July 16, 1946. M. H. ITTNER 2,403,925

MANUFACTURE OF SOAP

Filed July 20, 1940 2 Sheets-Sheet 1

Fig. 1.

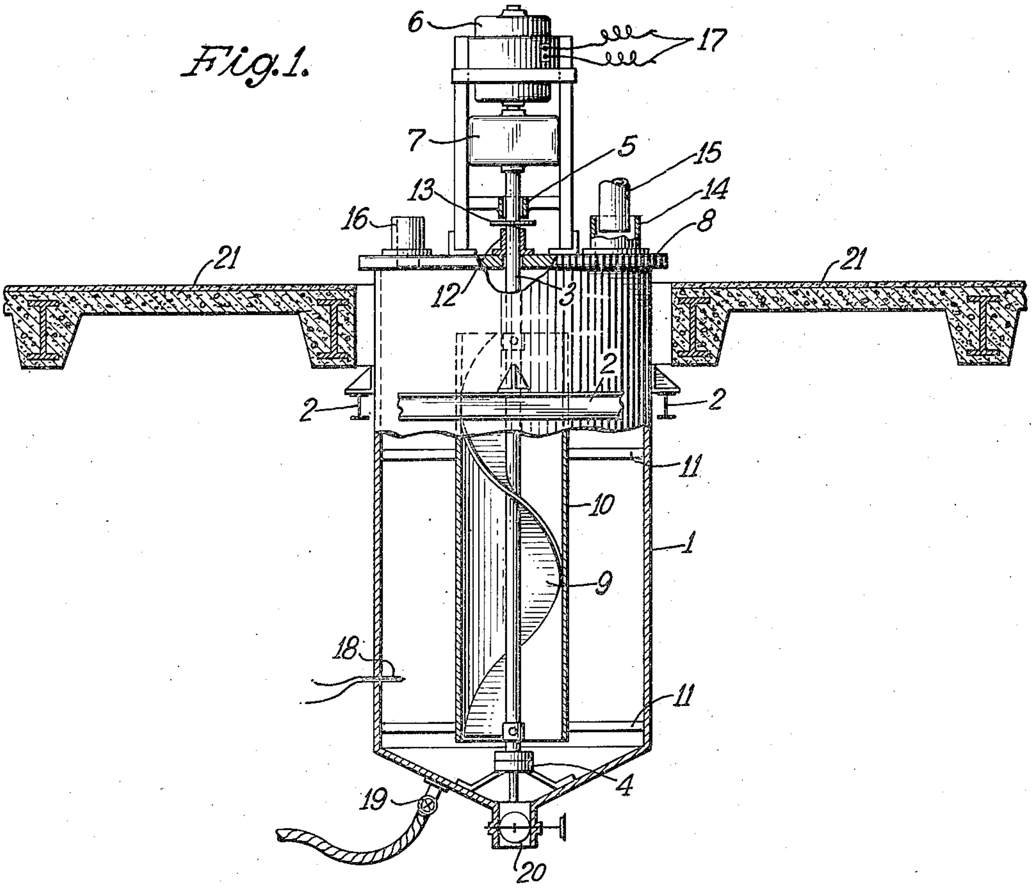
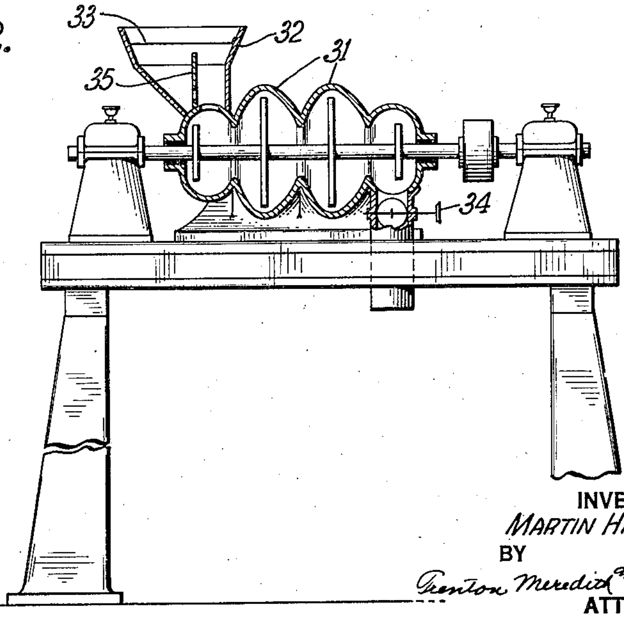


Fig. 2.



