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METHOD AND MEANS FOR EXTINGUISHING FIRES

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FIG. 2.

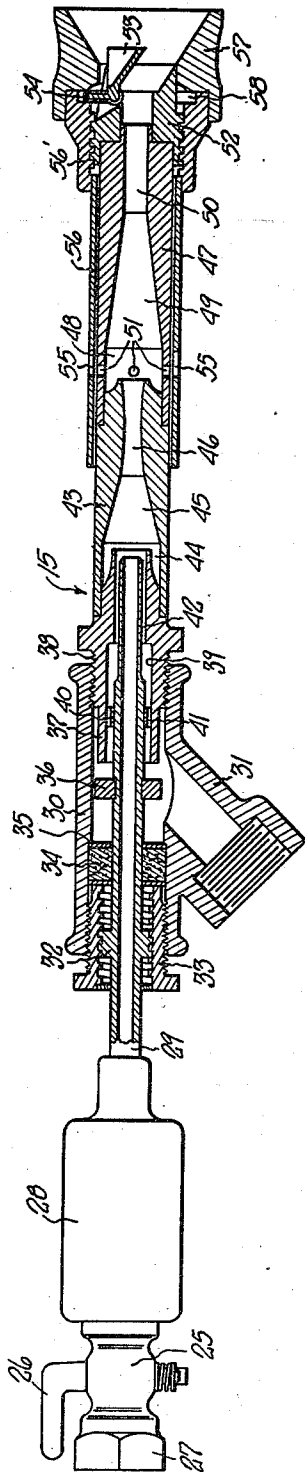
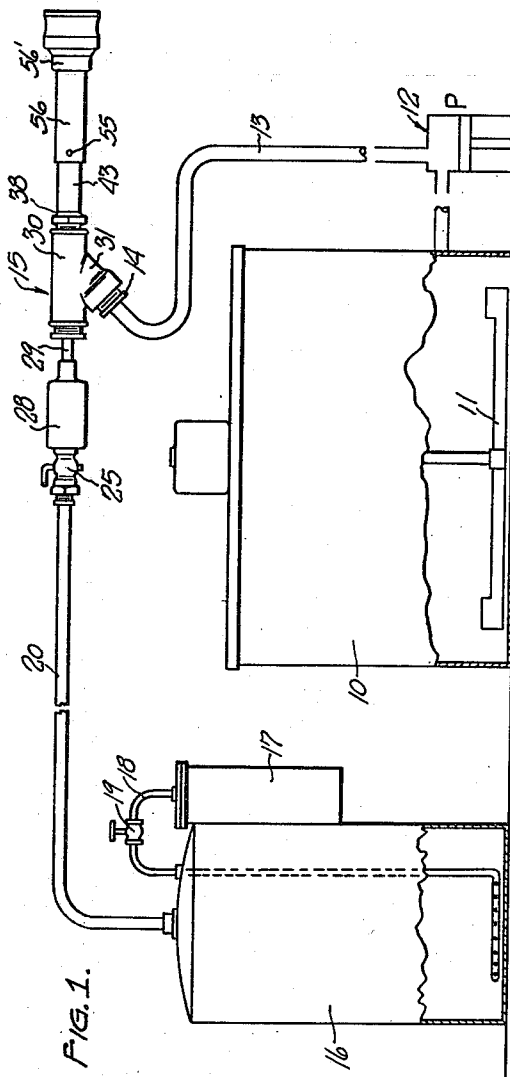


FIG. 1.



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METHOD AND MEANS FOR EXTINGUISHING FIRES

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12 Claims. (Cl. 169—15)

This invention relates to a method and means for extinguishing fires, and particularly to a method of this character utilizing chemicals adapted to smother a fire.

The two principal methods of extinguishing a fire which are now in common use are: to project a stream of water under a high pressure upon a burning object to quench and extinguish the flame; and to deposit a foam upon a burning object to blanket the same and smother the fire. Each of these two methods has definite limitations. Thus, the use of water usually entails substantial water damage to that portion of the burning object which is not consumed by fire. Also, water is not effective in fighting oil fires and is not effective or practical in freezing temperatures. Additionally, a large amount of water is necessary to extinguish a fire, and a considerable amount of time is required before a blaze can be brought under control by water. On the other hand, the present methods of handling, mixing, and discharging foam generating liquids, together with the characteristics of present foam generating chemicals per se, are such that firemen must be able to approach close to a fire in order to properly and effectively apply the chemicals to a burning object in a manner to blanket the object and smother the flame. Also, it is difficult to effectively blanket a fire in a rubbish pile, coal pile, or the like, where the fire is deep therein, with conventional foam apparatus, because the foam does not penetrate to the seat of the fire. Additionally, present foam materials do not have sufficient toughness and tenacity to resist "blow holes" resulting from pressures within the burning object, and to adhere to burning object.

