sight glass cap **31** which is thread-connected to valve stem **25**. The coil spring **29** is further compressed and stem **25** is lowered, thus providing a space between the beveled plug section **26** and shoulder **27** of the upper flange **20** for fluid passage therethrough.

Center boring **28** of upper flange **20** communicates with conduit **45** which in turn is connected to discharge hose **46** by coupling **47**. The fire extinguishing fluid is discharged through nozzle **48** which is sized in a manner well-known to those skilled in the art.

Eductor tube **24** with rod **35** therein extends into the lower header **14** where flexible prongs **49** attached at one end to the bottom of the indicating rod **35**, are secured at their opposite ends to the bottom of the upper cylindrical part **50** of the floating foam generator **51** which is preferably a one-piece flexible polyethylene molding substantially unaffected by the stored fluids. The foam generator **51** is of a density such that the wide baffle **52** of the floating foam generator **51** lies at the propellant-foam generating solution interface when the extinguisher is fully charged before operation. The baffle **52** thus provides a means of separating the two liquids. The lower end of eductor tube **24** extends into the upper cylindrical part **50** of floating foam generator **51** and is stopped by shoulder **53**. A loose fit is provided between tube **24** and the upper cylindrical part **50** to permit longitudinal sliding movement of the latter component along the outer surface of the eductor tube **24**. This movement is limited by the length of slots **53***a* in the wall of upper cylindrical part **50**, and pins **53***b* bonded to the outer wall of eductor tube **24** and extending through slots **53***a*. These pins **53***b* serve as a lower stop, and shoulder **53** provides an upper stop for longitudinal movement of floating foam generator. Any desired number of orifices **54**, for example, four, are located at equal intervals around the periphery of upper cylindrical part **50** and below shoulder **53** to provide communicating means between the foam generating solution in casing **12**, and the foam generating chamber **55**. The orifices **54** are preferably oppositely positioned from each other so that foam generating solution passing through any given orifice flows directly into the like solution emerging through an orifice on the opposite side of the floating foam generator **51**. This arrangement has been found to provide maximum turbulence in the foam generating chamber **55** which in turn improves the fire extinguishing characteristics of the foam. A wire mesh screen **56** extends around the base of the upper cylindrical part **50** to prevent passage of solid particles and plugging of the orifices **54** thereby. The screen **56** is attached to upper cylindrical part **50** and wide baffle **52** for rigidity.

Orifice **57** in the center of baffle **52** provides a communicating means between the liquid propellant beneath the baffle **52** and the foam generating chamber **55**, the propellant vaporizing and mixing with turbulent foam generating solution therein to form the desired fire extinguishing foam. The liquid propellant in the lower header **14** rises into the center passageway **58** of the lower cylindrical portion **59** and passes through wire-mesh screen **60** to orifice **57**, the screen preventing passage of solid particles which would plug the orifice.

The choice and proportion of constituents from which to generate and discharge fire-extinguishing foam by the process and apparatus of the present invention, is partially dependent on the type of fire to be extinguished. However, all suitable foam-generating solutions must have high foaming quality.

While there are undoubtedly many solutions that would be acceptable, a 1 to 5 weight percent solution of "Unox" in water has been found to be particularly suitable. "Unox" (sodium alkyl sulfate) is a commercially available foaming agent especially compounded for fighting fires.

The acceptable propellants have the following characteristics:

(1) non-flammable
(2) immiscible with the foam-generating solution
(3) boiling point of no higher than 32° F. at atmospheric pressure
(4) vapor pressure of at least 5 p.s.i.g. at 40° F.
(5) low toxicity.

A large number of the halogenated hydrocarbons meet these requirements, e.g. dichlorodifluoromethane, bromotrifluoromethane, and chlorotrifluoromethane. Also, halogen-containing compounds are particularly suitable in this application because of their well-known fire inhibiting qualities. Freon–12 (dichlorodifluoromethane) is a particularly suitable propellant for the "Unox"-water solution, and has a liquid density of 1.28 grams per cubic centimeter at 70° F. The practical Freon composition range is approximately 3 to 12 percent of the total fluid weight, and the preferred range is 5 to 7 weight percent Freon–12.

