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POWDERED SOAP AND PROCESS AND APPARATUS FOR MAKING SAME

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My invention relates to powdered soap and to a method or process of making the same and to apparatus used in carrying out said method or process. The general objects of my invention are to produce a substantially pure powdered soap composed of small particles of substantially uniform size free from dust and having a high combined alkali content and consequent high degree of saponification and free from binder and builder or filler which is further soft and flabby and has a low moisture content and is free from the external surface hardening commonly called case hardening in soaps so that it will dissolve very easily in water and will not tend to settle when it is placed in water in a dry form.

Other general objects of the invention are to provide a simple and efficient process for making powdered soap, which possesses the characteristics above set forth, cheaply and easily in commercial quantities and from ordinary soap stock, said process embodying, means for insuring a continuous circulation of the hot liquid soap, means for placing said hot liquid soap under a high pressure whereby substantially complete saponification is secured and means for spraying the hot liquid into a heated chamber in the presence of heated air whereby the soap will be formed into finely divided particles of substantially uniform size and will be completely dried almost instantly within this chamber so that it is ready for packing as soon as it is discharged from the chamber and cooled.

In laundries it is common practice to rotate cylindrical drum washers. The clothes are placed in these washers and usually are first washed in water to which a mild alkaline material as bi-carbonate of soda, borax, soda ash or the like has been added for the purpose of neutralizing the acid in the clothes. After this has been done soap may be added to the alkaline water for the first or preliminary washing and the clothes may then be washed through several changes of soapy water of varying temperatures and finally rinsed.

It has heretofore been practical to place the undissolved soap directly in the washers for several reasons, namely it is common practice to add a filler as sodium carbonate to soap, in the making, to facilitate the processes of manufacture and it is also common practice to compress the soap as by passing it between rolls. This compression and the filling of the filler makes the soap very heavy and puts a glaze or hardening on its outer surface with the result that the soap dissolves slowly and a portion of the same is liable to settle to the bottom of the washer and pass out as waste. Another disadvantage of using slow dissolving heavy soaps directly in the washers has been that their retarded solubility will retard the forming of the Suds with the result that they will lather very freely at the end of the washing period and cause trouble and loss of time.

On account of the above mentioned objections to placing the soap directly in the washers it has come to be common practice to first dissolve the soap in hot water and then add desired amounts of this concentrated soap solution to the washers. The work of dissolving a batch of this soap usually takes about two hours of the washerman's time and the dissolved soap must be kept at or near a boiling temperature which has a damaging and weakening effect on the soap. Furthermore the tanks in which the soap is dissolved are usually located at some distance from the washers thus necessitating extra labor and time in carrying the solution in pails from these tanks to the washers.

In accordance with my process I have produced a soap powder which is free from filler and binder and free from surface glaze and which will not settle but will dissolve very quickly and easily when placed in the washers in dry form thus producing a saving in time and labor and at the same time giving greater efficiency per pound of soap. Soap is ordinarily made by bringing together into intimate contact a fat and an alkali, usually caustic soda, in the presence of heat and water. This forms a colloidal mixture in which the particles of the fat and the alkali are brought together in very close and intimate relation and is commonly referred to as saponification. One object of the soap maker is to produce, as nearly as is possible, complete saponification because the cleansing efficiency of the soap is increased in proportion to the degree of saponification. After the soaps have been made by the use of heat processes they are often stored for long periods of time to allow the saponification to become more nearly complete but the aging of powdered or flaked laundry soap while it is still moist is open to the objection that it produces a hardening of the exterior surface of the soap commonly known as case hardening. This hardening retards the dissolving of the soap in water. The use of a filler in the soap also makes the soap slower to dissolve and increases the specific gravity of the same. It is also common practice in soap manufacture to use a binder to prevent separation of the soap elements in the process of
manufacture. This binder is usually in the form of a low grade mineral oil which will not saponify and is difficult to rinse out of the clothes in laundry work. In soap powder made by grinding or flaking the particles are not of uniform size but vary from the very fine particles to relatively coarse particles. The result is that they pack very solidly and the mass is much harder for the water to penetrate and dissolve than it is where the particles are of uniform size and form sufficient voids between them for the water to enter.

With the objectionable features of ordinary laundry soap in view it is the object of my invention to provide a soap powder in which the particles are small but are light and fluffy and are sufficiently uniform so that they will not pack and exclude the water from the voids; to provide a soap powder having a very high combined alkali content or in which substantially complete saponification is secured; to provide a soap powder having a low free moisture content and substantially no crystallized moisture; to provide a soap powder which is not case hardened by reason of prolonged exposure to the air while in a moist condition; to provide a soap powder which is free from binder; and to provide a soap powder which is free from builder or filler which increases its weight and reduces its efficiency and carries crystallized moisture.

