Oct. 11, 1949. A. H. KNOLL 2,484,098

BAR SOAP MANUFACTURE

Filed June 23, 1945 2 Sheets-Sheet 1

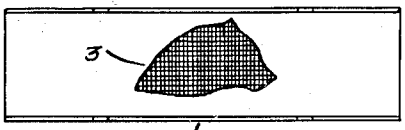


FIG. 4

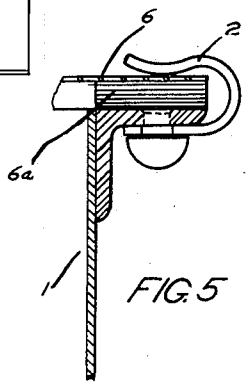


FIG. 5

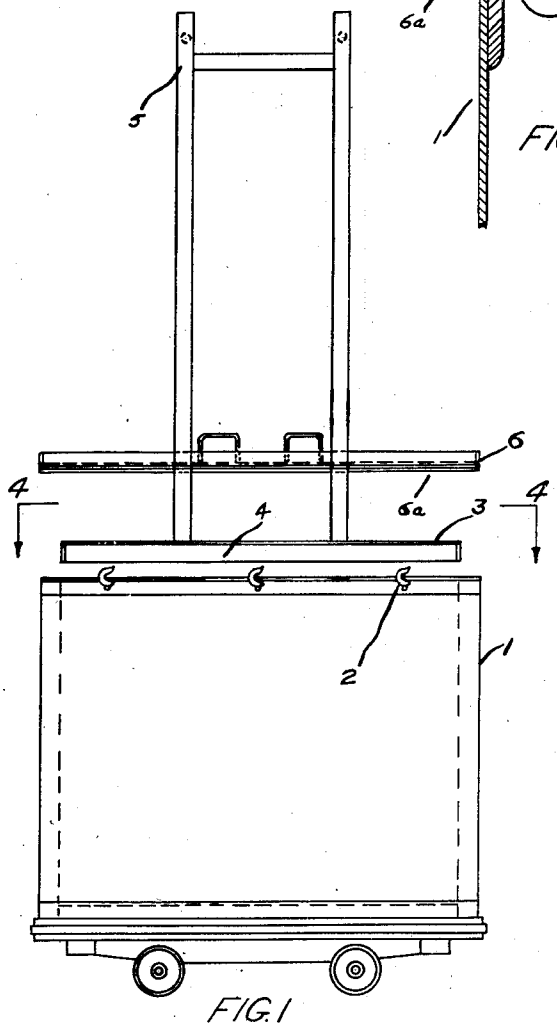


FIG. 1

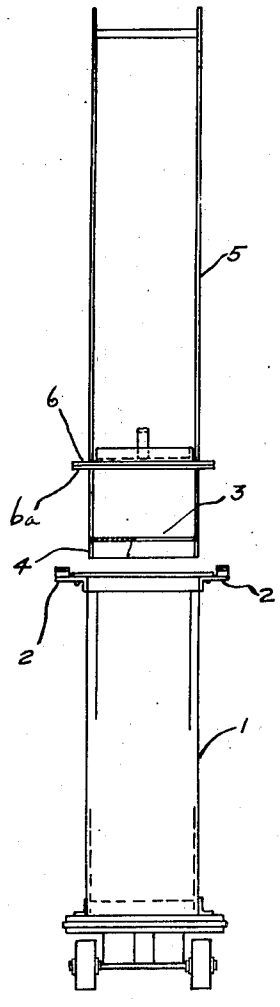


FIG. 2

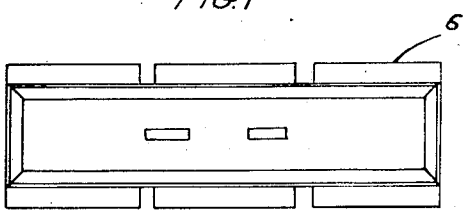


FIG. 3

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BAR SOAP MANUFACTURE

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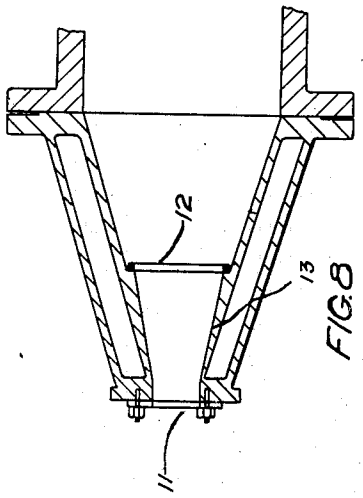