INVENTOR
MARTIN HILL ITTNER
BY
Preston Meredith and Ralph Carlisle Smith
ATTORNEYS

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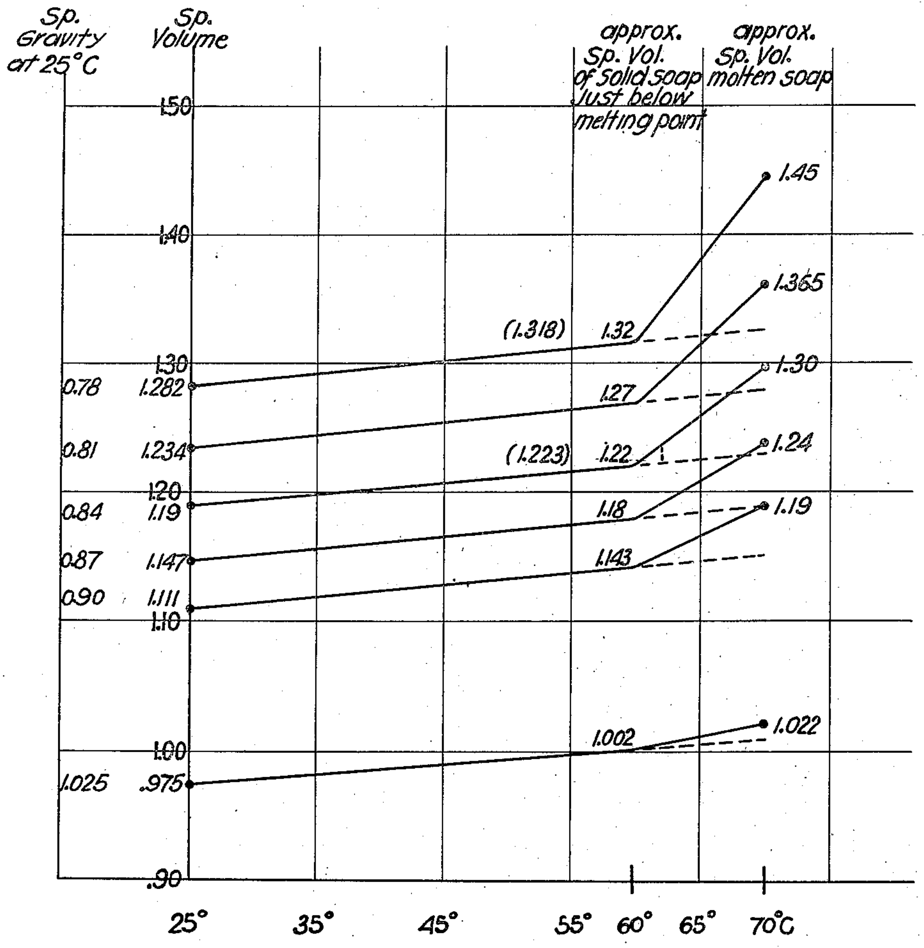
Filed July 20, 1940　　2 Sheets-Sheet 2

Fig. 3.



INVENTOR
MARTIN HILL ITTNER
BY
Quenton Meredith and Ralph Carlisle Smith
ATTORNEYS

Patented July 16, 1946 **2,403,925**

UNITED STATES PATENT OFFICE

2,403,925

MANUFACTURE OF SOAP

Martin Hill Ittner, Jersey City, N. J., assignor to Colgate-Palmolive-Peet Company, Jersey City, N. J., a corporation of Delaware

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14 Claims. (Cl. 252—370)

This invention relates to the manufacture of soap and it is more particularly directed to the manufacture of floating soap.

Floating soaps of various kinds have been known on the American market for over sixty years. They are commonly made by beating air into molten soap at temperatures considerably above its melting point until the volume is quite appreciably increased, pouring the aerated soap thus formed into large molds whereupon it is permitted to cool gradually until it has solidified, cutting the large blocks of soap into smaller pieces, and pressing these into individual cakes.

Floating soaps heretofore made have possessed one or more serious defects which have detracted greatly from their appearance, utility and value. They have fluctuated widely and undesirably in their degree of aeration, have had a tendency to split in pressing, to shrink unevenly in drying, and to crack in use.

The present invention has for one of its objects an accurate control of the degree of aeration to which the soap is subjected. It furnishes a means of controlling and minimizing the degree of contraction of the molten aerated soap in cooling and solidifying. The invention produces a floating soap with a minimum tendency to shrink unevenly on drying out, or to split in pressing, or to crack in use. The invention furnishes a means of subdividing the air or gas used in "aeration" to a high degree of dispersion resulting in an almost infinite multiplicity of extremely fine air bubbles evenly distributed which are so small that they have almost no tendency to unite with one another in an objectionable way while the soap is still molten, and this result is accomplished without disturbing the control over the desired amount of air actually employed in aeration of the soap. Another object of this invention is to prepare whiter, more opaque soap even without the introduction of pigments and inorganic fillers. Other objects and advantages of the invention will become apparent from the disclosures.

A soap well suited for making into floating soap can be made by the "settled soap process" from a mixture of, say, two weights of prime tallow and one of refined cocoanut oil. Such a soap can be readily obtained with a water content of approximately thirty percent, and containing a small and innocuous fraction of a percent of salt and free alkali. Soap satisfactory for making into floating soap may be made by my process of making soap and glycerine, U. S. Patent 1,918,603, July 18, 1933, which may be

processed by the present invention. It will also be found advantageous to employ for this purpose suitable fatty acids prepared by my process of countercurrent hydrolysis, U. S. Patent 2,139,589, December 6, 1938 (Reissue Patent No. 22,006, January 13, 1942). Acids so prepared may be made into soap with the aid of either caustic or carbonated alkalies, either continuously or batchwise and the fatty acids may be employed just as obtained from the process of hydrolysis, or may be distilled or they may be subjected to other types of purification where necessary or desirable, before making into soap.

