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APPARATUS FOR MAKING CELLULAR MASSES

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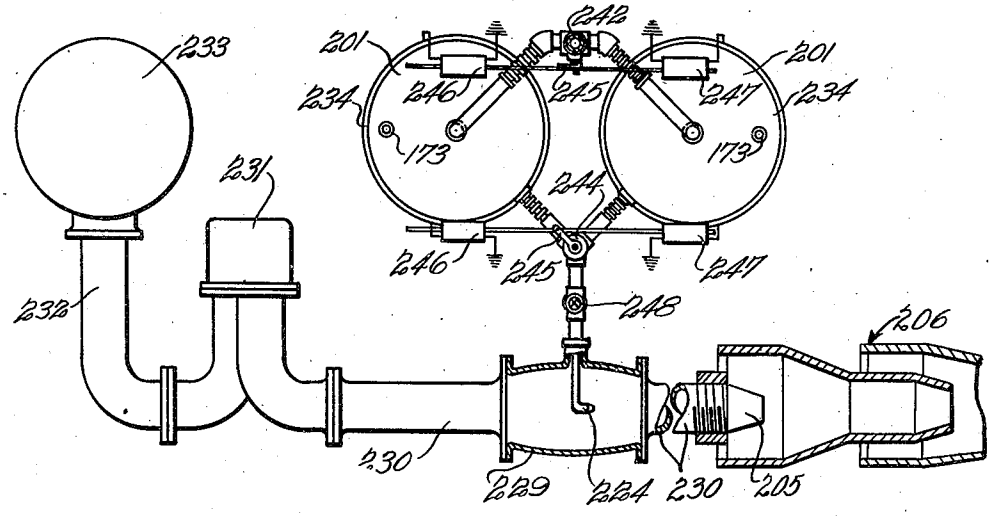


Fig. 1

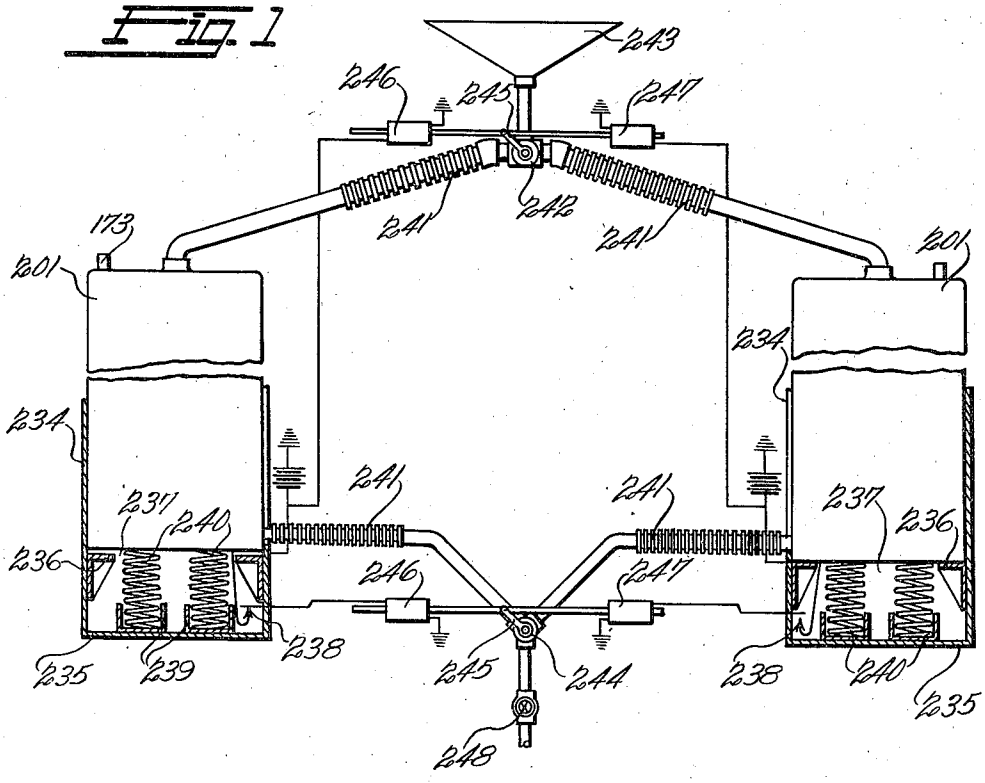


Fig. 2

Inventor

Radcliffe Morris Urquhart

By Strauch & Hoffman

Attorneys

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APPARATUS FOR MAKING CELLULAR MASSES

Radcliffe Morris Urquhart, Montgomeryville, Pa.