To charge the extinguisher, the valve and foam generator assembly is removed by unscrewing upper flange **20** from collar **17**, the baffle **52** being sufficiently flexible for distortion and removal through the center annulus **18** without damage thereto. The casing **12** is then filled with water to the desired level, as visually determined by lateral bead **16**. Next, the concentrated "Unox" foaming agent is poured into the extinguisher from a bottle or can which contains the required quantity to make the desired concentration, preferably 2 percent by weight. The valve and foam generator assembly is then reinstalled and the valve is screwed down tightly by hand, the O-ring **22** insuring a pressure-tight seal between collar **17** and upper flange **20**. The extinguisher is shaken to mix and uniformly disperse the "Unox" throughout the water.

Discharge hose **46** is removed and a charging vessel containing liquid Freon–12 is attached to conduit **45**. This vessel is sufficiently pressurized with a non-reactive gas, for example, air or nitrogen, to insure Freon flow into the extinguisher. The Freon is transferred by opening the extinguisher valve and the charging vessel discharge valve. After transfer is complete, the valves are closed and the extinguisher is allowed to stand until the liquid Freon has settled to the bottom of the extinguisher and the gaseous Freon has risen through the water to the space above the liquid, in the top header **13**. Sufficient Freon is charged into the fire extinguisher so that when the liquid Freon has settled to the bottom, the baffle **52** rises to the Freon-water interface. Indicating rod **35**, flexibly attached to floating foam generator **51**, also rises so that its tip **44** is visible in sight glass cap **31**, showing that the extinguisher is properly charged (see Figs. 1 and 2). The charging vessel is then removed, the hose **46** replaced, and the extinguisher is ready for service.

The extinguisher operates in the following manner: The trigger **38** is pulled to open the valve. When this occurs, the pressure inside the eductor tube **24** is reduced and a pressure differential is established between the eductor tube interior and the surrounding fire extinguisher casing **12**. This pressure differential forces the floating foam generator **51** upwardly against the bottom of the eductor tube **24**, as illustrated in Figs. 1 and 3, to provide a seal. The vapor pressure of Freon in the gas space above the water forces the water-"Unox" solution through orifices **54** and the liquid Freon through orifice **57** in

the correct proportions to generate foam with the desired characteristics. The baffle 52 of foam generator 51 prevents passage of liquid Freon through the water-"Unox" orifices 54. The generated foam is discharged through eductor tube 24, center boring 28, hose 46, and nozzle 48 to the atmosphere by means of the Freon propellant. The foam is believed to be generated by a combination of factors including rapid vaporization of the liquid Freon, the turbulence caused by oppositely positioning the water-"Unox" orifices 54 above the Freon orifice 57, and the foam flow through eductor tube 24 and hose 46, as well as the high foamability of the "Unox" solution.

The preferred orifice sizes depend on the fluids to be processed and the discharge rate as well as the desired foam characteristics. In any event, the combined orifice area must be no greater than that permitted for an adequate pressure differential between the inside and outside of the eductor tube 24 to seal the bottom of the tube. If the pressure differential is inadequate for the maintenance of such a seal, the Freon, water-"Unox" mixing ratio could not be controlled and the resultant foam would lose its excellent fire extinguishing characteristics.

For the Freon–12, "Unox"-water system, it has been found that an optimum foam is generated when the relative sizes of the orifices are such that the volume of Freon–12 (converted to vapor at normal temperature and pressure) metered is approximately ten times the volume of "Unox"-water solution metered (measured as unfoamed liquid volume). The orifices should be sized so that the flow results in a solution discharge rate of at least 0.10 gallon per sq. ft. per minute and preferably 0.25 gallon per sq. ft. per minute on the largest gasoline fire for which a particular extinguisher is designed, e.g., 0.085 inch diameter for the four "Unox"-water orifices, and 0.040 inch diameter for the Freon-12 orifice in a 1½ gallon extinguisher which is suitable for extinguishing 12 square feet of gasoline fire.