According to the present invention the "aeration" of molten soap with air or other suitable gas is performed at temperatures near enough to its solidifying point to render the soap sufficiently viscous to retain the incorporated gas in a fine state of subdivision, and yet sufficiently far above the solidifying point so that the soap may retain a proper degree of fluidity to enable it to flow together readily so that after solidification a smooth, uniform mass will result.

I have had determinations made of melting points of various soaps and have found, for instance, that a soap such as referred to above, made from cocoanut oil and tallow and containing about 30% water and minimal amounts of salt and free alkali, is substantially completely solidified below about 58.5° C. and is substantially completely melted above about 61° C. or at any rate to a degree so that it will flow with comparative ease and may be pumped. Below 58.5° C. the degree of rigidity of the solidified soap is further increased with drop in temperature. Between the temperatures at which rigidity is reached in one direction and fluidity in the other, there is an intermediate range of about 2° C. to 3° C. at which the soap is in a pasty, very viscous semi-molten condition.

I have also had determinations made of the cubical expansion of various soaps with increase of temperature both in solid condition and in fluid condition. I have found for example that a soap as described above made from cocoanut oil and tallow and containing about 30% water, in solid condition, whether aerated or not, expands at about a uniform rate with increase in temperature through a range of over 20° C. below and approaching its melting point, the amount of expansion of the soap and the increase in temperature bearing a substantially straight line relationship within this range, amounting to about 0.8% increase in volume for each 10° C. increase in temperature. As the temperature rises through the two or three degrees of transition period during which the soap softens and approaches fluidity its rate of expansion gradually increases until a temperature of about 60° C. is reached above which a considerably more rapid rate of expansion is observed which also bears to increase in temperature a substantially straight line relationship during a certain range of temperature above the point at which the soap becomes fluid. The rates of expansion at uniform pressure of various molten soaps with increasing temperatures vary considerably among themselves. It will thus be found that a soap of the kind referred to, above the point at which it becomes fluid, if containing little or no incorporated air, will expand for about ten to fifteen degrees above its melting point at a substantially uniform rate of about 2% for each 10° C. increase in temperature. If, however, the soap contains incorporated air in appreciable proportions the rate of expansion is much greater, and is greater approximately in proportion to the amount of air incorporated therein. At temperatures in excess of 10° C. above the point of fluidity the degree of fluidity of the molten soap increases to such a degree that incorporated air bubbles unite with comparatively greater ease and bubble out of the aerated soap to a considerable degree.

It will be seen from what has been disclosed that the reason that aerated solid soap has substantially the same rate of expansion as similar soap non-aerated, is that, owing to its rigidity in the solid state, the air and moisture are held confined and only the soap itself expands. On the other hand, as soon as the soap becomes fluid with increasing temperature there is not only an increase in volume due to the expansion of the soap itself and of the air contained therein, but due also to the vapor pressure of the moisture in the molten soap above its melting point, which is considerable. Furthermore, a similar soap that is aerated, when above its melting point no longer possesses the rigidity necessary to hold air and moisture confined and the rate of expansion of such a soap comprises the expansion of the soap itself, as well as the expansion of the hot incorporated air itself, and also a further considerable expansion of the air by the fact that it is charged to the point of saturation with moisture vapor which at the temperature of molten soap exerts a very considerable pressure. The rate of expansion of such an aerated soap on being heated above its melting point may equal or even exceed one percent per degree C. rise.

It can thus be seen from what I have already disclosed that temperatures much above the melting points of floating soaps are undesirable for the incorporation of air therein for at least two important reasons, one being that at higher temperatures the increased fluidity of the soap not only causes it to be more difficult to incorporate air therein but makes it easier for small bubbles to coalesce to larger, less desirable bubbles, and another reason being the greater expansion which a soap takes on due to unnecessarily high temperature, and conversely the greater the amount of shrinkage and distortion such a soap undergoes in cooling prior to, and during solidification in the frames.

I have found that one method of obviating or minimizing these difficulties is to accurately control the temperature of the fluid soap into which air or other gas is to be incorporated so that it will be both substantially uniform, and only a few degrees in temperature, at most, above the point at which it begins to solidify on cooling.

Another method I have found for controlling and minimizing the contraction which the aerated soap will undergo in cooling prior to and during solidification is to accurately control the amount of "aeration" so that it will be a substantially uniform and predetermined amount at all times. This may be accomplished by taking each time a known weight of soap at a definite desired temperature and aerating it up to a definite desired volume, provision being made that further agitation will not draw in by vortex action, or otherwise, further and undesired amounts of air.

Another method I have found for controlling and minimizing contraction of the aerated soap on cooling and solidifying is to comminute the gas bubbles contained in the molten soap so that they reach or approach an ultimate degree of fineness. This may be accomplished by the employment of a sufficient degree of agitation and comminution in a primary agitator, or by running the soap after it has acquired the desired degree of aeration, through a secondary and highly efficient mixing machine taking proper precautions against the incorporation of additional and undesired amounts of air in so doing. The soap thus prepared is ready for running into the molds or frames for cooling and solidification. Cooling may be due to ordinary loss of heat to the surrounding atmosphere or it may be induced by more positive and more rapid means of heat absorption and removal. The air in this more finely divided form gives a much whiter color and greater opacity to the soap even when employing lower grades of oils or more highly colored perfumes.