The primary object of this invention is to provide a method of mixing, under high pressure, two chemicals which are adapted to react to form a fire smothering foam, and of discharging the mixture while the same is still in liquid form.

A further object is to provide a method and means by which foam generating liquids may be projected into a fire from a point remote from the fire.

A further object is to provide a novel fire fighting chemical compound composed of constituents which react to generate a fire smothering foam at a predetermined measurable time after the constituents are mixed to facilitate projection thereof in a liquid stream and penetration of the burning object before foaming.

A further object is to provide a fire extinguishing chemical compound which will require a pre-

determined interval of time for the generation of foam after mixing thereof, which forms a tough and heavy foam, which will effectively adhere to a burning object to smother combustion, and which resists freezing at temperatures substantially below the freezing point of water.

A further object is to provide a foam generating fire fighting chemical compound which has sufficient body, fire resisting properties, and tenacity to form a fire preventing coating when dry.

A further object is to provide a method and means by which a chemical is projected in liquid form onto a fire to quickly reduce the temperature of the burning object, and wherein the liquid foams at a predetermined time after its mixture and deposit on and penetration into the burning object to completely extinguish the remainder of the fire by smothering it with foam.

A further object is to provide a method for quickly, effectively, and completely mixing two chemicals in accurately determined proportion while the same are subjected to high pressures.

Other objects will be apparent from the drawing, description, and appended claims.

In the drawing:

Fig. 1 is a diagrammatic view of the complete apparatus for the practice of my method.

Fig. 2 is a longitudinal sectional view of the nozzle employed to mix and project chemicals pursuant to my method.

Referring to the drawing, which illustrates the preferred embodiment of the invention, the numeral 10 designates a container for one of the liquid constituents of my improved fire fighting chemical compound which will be described hereinafter. Container 10 has arranged therein an agitator 11 by means of which the chemicals therein are maintained in uniformly mixed condition. Suitable means, in the nature of a pump or compressor 12, is associated with the container 10 for the purpose of subjecting the liquid contents of the container 10 to a high pressure. The pressure to which the contents of container 10 is subjected is preferably approximately 600 pounds per square inch, although this pressure may vary in the range of from 500 to 1000 pounds per square inch. The container 10 is provided with a flexible discharge conduit or the like 13 adapted for connection at 14 with nozzle 15.

Container 16 serves to receive a second liquid chemical adapted to react with the chemical in container 10 and of a character to be described. A sealed tank 17 adapted to contain carbon dioxide under pressure and in liquid form is juxtaposed to container 16.

posed to and connected with container 16 by a conduit 18 which extends through the top of container 16 and terminates in an annular discharge portion adjacent the bottom of container 16. A regulating valve 19 is interposed in conduit 18 for controlling the quantity and pressure of the carbon dioxide discharged into container 16 through conduit 18. The valve is normally adjusted to regulate this pressure at about 50 pounds per square inch, although this pressure may vary in a range from 40 to 100 pounds per square inch according to the pressure applied on the contents of container 10. A flexible conduit 20 connects the upper end of container 16 with the nozzle 15.

Nozzle 15 is of the construction best illustrated in Fig. 2. The nozzle has a valve 25 at one end, provided with an operating handle 26 and a socket 27 adapted for connection with line 20. The opposite end of valve 25 is connected with one end of a tubular member 28 from whose opposite end projects a reduced size elongated tube 29. Tube 29 projects into the tubular body 30 of a branch fitting. A branch 31 projects from the intermediate portion of fitting 30 for connection with the line 13 from container 10. Tube 29 has an enlargement 32 formed intermediate its ends and externally screw threaded to fit within a sleeve 33 threaded within the tubular body 30 of the branch fitting. The inner end of sleeve 33 bears against a compression gasket ring 34 encircling tube 29 and bearing against a shoulder 35 formed in tubular body 30 at a point between the end of sleeve 33 and the branch passage 31, for the purpose of sealing one end of said branch fitting.