I attain these objects and produce the desired product by taking the hot soap after the boiling and cooking process, and forcing it through pipes under a high pressure and discharging it in the form of a spray into a chamber which is supplied with a blast of heated air for drying purposes, no filter, nor binder, nor other foreign substance except the necessary preservative being used in the soap.

In the accompanying drawing Figure 1 is a somewhat diagrammatic side elevation of apparatus used in carrying out my process.

Figs. 2, 3, and 4 are detached sectional views respectively of a pressure reducing valve, and a pressure controlled two valve way, and a spray nozzle all of which are embodied in my apparatus.

Fig. 5 is a detached plan view of a spray nozzle disc.

Referring especially to Fig. 1 of the drawing, 5 designates a conditioning kettle adapted to contain hot liquid soap which has been thoroughly prepared, by the usual cooking or heat treatment process, from fats and alkalis without the addition of binder or builder or filler or any inactive substance, with the exception of sufficient preservative, as caustic soda, to keep the soap from becoming rancid. This hot soap may be introduced through a pipe 6 into the kettle 5 and said kettle may be provided with means, not shown, for keeping the soap at any desired temperature.

From the conditioning kettle 5 the soap passes through a pipe 7 to a low pressure pump 8 by which it is placed under the first stage of pressure and is forced through a pipe 9 to a high pressure pump, where the pressure is greatly increased and the soap is forced outwardly through a saponifying valve 11, of a form more clearly shown in Fig. 2 and thence upwards through a pipe 12 and past a two way valve 13, see Fig. 3, into a pipe 14 which is connected by an arched portion 15 with another two way valve 16. From the valve 16 the soap passes into one of two downwardly extending pipes 17 or 18 and finally is discharged from a spray nozzle 19, on the end of the pipe 17 or 18 through which said soap is flowing, into a dryer 20. The top portion of the dryer 20 is preferably cylindrical and the lower portion is conical, this shape being common to centrifugal blowers and precipitators of the cyclone type, an air inlet conduit 21 is arranged to deliver heated air tangentially into an annular compartment 22 which extends around the periphery of the upper cylindrical portion of the dryer. A whirling or cyclonic motion is thus imparted to this heated air and the moisture contained in it is caused to pass inwardly through slots 23 and thence downwardly in a sweeping whirling motion along the sides of the drier to a point near the bottom where the whirling motion of the air is greatly increased and said air is finally caused to move upwardly through a centrally arranged shaft or pipe 24. The liquid soap which is being sprayed from one of the spray nozzles 19 is directed outwardly in the form of a cone and is caught by the downwardly moving whirling hot air and dried almost instantly and thrown out against the conical walls of the dryer by centrifugal force and slides down said conical walls and discharges through an opening at the bottom of the dryer into a horizontal conduit 25 from whence it may be discharged into a blower and thence blown through an upright conduit 27 and allowed to descend through cooling chambers 28 and 29 onto a reciprocating screen 30 which may direct any chunks or lumps into a receptacle 31 and allow the dried and cooled soap powder to discharge into another receptacle 32. A conduit 33 may be used to discharge the air from cooling chambers 28 and 29 into the dryer 20. The parts 25 to 33 inclusive form convenient means for cooling the powdered soap and delivering it into receptacles but it will be understood that the process of making the powdered soap is complete when it discharges from the dryer and that other means may be used for cooling and disposing of the same.

The air which is delivered through conduit 21 into the dryer may be drawn through a conduit 34 from the space around the upper portion of the dryer, to a centrifugal blower 35, thence forced through a conduit 36 into a heating chamber 37 where it passes over heated pipes 38 or other heating means before returning to the dryer.

An important feature of the invention relates in the means for maintaining a constant circulation of the heated soap at all times regardless of the conditions of the nozzles 19. This prevents clogging up of any of the conduit pipes in case the nozzles should become clogged and also keeps the soap in the conditioning kettle 5 always thoroughly mixed and agitated. This is accomplished by providing a return pipe 40 between the valve 18 and the conditioning kettle 5 and by providing a by-pass pipe 41 between the return pipe 40 whereby the low pressure pump, which always pumps more soap than is taken by the high pressure pump 10 will keep up a constant circulation through pipes 41 and 40 and back to the kettle 5. A pressure operated valve 42 is provided in pipe 41 to prevent soap from being thrown through the pipe and yet maintain a substantial pressure, usually not in excess of one hundred pounds per square inch, in the pipe 9.