Another method I have discovered of lessening the undesirable contraction ordinarily observed in cooling and solidifying molten aerated soap is to subject the molten "aerated" soap to a definite amount of pressure while in fluid condition and until it cools to the point at which the soap becomes rigid so that the gas contained in the soap will be subjected to a pressure above atmospheric, about sufficient to overcome the expansion which the gas saturated with water vapor would experience in being heated from the temperature of solidification of the soap to the temperature of framing. An aerated soap that is permitted to cool without subjection in this way to controlled pressure will shrink excessively during cooling while in a molten condition whereas one subjected to a proper degree of pressure will contract in cooling and solidifying only at about the lesser rate of contraction that the soap follows in cooling after solidification. Aerated soap filled into large frames chills around the outside first, remaining molten in the center for a considerable length of time exaggerating the amount of shrinkage that occurs in the center of the frames, whereas aerated soap subjected to a proper degree of pressure is contracted thereby in the soap that solidifies first, before solidifying, and suffers less contraction in the center of the frame where the soap is last to solidify.

Of course it will be seen upon consideration of the various operations herein disclosed for making improved floating soap that although each is highly beneficial in itself, the conjoint use of the various operations multiplies rather than merely adds their several advantages. While it is preferred to employ all of the operations disclosed in order to obtain the greatest advantage, combinations of certain of the operations contribute notable improvement over known processes even though other operations are not all employed, or are not carried out with optimum control, and the invention embraces such combinations as are set forth in the claims. It should be pointed out that soap at a temperature just above its melting point has a degree of viscosity that permits air to be incorporated in it with great rapidity, and, without the weight-volume control of the invention, it would be difficult to avoid the incorporation of too much air. It should also be pointed out that without weight-volume control and without provision for further primary or secondary non-aerating agitation the size of air bubbles incorporated in such a soap even with the right proportion of air would be large and uneven so that an appreciable amount of air would either escape or coalesce into large air bubbles before the soap became rigid due to the ease with which large bubbles unite and become larger.

I am aware of the fact that molten soap has been stirred with air in various ways to make it float. As such soap is very rough when crutched too cold or framed too near its solidifying point, it has been common practice to crutch and frame it at comparatively elevated temperatures. I am aware of the fact that filled laundry soaps have been cooled to temperatures not greatly above their melting points but this is to prevent the highly filled soaps from dropping the silicate of soda and carbonate of soda commonly incorporated into them in large proportions, and which tend to separate out objectionably from soaps framed at too high temperatures. These soaps are not aerated and do not suffer objectionable contraction on solidifying even if they are framed considerably above their melting points. I am aware of soap having been weighed in mixing machines to properly proportion therewith the added filling materials but to the best of my knowledge weighing of soap in a mixing machine has not heretofore been employed in conjunction with accurate volume control, and/or with accurate temperature control except perhaps in the use of temperature control in conjunction with filled soaps to prevent separation of filling materials. I have long employed the practice of inserting boards into the top of frames containing molten soap for the purpose of evening the soap in the top of the frames and for the reduction of scrap on cutting, as a board so used acts as an insulator to the top surface of the soap and prevents uneven chilling on the surface. I am aware also that soaps have been crutched with more or less agitation, but, without the weight-volume control which I have disclosed, greater agitation has almost always resulted in increased and uncontrolled and undesirable addition of air, and without the simultaneous temperature control which I have disclosed and advocated, fine air bubbles even if obtained will reunite at certain undesirable temperatures to an objectionable degree.

The soap treated in accordance with the present invention may be made in any desired manner, e. g., by the kettle process, but it is particularly advantageous to combine the operations of the invention described hereinabove with the production of soap by the mechanical mixing of suitable soap making ingredients.

I may, for example, make soaps direct from the products of my process of countercurrent hydrolysis U. S. Patent 2,139,589, December 6, 1938 (Reissue Patent No. 22,006, January 13, 1942), though for soaps of highest quality I would prefer to employ fatty acids distilled by my process of distilling fatty acids U. S. Patent 2,202,007, May 28, 1940. High grade fatty acids obtained in this way by distillation may be mixed continuously or batchwise at a temperature of about 63° C. with a clear solution of high grade caustic soda in proper amounts to produce a completely saponified soap with a not objectionable amount of uncombined alkali. Where this operation is performed continuously the flow of the fatty acids employed and the flow of the caustic soda solution are both kept under close control and, whether or not at uniform rates, are properly proportioned to one another. This may be done manually or mechanically. The strength of the caustic soda solution employed may be adjusted to leave the requisite or desired amount of water in the finished soap. I may use, for instance, for this mixing a machine such as described by de Bethune in U. S. Patent 2,077,226, April 13, 1937, or other suitable mixer, and where fatty acids are employed I would use equipment that will not be injured by, or will not injure, the materials employed, or the final product.

Suitable fatty acids, preferably carefully distilled fatty acids, may be made into high grade soap suitable for making into floating soap by my process by the employment of a strong solution of soda ash in place of caustic soda. In some cases, notably in soaps containing appreciable amounts of cocoanut fatty acids or similar fatty acids which absorb large proportions of alkali, the finished soap might contain an undesirably large percentage of water, even when a saturated solution of soda ash is employed. In such cases I find that finely divided soda ash may be suspended in a saturated aqueous solution of soda ash and be kept in suspension with ease in definite proportion and flowed through conduits like a liquid. When a portion of the soda ash is used in this way in suspension in a solution of soda ash, best results are obtained by having the temperature of the suspension preferably above about 40° C. as at temperatures appreciably lower there is a strong tendency for the suspended soda ash to crystallize and cake.