Tube 29 fixedly mounts an annular valve member 36 adapted to be positioned adjacent the rear tubular end 37 of a jet member 38 threaded in the outer or forward end of body 30 of the branch fitting. Jet 38 has a bore 39 extending approximately one-half the length thereof and of a diameter to provide a substantial clearance between the same and the tubular member 29 extending therethrough. A suitable guide ring 40 encircles tube 29 and has spaced, longitudinally extending, radial ribs 41 bearing against the inner walls of the tubular portion of jet 38 to position tube 29 in centered relation thereto without materially interfering with the flow of liquid around tube 29 and through the jet 38. The forward end of jet 38 has a restricted bore 42 into which the forward end of tube 29 projects.

A second elongated jet 43 is fixedly mounted upon the outer end of jet 38 and has an enlarged chamber 44 at its rear end into which the forward tapered end of jet 38 projects. The bore of jet 43 tapers at 45 at its intermediate portion, and the forward end 46 of said bore is of reduced or Venturi proportion. An elongated cylindrical member 47 is secured at its rear end to the front of the jet 43 and has an enlarged chamber 48 into which the mouth of jet 43 extends. A tapered bore 49 is formed in the intermediate portion of cylindrical member 47, and a restricted forward bore portion 50 communicates with tapered portion 49. A plurality of openings 51 are provided in member 47 in circumferentially spaced relation for the admission of air into the chamber 48 adjacent the mouth of the outer jet.

A cylindrical socket member 52 is fixedly secured to and is aligned with the cylindrical member 47. Socket 52 tiltably mounts a baffle 53 provided with a laterally projecting tongue 54. A sleeve 56 rotatably encircles the member 47 and

the forward end of jet 43. Sleeve 56 is provided with a plurality of circumferentially spaced apertures 55 adapted to register with the openings 51 in chamber 48. At its forward end sleeve 56 mounts fixedly an enlarged collar 56' which is internally screw threaded for engagement with external screw threads on the socket 52. A mouth element 57 is fixedly mounted on the outer end of the collar 56' and has an outwardly flaring mouth opening extending outwardly complementary to the flared mouth of the socket 52 and receiving baffle 53. An interior circumferential groove 58 is formed between collar 56' and mouth 57 to receive the outer end of tongue 54 of baffle 53.

Container 16 is filled with a liquid formed by mixing bicarbonate of soda with powdered sodium chloride in water, in the proportion of one pound of bicarbonate of soda and one pound of sodium chloride in one gallon of water. The compressed carbon dioxide in tank 17 which is preferably in liquid form, passes into container 16 in gaseous form and at a pressure regulated by valve 19 when said valve is opened. The carbon dioxide discharging into container 16 continuously agitates the chemicals in said container, partially mixes therewith to saturate the water therewith, and subjects the contents of container 16 to desired discharge pressure, such as a pressure of 50 pounds per square inch.

The chemical compound in container 10 is formed by mixing, in one gallon of water, from one to four pounds of calcium chloride, one-half pound of aluminum sulphate or potassium sulphate, one ounce of powdered soap bark, powdered licorice root, or powdered alfalfa root, and one half ounce of soy bean flour. Sulphuric acid is added to this compound after it is deposited in container 10, preferably in the proportion of approximately four ounces of sulphuric acid to 200 gallons of water. However, the amount of sulphuric acid used may vary from two ounces to six ounces per 200 gallons of water. The mixture in container 10 is continuously stirred by agitator 11 to keep the mixture uniform.

When the mixture in container 10 is subjected to a high pressure, for example a pressure of 600 to 700 pounds per square inch by pump 12, for discharge through line 13 to nozzle 15; and the material in container 16 is subjected to a lower pressure, for example 50 pounds per square inch, and is discharged through conduit 20 to nozzle 15 of the construction illustrated wherein a negative pressure or suction effect is created by the action of interfitting jets 29 and 38 and of venturi 46 under the influence of the high pressure stream, to supplement the low positive pressure; the two chemical compounds may be mixed within the nozzle in desired proportions to each other. The preferred proportions of these two chemicals is one part of the compound from container 16 to from four to six parts of the compound from container 10. This proportion is controlled by adjustment of the valve 19 regulating the pressure on the contents of container 16.