FIG. 8

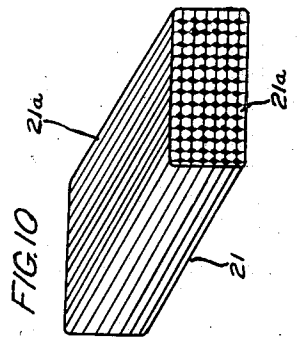


FIG. 10

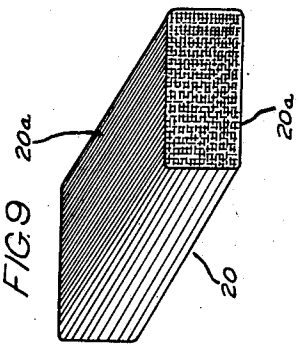


FIG. 9

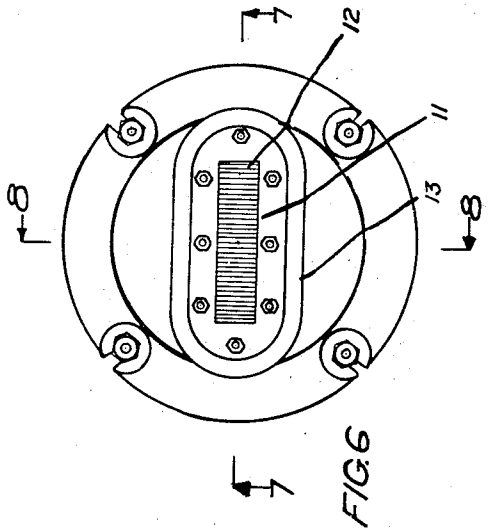


FIG. 6

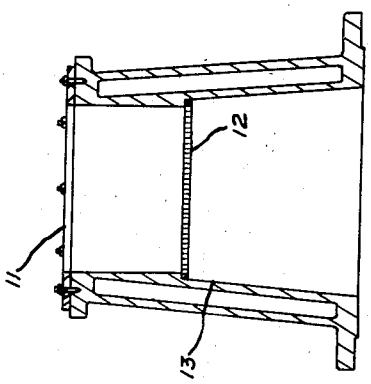


FIG. 7

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UNITED STATES PATENT OFFICE

2,484,098

BAR SOAP MANUFACTURE

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Application June 23, 1945, Serial No. 601,143

8 Claims. (Cl. 252—368)

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This invention relates to an improvement in the manufacture of non-milled detergent bar soap, as a result of which the bar has less tendency to develop cracks during use, and is improved in other characteristics as well.

One way of forming bar soap is by a process called "framing," in which a large receptacle, or so-called "frame" is filled with fluid (molten) soap which is permitted to cool slowly to a solidified state. The frame is then stripped away and the solidified "frame" of soap is cut into individual bars or tablets. The resultant product, which is called "framed soap," frequently has the undesirable characteristic of developing cracks during intermittent use on the washstand. These cracks, which are particularly prevalent during the spring and fall when the indoor temperature fluctuates rather widely during a 24-hour period, tend to collect dirt with the result that the bar becomes very unsightly. Our process has for an object the production of framed soaps which do not develop such cracks (which are commonly termed "wet cracks" or "washstand cracks"), or at least the production of framed soaps having a greatly reduced tendency to develop such cracks.

Another recognized fault of framed bar soaps is their objectionable tendency to become warped or distorted in shape when they dry out and shrink in volume as they age. My invention has for an additional object a reduction in this tendency of framed bar soaps to warp as they become dried out with age.