With the use of a suspension of soda ash, it is easy to make good soap with controlled water content from fatty acids even with the use of cocoanut fatty acids. Where fatty acids and soda ash are employed to make soap, a volume of gas is evolved which may be on the order of thirty to forty times the volume of the soap that is made. In this connection it should be explained that the chemical action between fatty acids and soda ash, or soda ash solution, is not a complete one in the presence of any appreciable quantity of carbon dioxide gas, which under the circumstances acts as an acid and tends to prevent complete soap formation. It is therefore necessary to get rid of the evolved gas substantially completely. In any ordinary method of reacting fatty acids and soda ash a large volume of gas escapes and gives troublesome swelling. The soap thus partly formed has a degree of viscosity that hinders and even entirely prevents complete gravity elimination of the remaining gas from the soap. I have operated at raised temperatures and with compositions to give comparatively low viscosity to the mixture, and passed air through the soap mixture to a degree to displace practically all the carbon dioxide leaving a soap with an indefinite amount of aeration. A preferred method of making soap from pure fatty acids and soda ash solution is to flow the two in proper proportions into a de Bethune mixer U. S. Patent 2,077,226, or other suitable mixer, made of corrosion resistant material. The fatty acids and soda ash solution properly proportioned may be fed separately to the mixing machine, or they may be partially premixed in the hopper of the machine. In this operation the exit of the machine should be kept open which will permit the spewing of the thoroughly mixed product and gas therefrom with the chemical action largely completed. To complete the chemical action the carbon dioxide which prevents or retards completion must be thoroughly removed and I find the best way to accomplish this result is by means of centrifugal action. This may be most readily applied by discharging the mixed material and carbon dioxide gas into the bottom of a vessel with flaring sides or bottom, such as I describe in my U. S. Patent 1,242,445, October 9, 1917, except that in the present invention I favor and produce the vortex action which was described but intentionally avoided by special means in the process of the patent. In this way the gas is rapidly removed toward the axial center of the machine and the reaction of the remaining soda ash on the remaining fatty acids, both held together in emulsified condition by the soap that has been formed, becomes completed and the last traces of gas escape as formed leaving a well combined soap. In cases where the fatty acids employed contain any appreciable amount of unsaponified oil, which is very apt to be the case where distilled fatty acids are not used, it is desirable to add a slight, and sufficient amount of caustic soda at the end to the soap thus made to complete saponification. In the case described where all the free carbon dioxide gas has been gotten rid of, the caustic soda thus employed is all put to good advantage and none of it is wasted, whereas if caustic soda is added to a soap from which the carbon dioxide gas has not been removed the caustic soda is first used up to neutralize any remaining carbon dioxide gas and is wasted without saponifying the neutral oil until an appreciable excess is taken. This procedure not only wastes caustic soda but leaves, in most cases, an objectionable amount of sodium carbonate in the soap. In the event that sodium carbonate is employed on a large scale to neutralize fatty acids to soap the amount of carbon dioxide thus set free is very considerable, and it may be desirable to collect the gas for further use. This may be accomplished readily by carrying out the centrifugal separation of carbon dioxide and soap in a closed machine for exclusion of air and confining the gas. Where this is done it is desirable to have the pressure within the centrifugal not much above atmospheric in order to facilitate removal of the gas so that the chemical action may become complete. The type of centrifugal action may be as described above in an apparatus with a flaring stationary bowl with the mixture activated by a rapidly revolving axial stirrer, or it may be performed in various types of revolving bowls which may have either vertical or horizontal or other axis of revolution. The soap freed from carbon dioxide gas may be permitted to overflow the bowls or may be collected by suitable skimming mechanism from the revolving wall of molten soap.

Soaps made from fatty acids as described whether with the aid of caustic soda or sodium carbonate or both are particularly well adapted to making into high grade floating soaps because of the simplicity of the process which entirely dispenses with the long laborious soap kettle process and which also permits of simpler, more economical, recovery of the glycerine from the fats employed, and also for the reason that substantially all of the fatty acids started with go into a high grade soap without the formation of a substantial proportion of degraded soap that always goes into the "nigre" in ordinary kettle soapmaking operations. The soap made in accordance with the method described may flow regularly into a "come and go" reservoir tank which is used to supply molten soap at proper temperatures to the floating soap weight-volume mixers.

The mechanically made soap herein described may be used advantageously as a base for toilet soap, and a soap base prepared in a similar manner from suitable fatty acids with or without rosin may be employed for making various types of laundry and household soaps and filled soaps.

For a clearer understanding of the invention reference may be had to the accompanying drawings.

Fig. 1 is a diagrammatic view of a primary mixing machine suitable for floating soap manufacture, provided with mixer and motor all mounted on a scale, for weighing machine and contents, shown partly cut away for giving a better view of the working.

Fig. 2 is a diagrammatic sketch of a suitable secondary mixing machine provided with a feed hopper and a discharge cutoff valve.

Fig. 3 is a temperature volume diagram of several soaps including floating soaps with different amounts of incorporated air, and nonfloating soap, both in solid and molten condition, giving approximately the volume relations of unpressed solid and molten floating soaps over a sufficient temperature range to illustrate the volume-weight-temperature principles involved in the invention.