The two way valves 13 and 16 are substantially the same in construction and are both controlled by pressure. The object of the valve 16 is to switch the flow of soap from one nozzle pipe 17 or 18 to the other in case one.
nozzle 19 becomes plugged up and the pressure in the pipe 15 rises above a predetermined amount. The valve 13 is set to operate at a higher pressure than the valve 16 and will close the passageway from pipe 12 to pipe 14 and connect pipe 12 with return pipe 40 in case the second nozzle becomes plugged up.

These valves are more clearly shown in Fig. 3, in which the two way valve member 43 is arranged to be moved by a lever arm 44 which is connected with a tension spring 45. When the end of this lever arm is engaged by trigger member 46 the valve is held in the position shown in Fig. 3, establishing connection to nozzle pipe 17. If pressure rises above a predetermined maximum in pipe 15 the plunger 47 will be forced outwardly against the pressure of the spring 48 and the stem 49 will press against and trip the trigger member 46 thus allowing the spring 45 to turn the valve 13 so as to close the passageway to nozzle pipe 17 and open a passageway to nozzle pipe 18. After the valve member 46 has thus been moved the valve must be re-set manually.

The valve 11 is a pressure valve of a type sometimes referred to as a homogenizing valve or a viscolizing valve. In this valve the pressure of the soap forces the valve member 50 back against the pressure of a very strong spring 51 and the soap is squeezed through a very narrow passage way between the valve and valve seat thus subjecting the globules and particles of the soap to a crushing action, which together with the high pressure produced by the pump 10 performs a very important function of bringing the fats and the alkalis in the soap into closer relation and completing the process of saponification. It is by reason of this step in the process that I am able to secure substantially one hundred per cent saponification.

The spray nozzles, Fig. 4, each preferably comprise a nipple 52 connected with pipe 17 or 18 and externally threaded to receive a cap 53 which has a centrally arranged opening 54. A thinner steel disc 55 having a small central discharge orifice 56 is placed in the cap 53 and a thicker disc 57 having a central conical recess 58 is placed on the disc 56 and clamped securely between said disc 56 and the end of the nipple 52 by screwing the cap onto said nipple.

Holes 59 are drilled through the disc 57 and the lower ends of said holes are connected with the conical recess 58 by grooves 60 which intersect the recess 58 tangentially in such a manner that a whirling motion will be imparted to the soap in the recess 58 before it is emitted from the perforation 56. This forms an exceptionally efficient spray nozzle which will produce a finely divided soap spray thus producing particles of substantially uniform size which are free from lumps and dust.

The spray nozzles are located near the central axis of the dryer and are within the ascending central column of heated air. The upward velocity of this column of heated air is not sufficient to carry off any of the sprayed soap but the drying begins at this point and moisture is carried off and by the time the soap particles reach the lower end of the dryer the desired amount of moisture has been evaporated and the powdered soap is ready for cooling and packing. Suction through the conduit 25 helps to remove the soap powder from the bottom of the dryer 20.

In practice I prefer to maintain the soap in the conditioning kettle at a temperature ranging from one hundred and forty degrees to just below the boiling point, which is substantially two hundred twelve degrees Fahrenheit. I obtain satisfactory results by placing the liquid soap under an initial pressure of from twenty pounds per square inch upwardly by the use of the low pressure pump 8, and by raising this pressure to anywhere from one thousand to three thousand pounds per square inch by the high pressure pump 10. The pressure may be somewhat reduced in the saponification valve 11 where a crushing and grinding of the liquid soap takes place and the pressure at the nozzle may vary from one to three thousand pounds. A finer powder may be secured by the use of a higher nozzle pressure.

A steam pipe 62 is connected with the soap pipes in such a manner that steam under pressure may be admitted for the purpose of cleaning out said soap pipes when they become stopped up or when the plant is to be shut down, or for the purpose of warming up the pipes before starting operation of the plant. Suitable shut off valves 61 are provided in the steam and soap pipes at all desired locations.

The means for keeping the soap moving in the pipes at all times constitutes an important feature of the invention because the soap, in the condition in which it is forced through the pipes, will solidify and clog the pipes very easily and very quickly if it is not kept moving. This continuous circulation takes place in substantially all of the exposed pipes. The pipes 14, 15, 17, and 18 are within the heated area of the liquid soap which will keep the soap liquid in these pipes even though circulation is stopped. No coverings or steam jackets are used.