The mixture from container 10 is passed through the jet 38 in the form of a hollow annular stream, while the material from container 16 passes through the tube 29 in a solid stream impinging and encircled by the annular stream. The chemicals are quickly, completely and effectively mixed or commingled within the mixing chamber of the second jet 43 by virtue of their intimate relation, the high pressure and velocity of discharge, and the deflection thereof by tapered bore

portion 45 and Venturi bore 46. Air is then entrained in the liquid mixture at chamber 48, and the mixture is projected from the nozzle in any suitable or desired stream or spray, governed by the position of baffle 53 in the mouth of the nozzle.

The final chemical mixture is so proportioned that it will foam at a predetermined time after its mixture in the nozzle, and preferably from 1½ to 4 seconds after mixture. The time required for foaming is controlled by the amount of sulphuric acid used in the liquid in container 10. This may vary from two to six ounces per 200 gallons of water, but four ounces are preferred in this method using the pressures above mentioned. Use of a smaller quantity of sulphuric acid will increase the time interval before foaming, and use of a larger quantity of the acid will reduce the time between mixture and foaming. However, if the pressures cited are materially altered, a proportionate change of the amount of acid will be required. Also, a greater amount of acid is required in cold weather to speed effervescence.

The use of soy bean flour in the mixture is important because it acts as a spreading agent and increases the catalytic or uniting action of the mixture. The soy bean flour also imparts toughness and tenacity or adhesion to the foam.

The calcium chloride in the mixture constitutes an anti-freeze agent and also serves to make the foam heavier and slower in generation. The retarding or slowing action of the calcium chloride upon the foaming reaction is overcome or controllably compensated by the amount of sulphuric acid used.

The mixture has the additional property that, when dry, it will form a fire preventing coating, whereas the usual materials employed to form foam for fighting fires will burn when dry, or will form a powder having no cohesion or body.

The construction of the nozzle as aforesaid accommodates the use of high pressure and the mixture of the constituent liquids uniformly and in desired proportion. Also, the nozzle effects the complete mixture of the two chemicals in a very short period of time, i. e., a minute fraction of a second; permits the entrainment in the liquid mixture of a quantity of air ample to produce a foaming action, i. e., volume of air equal to the volume of liquid; and permits discharge of the mixture in liquid form from the nozzle, so that it may reach the burning object and penetrate therein under high pressure, while still in liquid form. The foam is formed after the liquid strikes the burning object, i. e., from 1½ to 4 seconds after its mixture in the nozzle, whereby the liquid will have an opportunity to reach or penetrate to the flame to materially reduce the temperature of the burning object, and to quench the flame by the flame-smothering action of the foam. This combined cooling and smothering action facilitates complete extinction of a fire much quicker than usual foaming mixtures and apparatus, and the penetration insures that foam will reach the seat of the fire, even in a deep burning rubbish pile or the like. Additionally, the ability to project the chemical in liquid form permits the operator to station himself at a substantial distance from the fire and out of the range of the greatest heat thereof. Thus, the operator can accurately direct the liquid mixture into the vital points of the fire, and the high pressure employed provides a long trajectory for the liquid mixture. This is a great advance over present foam equipment, since present foaming mixtures usually

foam instantaneously upon mixture and hence can be applied only from a position close to the seat of the fire and within the area in which the greatest heat radiates from the fire.

It will be understood that the proportions of the constituent chemicals may be varied from those stated herein depending upon the conditions encountered. Thus, the calcium chloride may be used within a range of one to four pounds. In fighting fires at temperatures below freezing the quantity of calcium chloride used is at or near the upper limit of four pounds to impart anti-freeze properties to the mixture. Also, the amount of sulphuric acid may be varied, with increased amounts accelerating the foaming of the liquid after mixture or overcoming sluggishness of the foaming reaction in cold weather.

Many farmers now have spraying equipment generating pressures ranging from 500 to 1000 pounds and mounted on a trailer to be drawn by a tractor. Such spraying equipment can be utilized to practice my method by simply mounting on the trailer a unit comprising container 16 and charged tank 17, filling the tank of the sprayer with the other liquid, and connecting the mixing nozzle to the two containers. Thus, the farmer would be equipped with an effective fire-fighting apparatus which would be conditioned for use quickly, and which could be driven to the scene of the fire. The container 16 could be filled at all times, and stored conveniently, without danger of freezing; and a supply of the other liquid could be mixed either with or without the acid, and stored without danger of freezing in a receptacle from which it could be emptied into the tank of the sprayer quickly. Acid would be separately supplied to the tank in an amount as required by weather or other conditions.