Referring to Fig. 1, **1** is a soap mixing machine mounted on a scale platform not shown in detail. Beams **2**, supporting the mixer, are part of the scale platform. The mixer is provided with a central vertical shaft **3** supported by foot bearing **4** and bearing **5** and activated by motor **6** through suitable gear transmission **7**. Both motor **6** and gear transmission **7** are supported on the cover **8** attached to the mixer. Attached to the shaft **3** is a screw **9** which revolves with it. Screw **9** is encompassed by a stationary cylinder **10** fixed rigidly to the wall of mixer **1** by supports **11**. When shaft **3** revolves rapidly in one direction screw **9** conveys soap rapidly upwardly from the bottom of the mixer through cylinder **10** and the soap overflows the top of cylinder **10** and returns downwardly towards the bottom of the mixer in the space between the wall of the mixer and cylinder **10**. When the direction of the shaft is reversed the soap within cylinder **10** is depressed by screw **9** and when there is sufficient soap in the mixer the flow of soap is then completely reversed. Shaft **3** passes through a raised snug fitting sleeve **12** attached to cover **8** to prevent overflow of soap when the machine is full, and a disc **13** is attached to shaft **3** above sleeve **12**, to prevent oil or dirt from working into the soap through sleeve **12**. Cover **8** is also supplied with large raised sleeve **14** within which soap supply pipe **15** is placed without being in contact therewith. Raised open sleeve **16** permits a view of the contents of the mixer and of the action within until the mixer is full and then permits the continuation of stirring without overflow of soap, or entrance of air to the mixer by further stirring action.

Electric leads **17** supplying current to motor **6** are flexible so as not to impose a variable pressing action thereon. The mixer is supplied with a thermocouple **18** provided with flexible leads, and is also provided with a compressed air supply controlled by cock **19** connected to a supply of purified compressed air and/or other gas by a flexible tube. The bottom of the mixer is provided with a large special gate cock **20** for emptying the mixer rapidly or at other desired rate. The mixer or pipes leading thereto may be provided with steam blow-out connections not shown, also flexibly connected.

The whole mixer and contents as well as motor and transmission are carried only by the scale I beams **2** without any rigid connections or contacts so that mixer and contents may be weighed at will. The scale support of the mixer may be advantageously arranged so that the top of the mixer is at a desirable height above floor **21** or the positioning of mixer **1** may be entirely dictated with regard to the position of the secondary mixer **31** pictured in Fig. 2 so as to facilitate discharge of soap through gate valve **20** into hopper **32** of the secondary mixer **31**.

Fig. 2 is a modification of a de Bethune mill **31** provided with a hopper **32** so arranged that large air bubbles drawn into molten soap flowing through gate cock **20** into hopper **32** will be forced to separate from the soap before entering the mill **31**. Mill **31** is an extremely efficient mixer which takes the aerated soap from mixer **1** after the desired definite controlled ratio of weight to volume has been established and beats the gas bubbles contained therein to a state approaching ultimate mechanical fineness with even distribution. Mill **31** is so arranged and so operated that no additional air is incorporated into the soap. This may be accomplished by keeping hopper **32** nearly filled with soap at all times to level **33** and providing the discharge of the machine with a well controlled gate valve **34**. Dam **35** may be arranged in hopper **32** so as to separate out large unwanted air bubbles that may be entrained from soap issuing from valve **20**, or this soap may be conducted smoothly down a surface, not shown, so as to avoid entraining additional air bubbles. Mixer **1** may be provided with heat insulation, not shown, for example, two or three layers of aluminum foil or other suitable insulation.

The agitator shaft of mill **31** may be driven by means not shown at a desirable rate of speed to provide thorough mixing of the soap and comminution of the air bubbles, and mill **31** may be water jacketed or provided with heat insulation, not shown, and with thermocouple, not shown, for determination of the temperature of the soap passing through it. The soap discharged from mill **31** through valve **34** may be run for cooling into suitable frames, not shown, and the soap should be conducted down a smooth inclined surface in such a way as not to entrap additional unwanted air in the processed soap.

Soap may be passed rapidly through mill **31** because of its high efficiency, it being necessary only to control the flow so as to keep the machine full to a degree that will prevent unwanted air from entering. Of course agitator shaft **3** is not operated in mixer **1** during the emptying of the mixer, after the proper weight-volume-temperature relationship has been established therein, or until a new charge of soap is to be operated upon. It is evident that if screw **9** is operated while the mixer **1** is partly full, during emptying, additional, and unwanted, and uncontrolled air will be incorporated into the soap. An alternative arrangement, where a secondary mixer is used, is to connect it directly to the discharge of the primary mixer during the time of emptying the latter.

Fig. 3 represents a plot of the approximate weight-volume-temperature relations of a non-floating soap and of the same soap aerated in different degrees to different specific gravities. Specific gravities of various aerated soaps were determined at 25° C. as referred to water as unity. From these the reciprocal figures have been calculated and are referred to as "specific volume." Cubical coefficients of expansion of soap containing little or no air and of similar soaps aerated in different degrees were determined on the solid soaps up to their melting points, about 60° C. and for 10° C. to 20° C. there-above. Owing to the considerable decrease in viscosity and the rapid coalescing of air bubbles to larger air bubbles which escaped from the soap at a troublesome rate when the soap was being heated in the range from 70° C. to 75° C. and above, no attempt is made to record the expansion curves above 70° C. However, it should be recorded that, other conditions being equal, air showed very much less tendency to escape from molten soap where the air particles were very finely and comparatively evenly dispersed through the soap, and such soaps have an added whiteness over soaps with comparatively large uneven air bubbles.