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3 Claims. (Cl. 169—15)

1

My invention relates to apparatus for making cellular masses, such as foam or the like. The present application is a continuation-in-part of my co-pending application Serial No. 341,938 for Apparatus for making cellular masses, filed June 21, 1940, now Patent Number 2,324,605 issued July 20, 1943, which is in turn a division of my abandoned application Serial No. 144,885, filed May 26, 1937, for Apparatus and method for making cellular masses.

Cellular masses, for various purposes, have been made hitherto by means of chemical reactions, physical changes due to variations in heat and pressure, or by various mechanical methods. Most of these means have variously proven unsatisfactory by reason of expense of equipment, chemicals, or fuel, as well as frequent lack of adaptability of the apparatus to the place of application of the product.

Yet, the need is great for inexpensive means for making cellular substances, particularly at the place of application of said substances for the uses for which they are intended; and, in many instances, there is an important need for varying the size and integral constituents of the individual cells. Instances of such needs may be found in the fire extinguishing field, the building and construction industries, liquid storage tank fields, the food industries, and fields involving the simulation or reproduction of desired views such as scenic effects.

One object of my invention therefore is to provide means whereby a cellular mass such as foam may be practically, readily and inexpensively produced in the general region of a fire, for fire extinguishing purposes.

Another object of my invention is to provide means for making cellular substances such as insulation, acoustic walls, ceilings, wall fillers, panels and the like, for use in the building or construction industries.

A further object of my invention is to provide means for satisfactorily and inexpensively producing scenic displays.

Still another object of my invention is to provide a continuous foam forming apparatus utilizing apparatus requiring relatively simple parts of small size.

With the above and other objects in view, my invention consists in means for making a cellular substance, which comprises emitting a liquid capable of supporting foam, in the presence of a gas, in a manner to increase the surface of said liquid exposed to said gas operatively to entrain the same, and discharging the resultant mass.

2

My invention also consists in means for manufacturing a foam dried in a manner to retain the cellular structure of the foam in a substantially solid form.

My invention also consists in means for varying the physical properties of the cellular mass by regulating the relative quantities of gas, liquid, or cellular mass forming substance.

For the purpose of illustrating my invention, I have shown in the accompanying drawings forms thereof which are at present preferred by me, since the same have been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangements and organizations of the instrumentalities as herein shown and described.

Referring to the drawings in which like reference characters indicate like parts;

Figure 1 is a diagrammatic view illustrating a continuous foam forming system employing the present invention;

Fig. 2 is a diagrammatic view illustrating a preferred means for automatically controlling the system of Figure 6.

Referring to the drawings wherein like reference numerals are utilized throughout to indicate the same parts, it is to be understood that the liquid having viscous qualities may be any desired liquid which is capable of entraining a gas. Thus, it may be an aqueous solution of a cementitious material, such as glue, albumen, or of a saponaceous material such as tannin, licorice, soap, spent sulphite liquor, or the like, or any material such as casein, glucose or the like, or combinations thereof capable of altering, forming or supporting a filmy surface in the production of foam.

If desired, a freezing point depressant such as calcium chloride, magnesium chloride, sodium chloride or potassium carbonate may be placed in solution with the liquid thereby to prevent said solution from freezing in the container prior to the operation thereof. Moreover, if desired, a corrosion inhibitor such as potassium chromate or potassium acetate may also be placed in solution with the liquid, in order to protect the elements of the apparatus.