The method and means aforesaid also has the advantages of flexibility. Thus, the tank 17 can be so proportioned as to contain a quantity and pressure of carbon dioxide substantially in excess of that required to exhaust the contents of container 16. Then, if a large fire is encountered for whose extinction the amount of foaming chemicals available is inadequate, container 10 can be filled with water without stopping operation of the device, and the apparatus will feed the water and carbon dioxide to the nozzle to entrain the carbon dioxide in the water. Water saturated with carbon dioxide, though not as effective as a foam-generating liquid for extinguishing fires, is much more effective than water only, and hence the exhaustion of the foaming chemicals will not be as serious a handicap as exhaustion thereof is in present equipment utilizing the same.

I claim:

1. The method of producing a foaming fire extinguishing medium comprising the steps of subjecting to a pressure of from 500 to 1000 pounds per square inch a liquid constituting a mixture of from one to four pounds of calcium chloride, approximately one-half pound of a material of the class including aluminum sulphate and potassium sulphate, approximately one ounce of a powdered material of the class including soap bark, licorice root and alfalfa root, and approximately one-half ounce of soy bean flour, per gallon of water; subjecting to a pressure of from 45 to 100 pounds per square inch a liquid constituting approximately one pound each of bicarbonate of soda and sodium chloride per gallon of water; adding from two to six ounces of sulphuric acid per 200 gallons of the first mentioned liquid; discharging said liquids into a mixing chamber

in a manner whereby the high pressure liquid exerts a feeding negative pressure upon the intake of the low pressure liquid, and discharging said liquids from said mixing chamber within a small fraction of the time required to produce foaming thereof.

2. The method of producing a fire extinguishing medium by the use of chemicals, including a saline solution and an activating solution, which react to generate foam within from 1½ to 4 seconds after mixture, comprising the steps of subjecting the saline solution to from 45 to 100 pounds pressure, subjecting the activating solution to form 500 to 1000 pounds pressure, discharging said solutions to a mixing chamber having a discharge opening in a manner whereby said high pressure solution exerts a suction effect upon the intake of the low pressure liquid, regulating the pressure of the low pressure solution to control the ratio in which said solutions are fed to said chamber, and discharging the mixture from said chamber in a high velocity stream within a small fraction of the time required for reaction thereof.

3. The method of producing a fire extinguishing medium by the use of chemicals, including a saline solution and an activating solution, which react to generate foam in a predetermined length of time, comprising the steps of discharging carbon dioxide under a pressure of from 45 to 100 pounds into the container of the saline solution to agitate, and saturate said solution and discharge it to a mixing chamber, subjecting said activating solution to a pressure of from 500 to 1000 pounds and discharging the same into said chamber in a manner to exert a suction effect upon the saline solution, regulating the pressure of the carbon dioxide to feed one part of the saline solution to the chamber to from four to six parts of the activating solution fed to said chamber, and discharging the mixed solution from said mixing chamber within a small fraction of the time required for reaction thereof.

4. The method of producing a fire extinguishing medium by the use of chemicals, including a saline solution and an activating solution, which react to generate foam in a predetermined length of time, comprising the steps of adding to and mixing with the activating solution an inert anti-freeze agent and a quantity of acid to at least partially counter-balance the retarding effect of the anti-freeze agent upon the reaction of the activating solution with the saline solution, mixing the two solutions under pressure in a range of from 500 to 1000 pounds in the proportion of one part of saline solution to from four to six parts of activating solution, and depositing said mixture upon a fire in liquid form within a fraction of said time of reaction.

5. The method of producing a fire extinguishing medium by the use of chemicals, including a saline solution and an activating solution, which react to generate foam in a predetermined length of time, comprising the steps of mixing with the activating solution from 1 to 4 pounds of calcium chloride per gallon and from 1 to 3 ounces of sulphuric acid per 100 gallons of solution, mixing the two solutions in the ratio of 1 part of saline solution to from 4 to 6 parts of activating solution under a pressure of from 600 to 700 pounds, and discharging said mixture upon a fire before said time of reaction expires.