If desired, a flow restricting foam orifice 69 may be inserted in the eductor tube 24 at an intermediate position between the inlet and outlet ends of such tube. When the fire extinguisher is operated as previously described, the Freon propellant evaporates as it passes through the Freon orifice 57 since the greatest pressure drop occurs at this point and the eductor tube interior is at substantially atmospheric pressure. The insertion of foam orifice 69 downstream from the Freon orifice 57 transfers the point of greatest pressure drop to such foam orifice, and most of the liquid Freon propellant is evaporated on passing therethrough. The advantage of such an orifice is that a shorter hose 46 may be used. The shorter hose is possible because the remaining liquid propellant and the foam-generating solution have an opportunity to become intimately mixed prior to vaporization of the remaining liquid propellant at the point of greatest pressure drop. Although some foam is generated between the inlet end and the foam orifice, the majority of the foam is generated downstream of the orifice 69 in this embodiment of the invention.

Fig. 5 illustrates an alternate means of determining the propellant liquid level comprising a sight gage assembly 61. This assembly includes a cylinder 62 which is leak tightly connected at its inner end to the lower header 14 so as to communicate with the liquid propellant in casing 12. A sight window 63 of transparent plastic or glass is sealed against the outer end of the cylinder 62 and is retained by cap 64 which is thread-connected to the cylinder. A pocket section 65 of sight window 63 holds indicator ball 66 which is free to move up and down, and floats at the Freon-"Unox" solution interface. The falling of ball 66 to the bottom of pocket 65 indicates that additional Freon must be charged into the extinguisher for generation and discharge of optimum quality foam. An opening 67 in the casing 12 and a center annulus 68 in the cap 64 permit visual location of the indicator ball 66 and determination of the propellant liquid level. When this assembly is used, the foam generator 51 is rigidly attached to the bottom of eductor tube 24 in the position shown in Fig. 3 so that the baffle 52 is properly fixed at the Freon-"Unox" solution interface when the extinguisher is fully charged.

Fig. 6 illustrates another fire extinguisher embodiment of the invention similar to Fig. 1, except that gaseous instead of liquid Freon is metered into the eductor tube and the foam is generated near the top of such tube instead of at the bottom. Also, a foam generating assembly is not required at the bottom of the eductor tube. It is also contemplated that the gas phase Freon orifice of Fig. 6 may be used in combination with the liquid phase Freon orifice, floating foam generator assembly of Fig. 1.

Referring more specifically to Fig. 6, the components which are similar to those shown in the other figures are designated by similar reference numerals. Liquid Freon and the "Unox" solution are charged into the container 11 as previously described. On opening the discharge valve, the "Unox" solution is forced through the orifices 154 in the wall of the eductor tube 24 and rises through such tube to the foam generating section 155 of the eductor tube. At this level the "Unox" solution turbulently mixes with gaseous Freon propellant passing through propellant orifice 157 in the gas space above the "Unox" solution. A high quality fire extinguishing foam is generated by such turbulent mixing, and the foam is discharged through the valve and hose 46. In this embodiment, the bottom end of eductor tube 24 is closed to prevent leakage of liquid Freon into such tube. Although not illustrated in Fig. 6, the sight gage assembly 61 of Fig. 5 may be used to determine the liquid level of the Freon propellant in the bottom of container 11.

What is claimed is:

1. In apparatus for generating and discharging fire-extinguishing foam, the combination of a container for holding a foam generating solution consisting of water and a foaming agent, and a halogen-containing hydrocarbon propellant present in both the liquid and gaseous phases, the halogen-containing propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; orifice metering means for passing the foam generating solution and the gas phase propellant into the eductor tube at proportional rates sufficient to generate such foam; and means comprising a sight gage containing an indicator ball, such gage being positioned in the container wall for determining the liquid level of the propellant in said container.

2. In apparatus for generating and discharging foam, the combination of a container for holding a foam generating solution and a propellant present in both the liquid and gaseous phases, the propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator attached to said eductor tube and located between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with said eductor tube for passage of foam therethrough; and orifices in the walls of the generator for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber.

3. In apparatus for generating and discharging fire-extinguishing foam, the combination of a container for holding a foam generating solution and a halogen-containing hydrocarbon propellant present in both the liquid and gaseous phases, the halogen-containing hydrocarbon propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said con-

tainer for discharging the foam; a foam generator attached to said eductor tube and located between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with said eductor tube for passage of foam therethrough; and orifices in the walls of the generator for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber.