By my novel invention, it is possible to change the character of the emitted cellular mass by varying the pressure or volume of gas introduced thereinto. Thus, for example, but not by way of limitation, a ratio by volume of three parts of

gas at average atmospheric pressure and temperature to one of liquid, fed into the eductor or proportioner, will produce a relatively wet cellular mass having substantially free flowing qualities. This cellular mass is of a specific weight much greater than that of a cellular mass having a larger ratio of gas to liquid, used in the generation thereof.

A cellular mass having a ratio of ten parts of gas to one of liquid introduced into the eductor or proportioner, will be of a substantially stiff, resilient and very light weight structure, non-free-flowing, but very cohesive. A cellular mass of this ratio tends to cling to almost any solid or liquid surface. It is capable of supporting fairly substantial weight, and can be built up into mounds of substantial size for any of various desired uses, such as the building of scenic effects. Such uses include the simulation or reproduction of glaciers, snow scenes, mountains or rock formations, for photographic purposes. Cellular masses having a ratio of seven or eight parts of gas to one of liquid are of substantially dry characteristics, yet of sufficient ability to flow to enable them to spread when emitted from the discharge nozzle. Such cellular mass is particularly adaptable for use for fire extinguishing purposes. Thus, such foam may be poured on burning surfaces, such as that of volatile liquids, and will spread over such surfaces operatively to suffocate the combustion thereof. Also, such cellular mass will cling to a burning wall, and is capable of forming a blanket thereon to suffocate the combustion thereof.

Furthermore, quick-setting chemicals, such as salts, cement, plaster of paris, of gypsum derivatives, may be introduced with the cellular mass forming substance, operatively to cause the cellular mass discharged from the generator quickly to solidify. Moreover, fire resisting elements such as silicate of soda may also be introduced therewith.

From the foregoing description, it will be clear that any variations in the pressure of the water supply will automatically and equally affect the amount of foam stabilizer delivered and the velocity of the water. As a consequence, any desired proportioning of the foam stabilizer and water may be secured merely by selection of appropriately sized pipes and nozzles. It, therefore, will be appreciated that the present invention provides a simple construction for predetermining the character of foam formed by the generator. While satisfactory devices for producing relatively small quantities of foam can be produced from the teachings of my aforesaid applications, it is sometimes desirable to produce large quantities of foam over an extended period of time. By simple re-arrangement of the conduits and eductors shown in my aforesaid applications, the devices there shown may be readily adapted to provide a continuous process capable of accomplishing this end. Referring to Figure 1, a pair of containers **201** is connected for alternately supplying the foam stabilizer to a suitable nozzle **224** concentrically disposed in a mixing chamber **229**. Chamber **229** is inserted in a conduit **230** one end of which is connected to the discharge end of a pump **231** capable of delivering water under pressure through chamber **229** and the other end of which is provided with a suitable eductor nozzle **205**, designed to disperse or increase the surface area of a stream of liquid, for example, a spiral baffle nozzle like that shown and described in Patent 2,106,043 issued January

18, 1938, to George Gordon Urquhart and me as joint inventors. Nozzle **205** leads into a suitable eductor **206** which may take the form of the eductors shown in my aforesaid applications or Patent 2,106,043. The inlet of pump **231** is connected through conduit **232** to a water tank **233** or any other suitable source of water. It is to be understood, however, that chamber **229** may be connected to any other suitable source of water under pressure, such as the mains of a city water system, if desired, so long as a stream of water under pressure passes through chamber **229** to form a foam forming solution in chamber **229**.

Tanks **201** are arranged so that while one tank is supplying the stabilizer to chamber **229** the other is being filled. While any suitable means for accomplishing this end may be provided, some suitable automatic control means responsive to the weight, pressure, or height of the stabilizer in tanks **201** is preferred. A suitable means is illustrated in Figure 2 wherein the weight of the stabilizer is the controlling factor. Such a mechanism is particularly suited to this purpose since it permits the use of a stabilizer in either liquid or powdered form.