6. The method of extinguishing fires by the use of chemicals, including a saline solution and an activating solution, which react to generate foam

within a predetermined period of time, comprising the steps of mixing in the activating solution approximately one-half ounce of soy bean flour per gallon of solution, mixing the two solutions under a pressure of from 500 to 1000 pounds, adding air to the solutions when mixed, and discharging the mixture under the mixing pressure within a small fraction of the time required for reaction thereof.

7. The method of extinguishing fires by the use of chemicals, including a saline solution and an activating solution, which react to generate foam within a predetermined length of time, comprising the steps of subjecting the saline solution to the action of carbon dioxide under pressure of from approximately 45 to 55 pounds to agitate and saturate the solution, discharging the two solutions into a mixing chamber with said activating solution under a pressure from 600 to 700 pounds, regulating the pressure of the carbon dioxide to control the ratio in which the two solutions are fed to the chamber, adding air to the solutions when mixed, and discharging said mixture under the mixing pressure within a small fraction of said reaction time.

8. Means for extinguishing fires comprising a saline solution including sodium bicarbonate and sodium chloride and an activating solution mixed in the proportion of 1 part of saline solution to from 4 to 6 parts of activating solution, to generate foam, said activating solution containing a material of the class consisting of soap bark, licorice root and alfalfa root, a material of the class consisting of aluminum sulfate and potassium sulfate, from 1 to 4 pounds of calcium chloride per gallon of solution to prevent freezing and retard generation of foam, and from 1 to 3 ounces of sulphuric acid per 100 gallons of solution to partially overcome the retarding effect of the calcium chloride upon the reaction between the solutions.

9. Means for extinguishing fires comprising a saline solution including sodium bicarbonate and sodium chloride and an activating solution mixed together with a small quantity of an acid in the proportion of 1 part of saline solution to from 4 to 6 parts of activating solution to generate foam, said activating solution containing a material of the class consisting of soap bark, licorice root and alfalfa root, a material of the class consisting of aluminum sulfate and potassium sulfate, and approximately ½ ounce of soy bean flour per gallon of solution to impart cohesive properties and toughness to the foam.

10. Means for extinguishing fires comprising a saline solution including sodium bicarbonate and sodium chloride and an activating solution mixed in the proportion of 1 part of saline solution to from 4 to 6 parts of activating solution, to generate foam, said activating solution containing a material of the class consisting of soap bark, licorice root and alfalfa root, a material of the class consisting of aluminum sulfate and potassium sulfate, from 1 to 4 pounds of calcium chloride per gallon of solution to prevent freezing and retard generation of foam, and from 1 to 3 ounces of sulphuric acid per 100 gallons of solution to partially overcome the retarding effect of the calcium chloride upon the reaction between the solutions, and substantially ½ ounce of soy bean flour per gallon of solution to impart cohesive properties and toughness to the foam.

11. Means for extinguishing fires comprising a saline solution and an activating solution mixed

in the proportion of 1 part of saline solution to

from 4 to 6 parts of activating solution to generate foam, said saline solution containing substantially one pound each of sodium bicarbonate and sodium chloride in one gallon of water, said activating solution containing from one to four pounds of calcium chloride, substantially one-half pound of material of the class consisting of aluminum sulphate and potassium sulphate, substantially one ounce of a foaming agent of the class consisting of soap bark, licorice root and alfalfa root in powdered form, and substantially one-half ounce of soy bean flour in one gallon of water, and from one to three ounces of sulphuric acid per one hundred gallons of solution.

12. Means for extinguishing fires comprising a saline solution and an activating solution mixed in the proportion of 1 part of saline solution to

5 from 4 to 6 parts of activating solution to generate foam, said saline solution containing substantially one pound each of sodium bicarbonate and sodium chloride in one gallon of water, said activating solution containing from one to four pounds of calcium chloride, substantially one-half pound of material of the class consisting of aluminum sulphate and potassium sulphate, substantially one ounce of a foaming agent of the class consisting of soap bark and, licorice root in powdered form, and substantially one-half ounce of soy bean flour in one gallon of water, and from one to three ounces of sulphuric acid per one hundred gallons of solution, said saline solution, being saturated with carbon dioxide gas.

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