4. In apparatus for generating and discharging fire-extinguishing foam, the combination of a container for holding a foam generating solution consisting of water and a foaming agent, and a halogen-containing hydrocarbon propellant present in both the liquid and gaseous phases, the halogen-containing propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator attached to said eductor tube and located between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with said eductor tube for passage of foam therethrough; and orifices in the generator walls for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber.

5. In apparatus for generating and discharging foam, the combination of a container for holding a foam generating solution and a propellant present in both the liquid and gaseous phases, the liquid phase propellant being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator attached to said eductor tube and located between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with said eductor tube for passage of foam therethrough; and orifices in the generator walls for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber, the foam solution orifices being substantially oppositely positioned from each other to provide maximum mixing turbulence in the chamber.

6. In apparatus for generating and discharging fire-extinguishing foam, the combination of a container for holding a foam generating solution consisting of water and a foaming agent, and a halogen-containing hydrocarbon propellant present in both the liquid and gaseous phases, the halogen-containing propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator attached to said eductor tube and located between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with the bottom of said eductor tube for passage of foam therethrough; orifices in the walls of the generator for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber, the foam solution orifices being substantially oppositely positioned from each other and above the propellant orifice to provide maximum mixing turbulence in the chamber; and a baffle comprising part of the foam generator and serving to prevent passage of the propellant through said foam solution orifices.

7. In apparatus for generating and discharging foam, the combination of a container for holding a foam generating solution and a propellant present in both the liquid and gaseous phases, the liquid phase propellant being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator slideably mounted to said eductor tube and adapted to float between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with said eductor tube for passage of foam therethrough; orifices in the walls of the generator for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber; and indicator means associated with the movement of the foam generator along said eductor tube for determining the liquid level of said propellant in said container.

8. In apparatus for generating and discharging fire-extinguishing foam, the combination of a container for holding a foam generating solution and a halogen-containing hydrocarbon propellant present in both the liquid and gaseous phases, the halogen-containing hydrocarbon propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator slideably mounted to said eductor tube and adapted to float between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with said eductor tube for passage of foam therethrough; orifices in the walls of the generator for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber; and indicator means associated with the movement of the foam generator along said eductor tube for determining the liquid level of said propellant in said container.

9. In apparatus for generating and discharging fire-extinguishing foam, the combination of a container for holding a foam generating solution consisting of water and foaming agent, and a halogen-containing hydrocarbon propellant present in both the liquid and gaseous phases, the halogen-containing propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator slideably mounted to said eductor tube and adapted to float between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with said eductor tube for passage of foam therethrough; orifices in the walls of the generator for metering the foam generating solution and the propellant into said chamber at proportional rates sufficent to generate said foam in said chamber; and indicator means associated with the movement of the foam generator along said eductor tube for determining the liquid level of said propellant in said container.

10. In apparatus for generating and discharging foam, the combination of a container for holding a foam generating solution and a propellant present in both the liquid and gaseous phases, the propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator slideably mounted to said eductor tube and adapted to float between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with said eductor tube for passage of foam therethrough; orifices in the walls of the generator for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber, the foam solution orifices being substantially oppositely positioned from each other to provide maximum mixing turbulence in the chamber; and indicator means associated with the movement of the foam generator along said eductor tube for determining the liquid level of said propellant in said container.

11. In apparatus for generating and discharging foam, the combination of a container for holding a foam gen-

erating solution and a propellant present in both the liquid and gaseous phases, the propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator slideably mounted to said eductor tube and adapted to float between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with the bottom of said eductor tube for passage of foam therethrough; orifices in the walls of the generator for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber; sealing means between the eductor tube bottom and the foam generator for preventing passage of the solutions into said chamber except through said orifices; and indicator means associated with the movement of the foam generator along said eductor tube for determining the liquid level of said propellant in said container.

12. In apparatus for generating and discharging fire-extinguishing foam, the combination of a container for holding a foam generating solution consisting of water and a foaming agent, and a halogen-containing hydrocarbon propellant present in both the liquid and gaseous phases, the halogen-containing propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator slideably mounted in said eductor tube and adapted to float between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with the bottom of said eductor tube for passage of foam therethrough; orifices in the walls of the generator for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber, the foam solution orifices being substantially oppositely positioned from each other to provide maximum mixing turbulence in the chamber; sealing means between the eductor tube bottom and the foam generator for preventing passage of the solutions into said chamber except through said orifices; a baffle comprising part of the foam generator and serving to prevent passage of the propellant through said foam solution orifices; and the indicator means associated with the movement of the foam generator along said eductor tube for determining the liquid level of said propellant in said container.