The control means of this invention is the same for each tank and consists of a frame work **234** having a base **235** designed to be supported in any suitable manner on the ground, floor, walls, ship or the frame work of a vehicle. Vertically spaced from base **235** is a tank supporting surface **236** having an open center **237** and an electric switch **238**. Base **235** below the open center **237** is provided with one or more spring receiving cups **239** designed to receive heavy coil springs **240** which normally extend above the surface **236** so as to contact the bottom of tank **201**. Springs **240** are of sufficient strength to raise tank **201** off of surface **236** when the tank is empty or the stabilizer reaches a predetermined minimum height so as to close switch **238**. While springs **240** may be designed to raise tank **201** any suitable distance, it is sufficient to raise the tank about one-eighth to one-quarter of an inch depending upon the distance necessary to close switch **238**. To permit this movement of tank **201**, the filler and discharge outlets are provided with suitable flexible conduits **241**.

As clearly shown in Figure 2, upper conduits **241** are connected to a three-way supply valve **242** the inlet of which is connected to a filling hopper **243** and lower conduits **241** are connected to a three-way discharge valve **244** the outlet of which is connected to nozzle **224**. Valves **242** and **244** are provided with operating arms **245** each of which is connected to a pair of opposed solenoids **246** and **247**. Solenoids **246** are energized upon closing of switch **238** of the left-hand tank **201** so as to rotate valves **244** and **242** to simultaneously open the inlet of the left-hand tank **201** and the outlet of the right-hand tank **201** and close the outlet of the left-hand tank **201** and the inlet of the right-hand tank **201**. As the left-hand tank fills, its associated switch **238** is opened to de-energize solenoids **246**. Opening of these switches, however, does not alter the position of valves **244** and **245** which remain in the above-described positions until the stabilizer in right-hand tank **201** is substantially exhausted. When this occurs, right-hand tank **201** is raised and its associated switch **238** is closed to energize solenoids **247** which rotate valves **244** and **245** to open the inlet of right-hand tank **201** and the outlet of left-hand tank **201** and close the outlet of right-hand tank **201** and the inlet of left-hand

tank 201. A manual shut-off valve 248 is preferably provided between chamber 229 and valve 244 to shut off the system when not in use.

It will also be appreciated that the water in tank 233 and the stabilizer in tanks 201 may be forced from the tanks by compressed air, if desired, and that the use of compressed air would eliminate the need for pump 231. Furthermore, it is to be understood that the stabilizer may be forced out of containers 201, if desired, without departing from the invention and that the hopper 243 and its associated filling mechanism may be eliminated.

It is to be understood that the stabilizer used in the apparatus of Figures 1 and 2 may be in any suitable form such as a liquid, powder, paste without departing from the present invention.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. Apparatus for continuously producing a foam forming liquid capable of producing foam by entraining a gas into a stream of said liquid comprising a mixing chamber, a conduit for delivering a stream of water under pressure through said chamber, a pair of tanks adapted to hold a supply of foam stabilizer, a multi-branch conduit connecting said tanks to said chamber, a multiport valve in said conduit for controlling the flow of stabilizer to said chamber so that foam stabilizer may be supplied to said chamber alternately from said tanks, means for automatically operating said valve to alternately connect said tanks to said chamber to effect a continuous supply of stabilizer in accordance with the available supply of stabilizer in said tanks and means in said chamber for introducing a predetermined proportion of stabilizer into said stream of water.

2. The combination defined in claim 1 wherein a frame work having electric switches, one for each of said tanks, secured thereto is provided for supporting said tanks for independent vertical movement so as to alternately open and close said switches as the stabilizer in said tanks is exhausted and replenished and wherein said first-mentioned means comprises a pair of independently energized solenoids connected to said valve to alternately move said valve from one operative position to the other as said switches are alternately opened and closed.

3. The combination defined in claim 1 wherein said automatic means comprises a pair of opposed solenoids operatively connected to said valve for alternately moving said valve from one operative position to the other; a pair of switches, one of which is operated in response to the quantity of stabilizer in one tank and the other of which is operated in response to the quantity of stabilizer in the other tank, connected to said solenoids for independently energizing said solenoids and a source of electrical energy adapted to be connected to one or the other of said solenoids when its associated switch is closed.

RADCLIFFE MORRIS URQUHART.

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