Further reference to Figure 3 shows prolongation above the melting points of the various soaps, of the lines which represent approximately the rate of cubical expansion of these soaps in solid condition. The difference between the ordinate measured to this extended line at any fixed temperature above the melting point of the soap, as for instance at 62° C. and the ordinate at the same temperature to the line which represents approximately the actual rate of expansion of the same soap above its melting point at atmospheric pressure shows how much the molten aerated soap must be compressed at this temperature to overcome the disadvantage of increased volume that is commonly experienced in the contraction of aerated soaps in cooling. This is illustrated in Fig. 3 for the soap which at 25° C. has an approximate specific gravity of 0.84 compared with water as 1. By reference to Fig. 3 it may be seen that if such a soap in molten condition be compressed at 62° C. so as to experience a diminution in volume from about 1.236 to about 1.224, relatively speaking, or about 1%, the soap will on cooling shrink before solidifying at about the same rate that it shrinks after solidifying and thus suffer a minimum of distortion in solidifying and cooling. The compression which thus occurs in a molten aerated soap is exclusively in the incorporated air and water vapor. On the other hand, a soap not thus compressed but permitted to chill at atmospheric pressure will experience the greater contraction approximately as indicated, and when it is borne in mind that the outer part of the frame chills quickly at first, contracting away from the soft interior, and that the inner part stays molten much longer the reason becomes apparent why the inner portion contracts objectionably more than the outer part. It is also within the scope of the invention to compress the molten aerated soap to an even greater degree so that the amount of contraction thus induced by compression will be even greater than the contraction caused by cooling and subsequent solidification.

I have shown ways and means of making improved soaps and of converting these into improved floating soaps. Where specific means are named it is to be understood that other means which accomplish similar or equivalent results by the use of similar principles are also within the scope of the invention. Figures and temperatures given are by way of illustration and may be modified.

Floating soaps made after the disclosures of the invention may be cut in solid form into cakes of suitable size and shape and pressed as finished cakes. Soaps so made may be marketed without drying or may be dried. They may be subjected to some drying before pressing. Soaps described in the examples contain about 30% water, this being close to an average figure for undried soap. It will be understood however that soaps possessing a requisite degree of fluidity may be employed in the process even though their water content may be appreciably above or below 30%.

I claim:

1. The process of making floating soap which comprises aerating molten soap to a definite desired extent employing a sufficient degree of agitation of said soap while still in a molten state in order to comminute the gas particles to an extremely fine and substantially uniform state of subdivision, applying pressure to the molten soap with a reduction in volume thereof substantially equal to the reduction in volume the same soap would suffer at atmospheric pressure in cooling from the same temperature to its solidifying point, then cooling and solidifying the soap.

2. The preparation of a floating soap which comprises intimately mixing a stream of distilled fatty acids and a stream of caustic soda in solution in water at a temperature for the mixture of above about 60° C., the streams of fatty acids and of caustic soda solution being so proportioned to one another that the fatty acids and caustic soda are employed in about chemical combining proportions, and the amount of water employed being sufficient to produce a soap with about 30% water, aerating the molten soap with gas evenly distributed in finely comminuted form so that a definite weight of said hydrated, molten aerated soap will occupy a definite desired volume at a definite temperature, framing said soap at a temperature not substantially above its melting point, subjecting said framed soap while still in molten condition to pressure to minimize shrinkage of said aerated soap while cooling prior to solidification, cooling and solidifying said soap.

3. The preparation of a floating soap which comprises intimately mixing a stream of fatty acids and a stream of alkaline material in solution in water at a temperature for the mixture of above about 60° C., the streams of fatty acids and of alkaline material in solution being so proportioned to one another that the fatty acids and alkaline material are employed in about chemical combining proportions, the amount of water employed being sufficient to produce a soap with about 30% water, aerating the molten soap with gas evenly distributed in finely comminuted form so that a definite weight of said hydrated, molten, aerated soap will occupy a definite desired volume at a definite temperature, framing said soap at a temperature not substantially above its melting point, subjecting said framed soap while still in molten condition to pressure to minimize shrinkage of said aerated soap while cooling prior to solidification, cooling and solidifying said soap.

4. The process of making floating soap which comprises aerating a definite weight of molten soap with the aid of agitation so that it will occupy a greater, definite volume, employing a sufficient degree of agitation of said soap while still in a molten state to comminute the gas particles with which said soap is aerated to a fine and uniform state of sub-division without substantially altering the weight of soap or desired volume thereof, framing said aerated soap at a temperature not higher than about 2° C. above its melting point, and subjecting said framed soap to pressure and compression with reduction in volume about equal to the reduction in volume the same soap would undergo in cooling from the same temperature at atmospheric pressure, and allowing the soap to solidify.