Other objects are to produce framed bar soaps which tend to be stronger and tougher than the soaps of the same composition when made by conventional processes.

My invention is applicable to framed kettle soap, framed cold process soaps, and framed semi-boiled soaps and to other crutcher-agitated neat soaps, aerated and non-aerated. Its benefits are more outstanding with framed kettle soap than with cold process soap, because the former is normally more subject to wet cracking and distortion than is the latter.

The practice of my invention is not applicable to milled soaps in which the soap is solid when extruded with great force through an orifice. Indeed the use of screens or perforated plates through which the initially solid soap is forced as a part of its conditioning in the plodder, before extruding it through the cone and orifice, does not accomplish the objects of my invention or result in a product such as I produce with my practice.

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My practice is applicable, however, to processes such as are set forth in Mills Patent 2,295,594, more particularly where continuous bars are extruded having cross sectional areas of more than about 6 square inches, i. e. larger than the cross sectional area of large laundry sized bar soaps in their narrowest dimension. When in the Mills practice the cross sectional area of the extruded bar is that of the smallest cross sectional area of the final cake of soap, as illustrated in the said patent, there appears to be no appreciable benefit from the use of my practice. In the practice of the Mills patent, the soap contains some neat soap but also contains crystals of beta phase soap when extruded, and is still in the condition of pasty cohesiveness, as will be noted.

Indeed my invention is of value in any instance where a slab of soap is produced from a mass which is not initially solidified, whether it be cast from molten soap or extruded as a slab. By "slab" in this specification, I refer not only to the horizontal layers from which bars are cut in the "framed soap" practice but I include also any layer of soap having a cross sectional area at least several times the smallest cross sectional area of the finished cake or bar, thus including dimensions up to the size of a standard frame and down to but excluding extruded masses of around 6 square inches in cross section or less, which are so conditioned in processing that there is no need for the use of my practice.

The invention is applicable also in processes which comprise the continuous cooling of crutched neat soap by such means as the bar forming machine described in Hunten Patent No. 1,903,920, and my objects include the improvement of bar soaps made by processes of this character.

In essence my process consists in causing a mass of soap of uniform composition, which may be either in the fully molten neat soap phase or in a partially solidified and partially liquid condition containing both neat soap and dispersed solid soap crystals, to pass through the numerous closely set openings of a grid (or screen) and to reunite as an integral mass after passing said grid, and thereupon chilling the mass until it is fully solidified. The soap, whether neat or both neat and crystalline, should not be so low in temperature that the soap has lost its pasty cohesiveness due to substantially complete solidification, this pasty cohesiveness being defined as the property of the soap which enables freshly separated masses of said soap to become reunited when brought together, without requiring the appli-

cation of high pressures such as are employed in plodding milled soap. One way of practicing the invention is to push a wire screen through the molten or partially solidified crutched neat soap, while the soap is in a conventional soap frame or other receptacle, in such a manner as to force the soap to pass through the meshes of the screen. Another way is to extrude a continuously flowing slab of soap, at a temperature above its complete solidification point, through a screen or grid placed across the extrusion channel at a point such that the soap strands emerging from the apertures of the grid have an opportunity to reunite just before the soap mass emerges from the extrusion orifice.

The accompanying drawings illustrate examples of soap making apparatus suitable for the practice of my invention, and also depict soap bars made by my process.

Fig. 1 is a side elevation of a soap frame together with a wire screen mounted in a supporting structure and a cover for the frame.

Fig. 2 is an end elevation of the same equipment.

Fig. 3 is a plan view of the cover for the frame.

Fig. 4 is a horizontal sectional view of the screen and its supporting structure taken on the line 4—4 of Fig. 1.

Fig. 5 is a cross sectional detail view of the upper edge of one of the sides of the soap frame showing how the cover may be clamped to the frame.

Fig. 6 is an end elevation of the extrusion end of a soap chilling and agitating device (of the general character described in Patent 2,295,594), having a grid mounted in the discharge passage a short distance removed from the extrusion orifice.