13. In apparatus for generating and discharging foam, the combination of a container for holding a foam generating solution and a propellant present in both the liquid and gaseous phases, the propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator attached to said eductor tube and located between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with the bottom of said eductor tube for passage of foam therethrough; orifices in the walls of the generator for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber; and means comprising a sight gage in the container wall for determining the liquid level of said propellant in said container.

14. In apparatus for generating and discharging foam, the combination of a container for holding a foam generating solution and a propellant present in both the liquid and gaseous phases, the propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator attached to said eductor tube and located between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with the bottom of said eductor tube for passage of foam therethrough; orifices in the walls of the generator for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber; and means comprising a sight gage containing an indicator ball, such gage being positioned in the container wall for determining the liquid level of said propellant in said container.

15. In apparatus for generating and discharging fire-extinguishing foam, the combination of a container for holding a foam generating solution and a halogen-containing hydrocarbon propellant present in both the liquid and gaseous phases, the halogen-containing hydrocarbon propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator attached to said eductor tube and located between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with said eductor tube for passage of foam therethrough; orifices in the walls of the generator for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber; and means comprising a sight gage containing an indicator ball, such gage being positioned in the container wall for determining the liquid level of said propellant in said container.

16. In apparatus for generating and discharging fire-extinguishing foam, the combination of a container for holding a foam generating solution consisting of water and a foaming agent, and a halogen-containing hydrocarbon propellant present in both the liquid and gaseous phases, the halogen-containing propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator attached to said eductor tube and located between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with said eductor tube for passage of foam therethrough; orifices in the generator walls for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber; and means comprising a sight gage containing an indicator ball, such gage being positioned in the container wall for determining the liquid level of said propellant in said container.

17. In apparatus for generating and discharging foam, the combination of a container for holding a foam generating solution and a propellant present in both the liquid and gaseous phases, the propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator attached to said eductor tube and located between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with said eductor tube for passage of foam therethrough; orifices in the generator walls for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber, the foam solution orifices being substantially oppositely positioned from each other to provide maximum mixing turbulence in the chamber; and means comprising a sight gage containing an indicator ball, such gage being positioned in the container wall for determining the liquid level of said propellant in said container.

18. In apparatus for generating and discharging fire-extinguishing foam, the combination of a container for holding a foam generating solution consisting of water

and a foaming agent, and a halogen-containing hydrocarbon propellant present in both the liquid and gaseous phases, the halogen-containing propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator attached to said eductor tube and located between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with the bottom of said eductor tube for passage of foam therethrough; orifices in the walls of the generator for metering the foam generating solution and the propellant into said chamber at proportional rates sufficient to generate said foam in said chamber, the foam solution orifices being substantially oppositely positioned from each other and above the propellant orifice to provide maximum mixing turbulence in the chamber; a baffle comprising part of the foam generator and serving to prevent passage of the propellant through said foam solution orifices; and means comprising a sight gage containing an indicator ball, such gage being positioned in the container wall for determining the liquid level of said propellant in said container.

19. In apparatus for generating and discharging fire-extinguishing foam, the combination of a container for holding a foam generating solution consisting of water and a foaming agent, and a halogen-containing hydrocarbon propellant present in both the liquid and gaseous phases, the halogen-containing propellant liquid phase being substantially immiscible with and of greater density than the foam generating solution; valve means and an eductor tube in said container for discharging the foam; a foam generator attached to said eductor tube and located between the immiscible propellant and foam generating solutions, said foam generator having a chamber in open communication with the bottom of said eductor tube for passage of foam therethrough; orifices in the walls of the generator for metering the foam generating solution and the liquid propellant into said chamber at proportional rates sufficient to generate said foam in said chamber, the foam solution orifices being substantially oppositely positioned from each other and above the propellant orifice to provide maximum mixing turbulence in the chamber; a baffle comprising part of the foam generator and serving to prevent passage of the propellant through said foam solution orifices; at least one orifice positioned in the eductor tube at a point between the bottom and top of such tube so that the liquid propellant is vaporized on passing therethrough; and means comprising a sight gage containing an indicator ball; such gage being positioned in the container wall for determining the liquid level of said propellant in said container.