5. The process of making floating soap which comprises aerating successive, substantially equal weights of molten soap with the aid of agitation so that each such successive equal weight will occupy a greater, substantially equal volume, under substantially uniform conditions of operation, agitating said soap to comminute the gas particles with which said soap is aerated, to a fine and substantially uniform state of subdivision without substantially altering the ratio of gas to soap, and cooling said aerated soap to form-retaining condition without substantially altering the actual ratio of said gas to said soap.

6. The process of making floating soap which comprises aerating successive, substantially equal weights of molten soap with the aid of agitation so that each such successive equal weight will occupy a greater substantially equal volume, under substantially uniform operating conditions of temperature and pressure, agitating said soap to comminute the gas particles with which said soap is aerated, to a fine and substantially uniform state of sub-division without substantially altering the ratio of gas to soap, and cooling said aerated soap under pressure to form-retaining condition without substantially altering the actual ratio of said gas to said soap.

7. The process of making floating soap which comprises aerating successive, substantially equal weights of molten soap with the aid of agitation so that each such successive equal weight will occupy a greater substantially equal volume, under substantially uniform conditions of operation, agitating said soap to comminute the gas particles with which said soap is aerated, to a fine and substantially uniform state of subdivision without substantially altering the ratio of gas to soap, and cooling said aerated soap to form-retaining condition without substantially altering the actual ratio of said gas to said soap, the completion of said agitation prior to subjection of said soap to cooling to form-retaining condition being accomplished when the soap is not substantially hotter than about 2° C. above its melting point.

8. The process of making floating soap which comprises aerating successive, substantially equal weights of molten soap with the aid of agitation so that each such successive equal weight will occupy a greater substantially equal volume, under substantially uniform conditions of operation, agitating said soap to comminute the gas particles with which said soap is aerated, to a fine and substantially uniform state of subdivision without substantially altering the actual ratio of

said gas to said soap, the completion of said agitation prior to subjection of said soap to cooling being at a temperature not substantially higher than 5° C. above the point at which said soap begins to solidify on cooling, and immediately subjecting said soap to cooling under pressure and under form-imparting conditions.

9. In the production of floating soap, the steps comprising compressing aerated soap while in fluid condition above its solidifying point to at least about the volume it would occupy immediately after cooling and solidifying at atmospheric pressure, and solidifying said soap while so compressed.

10. In the production of floating soap, the steps comprising cooling aerated soap from molten condition to rigid condition under sufficient pressure to reduce the rate of contraction on cooling to the solidifying point to at least approximately the contraction rate that the soap follows after solidification.

11. The process of making floating soap which comprises incorporating air into successive batches of molten soap of practically the same weight and at practically the same temperature until each batch occupies a predetermined greater volume, subjecting the aerated soap to agitation, while preventing further substantial incorporation of air, to comminute the gas to an extremely fine and substantially uniform stage of subdivision, said agitation being completed above the solidification point but not more than about 10° C. above the solidification point, and cooling and solidifying the soap.

12. The process of making a floating soap which comprises aeration of a soap in heated condition containing water of hydration, the proportion of said water of hydration in said soap being sufficient to impart a degree of fluidity to said soap, at above about 60° C., requisite to mechanical working and agitation of said soap, aerating successive amounts of said soap, while in fluent condition, with gas evenly distributed in finely comminuted form so that successive substantially equal weights of said aerated soap will each occupy a substantially equal volume under substantially fixed conditions of operation, submitting said soap to form-imparting conditions while at a temperature not greatly above its melting point, subjecting said soap while still in fluent condition to pressure to minimize shrinkage of

said aerated soap while undergoing cooling prior to solidification, cooling and solidifying said soap.

13. The preparation of a floating soap which comprises intimately mixing a stream of distilled fatty acids and a stream of caustic soda in solution in water at a temperature for the mixture of above about 60° C., the streams of fatty acids and of caustic soda solution being so proportioned to one another that the fatty acids and caustic soda are employed in about chemical combining proportion, and the amount of water employed being sufficient to produce a hydrated soap with a degree of fluidity, at the temperature employed, requisite for mechanical working and agitation of said soap, aerating the molten soap with gas evenly distributed in finely comminuted form so that a definite weight of said hydrated, molten, aerated soap will occupy a definite desired volume under definite substantially fixed conditions of operation, submitting said soap to form-imparting conditions while at a temperature not substantially above its melting point, subjecting said soap while still in fluent condition to pressure to minimize shrinkage of said aerated soap while undergoing cooling prior to solidification, cooling and solidifying said soap.

14. The preparation of a floating soap which comprises intimately mixing a stream of fatty acids and a stream of alkaline material in solution in water at a temperature for the mixture of above about 60° C., the streams of fatty acids and of alkaline material in solution being so proportioned to one another that the fatty acids and alkaline material are employed in about chemical combining proportions, the amount of water employed being sufficient to produce a hydrated soap with a degree of fluidity, at the temperature employed, requisite for mechanical working and agitation of said soap, aerating the molten soap with gas evenly distributed in finely comminuted form so that a definite weight of said hydrated molten aerated soap will occupy a definite desired volume under definite substantially fixed conditions of operation, submitting the said soap to form-imparting conditions while at a temperature not substantially above its melting point, subjecting said soap while still in fluent condition to pressure to minimize shrinkage of said aerated soap while undergoing cooling to solidification, cooling and solidifying said soap.

MARTIN HILL ITTNER.