The means for automatically cutting in another spray nozzle in case one nozzle becomes plugged up is also an important feature of the invention and makes it possible to operate continuously and to remove and clean one nozzle while the other is operating.

The product obtained is substantially different from any comminuted soap with which I am familiar, the differentiating characteristics being that the particles of my soap powder are soft and fluffy without greatly increasing their bulk and are free from case hardening and all float in water and are substantially uniform in size thus forming sufficient voids for the water to permeate the soap easily and making the soap dissolve easily and that my soap powder is free from binder and from builder or filler and is substantially completely saponified thereby increasing its cleansing efficiency.

The foregoing description and accompanying drawing clearly disclose a preferred embodiment of my invention, but it will be understood that changes may be made in my process and apparatus within the scope and spirit of the following claims.

I claim:

1. The method of producing a soap powder which consists in placing heated liquid soap under a high pressure of from one thousand to three thousand pounds per square inch and directing a finely divided spray of said heated liquid soap into a centrifugal drying chamber through which a whirling blast of heated air is continuously passed.

2. The method of producing a completely saponified soap powder which consists in placing heated liquid soap under a high pressure, forcing said soap while under said high pressure through
means which affords a restricted passageway for exerting a crushing effect on the soap, and directing a finely divided spray of said liquid soap under heavy pressure into heated moving air.

3. The method of completing the saponification of soap which has been prepared by the usual heat treatment process, which consists in forcing the heated liquid soap under a heavy pressure through a restricted orifice where a crushing and grinding action is exerted on the liquid soap.

4. The method of producing a light and fluffy soap powder in which the particles are substantially uniform in size and which is free from case hardening and is readily soluble and will float in water, which consists in placing heated liquid soap under a high pressure and forcing the same through an orifice of restricted area and discharging the same under the high pressure in the form of a spray into a receptacle in the presence of a blast of heated air.

5. Apparatus for making powdered soap embodying a receptacle for heated liquid soap, a high pressure pump arranged to produce a pressure in excess of one thousand pounds per square inch, a centrifugal drying chamber, means for supplying heated air to said drying chamber, spray nozzle means located in said drying chamber, conduits connecting said pump with said spray nozzle means and with said receptacle, and a pressure resistant saponification valve interposed in said conduits and affording a restricted passageway through which the soap is passed under high pressure.

6. Apparatus for making powdered soap embodying a receptacle for heated liquid soap, high pressure pump means connected with said receptacle, soap drying means, a spray nozzle located within said drying means, soap circulating conduits connecting said pump means with said spray nozzle, a pressure resistant saponification valve interposed in said conduits and affording a restricted passageway through which the soap is passed under high pressure, and continuous circulation by-pass means connected with said soap circulating conduits at a point near said nozzle and forming a return passageway between said soap circulation means and said receptacle.

7. Apparatus for making powdered soap, embodying a receptacle for heated liquid soap, high pressure pump means connected with said receptacle, a soap dryer, a spray nozzle, a pressure resistant saponification valve interposed in said conduits and affording a restricted passageway through which the soap is passed under high pressure, by-pass means connecting said soap circulating conduits at a point near said nozzle with said receptacle, and a pressure controlled valve interposed between said soap circulating conduits and said by-pass means.

8. Apparatus for making powdered soap, embodying a receptacle for heated liquid soap, low pressure pump means connected with said receptacle, high pressure pump means, a conduit connecting said low pressure pump means and said high pressure pump means, a drying chamber, a spray nozzle for directing a spray of liquid soap into said drying chamber, conduit means connecting said spray nozzle with said high pressure pump means, and a by-pass conduit connecting the conduit between said two pump means with said receptacle to permit a constant circulation of soap back to said receptacle.

9. The apparatus as claimed in claim 8 in which the conduit between said spray nozzle and said high pressure pump means is connected with said by-pass conduit by a two way valve controlled by pressure within said spray nozzle conduit and arranged to open a passageway to said by-pass conduit in response to excess pressure in said spray nozzle conduit.

10. In apparatus of the class described, a conduit for heated liquid soap, a pump for forcing said soap under pressure through said conduit, a plurality of spray nozzles at the discharge end of said conduit, a multiple way valve for selectively connecting one of said spray nozzles with said conduit and closing the passageway to the other nozzles, and means actuated by excess pressure within said conduit for operating said valve to close the passageway to one nozzle and open a passageway to another nozzle.

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