20. In a process for providing foam from a foam generating solution, the steps comprising providing and storing in a single container such solution and a halogen-containing vaporizable hydrocarbon propellant in direct contact with said solution and present in both liquid and gas phases, the liquid phase propellant being substantially immiscible with and of greater density than the solution, said solution being stored as a liquid layer between the liquid and gas phases of the propellant; separately passing controlled portions of said solution and of the propellant into a foam generating chamber by action of the pressure of the gas phase propellant; generating a foam in such chamber by effecting turbulent mixing of the foam generating solution and the propellant; and discharging the generated foam from such chamber by action of the propellant.

21. In a process for providing foam from a foam generating solution, the steps comprising providing and storing in a single container such solution and a halogen-containing vaporizable hydrocarbon propellant in direct contact with said solution and present in both liquid and gas phases, the liquid phase propellant being substantially immiscible with and of greater density than the solution, said solution being stored as a liquid layer between the liquid and gas phase of the propellant; separately passing controlled portions of said solution and said liquid phase propellant into a foam generating chamber by action of the pressure of the gas phase propellant; generating a foam in such chamber by turbulently mixing the foam generating solution and the propellant; and discharging the generated foam from such chamber by action of the propellant.

22. In a process for providing foam from a foam generating solution consisting of water and a foaming agent, the steps comprising providing and storing in a single container such solution and a halogen-containing vaporizable hydrocarbon propellant in direct contact with said solution and present in both liquid and gas phases, the liquid phase propellant being substantially immiscible with and of greater density than the solution, said solution being stored as a liquid layer between the liquid and gas phases of the propellant; separately passing controlled portions of said solution and said liquid phase propellant into a foam generating chamber by action of the pressure of the gas phase propellant; generating a foam in such chamber by turbulently mixing the foam generating solution and the propellant; and discharging the generated foam from such chamber by action of the propellant.

23. In a process for providing foam from a foam generating solution consisting of water and a foaming agent, the steps comprising providing and storing in a single container such solution and a halogen-containing vaporizable hydrocarbon propellant in direct contact with said solution and present in both liquid and gas phases, the vaporizable liquid phase propellant being substantially immiscible with and of greater density than the solution, said solution being stored as a liquid layer between the liquid and gas phases of the propellant; separately passing controlled portions of said solution and said vaporizable liquid phase propellant into a first mixing zone by action of the pressure of the gas phase halogen-containing propellant; intimately mixing such foam generating solution and vaporizable liquid phase propellant in the first zone and partially generating the foam; controllably passing the partially generated foam into a second foam-generating zone and vaporizing the propellant during such passage; generating the remainder of the foam in the second zone; and discharging the generated foam from the second zone by action of the propellant.

24. In apparatus for generating and discharging foam, the combination of a single container; a foam generating solution and a halogen-containing vaporizable hydrocarbon propellant present in both liquid and gas phases and stored in said single container in direct contact with each other prior to such foam generation and discharge, the liquid phase propellant being substantially immiscible with and of greater density than the solution which is stored as a liquid layer between the liquid and gas phases of the propellant; valve means and an eductor tube in said container for discharging the foam; and orifice metering means for separately passing the foam generating solution and the propellant into the eductor tube at proportional rates sufficient to generate the foam.

25. Apparatus according to claim 24 for generating and discharging foam, in which said orifice metering means are provided for separately passing said foam generating solution and the liquid phase halogen-containing hydrocarbon propellant into the eductor tube.

26. Apparatus according to claim 24 for generating and discharging foam, in which said orifice metering means are provided for separately passing said foam generating solution and the gas phase halogen-containing hydrocarbon propellant into the eductor tube.

27. Apparatus according to claim 24 for generating and discharging foam, in which said orifice metering means are provided for separately passing said foam generating solution as well as the gas phase and liquid phase halogen-containing hydrocarbon propellant into the eductor tube.

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