Fig. 7 is a horizontal sectional view of this same extrusion end taken on line 7—7 of Fig. 6.

Fig. 8 is a vertical sectional view of this same extrusion end taken on line 8—8 of Fig. 6.

Fig. 9 and Fig. 10 represent, in perspective, unstamped bars of soap made by the process.

In Figures 1 to 5, element 1 (diagrammatically shown) is the soap frame, 2 is one of the clamps to hold the cover in place, 3 is a wire screen, 4 is a metal supporting structure for the screen, having handles 5, 6 is the cover for the frame, and 6a is a sponge rubber gasket mounted on the under side of this cover.

In Figures 6, 7, and 8, element 12 is a screen or grid, 13 is the discharge passage in which it is mounted, and 11 is the extrusion orifice.

The following examples will serve to illustrate typical applications of my invention.

Example 1.—Kettle soap of 31% moisture content, made by well known kettle boiling practice from an aqueous solution of sodium hydroxide and a mixture consisting of 15 parts of coconut oil, 2 parts of rosin and 83 parts of tallow, is crutched at a temperature of about 152° F. with the addition of small fractions of 1% each of perfume and of preservative, and is simultaneously aerated until the density of the mass is sufficiently reduced so that the finished bar will float in water. The agitated soap is at once discharged from the crutcher into an empty soap frame such as the frame 1, on the floor of which has previously been placed a wire screen 3, having 34 wires of 0.0095 inch diameter per linear inch. The screen supporting structure 4 is slightly smaller than the inside plan dimensions of the soap frame, so that the screen and its supporting structure may be moved up and down within the frame with just sufficient clearance to prevent binding. The cover 6 is then placed on top of and in contact with the soap in the filled frame and is clamped into place. The screen on its supporting structure is then raised forcibly and at a fairly rapid rate through the soap to the top of the frame; the cover and the screen are then removed and the frame of soap is cooled, usually by placing it in a relatively cool atmosphere until full solidification occurs whereupon the sides of the frame may be removed and the block of soap further cooled until it is firm enough to cut without undue smearing. It is then cut into slabs, these slabs into strips and the strips into individual bars, preferably in such manner that the direction of the grain, which is the direction in which the soap flowed through the apertures of the screen as the latter was raised through the soap, is lengthwise of the finished bar as indicated in Figures 9 and 10. This example, referring to but a single screening, may be modified by pushing the screen several times through the soap, as, for instance, in the next example.

Example 2.—A crutcher charge of an emulsified mixture of coconut oil and 34° Baumé caustic soda solution (the amount of caustic being about 95% of the amount required to fully saponify the oil) is discharged into an empty soap frame in accordance with normal practice in making cold process soap. After the mass has stood in the frame for several hours and has increased in temperature as a result of the saponification which occurs in the frame, and has then cooled to a temperature of about 150° to 160° F., the wire screen 3 is placed on top of the soap in the frame, and is then pushed forcibly to the bottom of the frame. The cover 6 is placed on the frame as in Example 1, and the screen is pulled up to the top of the frame, whereupon the cover and screen are removed and the bar soap making process continued as in Example 1.

Example 3.—Neat soap of 22% moisture content made from a mixture of 15% coconut oil, 50% tallow and 35% lard, saponified with caustic soda solution, is chilled from a temperature at which the soap is molten to a temperature of 150° F., and is simultaneously agitated, while forcing the mass to flow in a continuous stream through a cooling and agitating device as described in Mills Patent 2,295,594. The chilled flowing soap, which at 150° F. is partially liquid and partially solidified, is further agitated in the discharge end of the cooling and agitating device after leaving its cooling zone, and is extruded in a form-retaining condition through a cone-shaped discharge passage 13 (Figures 7, 8 and 9), through a grid 12 consisting of steel bars $\frac{1}{16}$ of an inch wide (in direction perpendicular to the direction of soap flow) and $\frac{3}{16}$ of an inch thick (in the direction of the soap flow), spaced on $\frac{3}{16}$ inch centers, and finally through an oblong discharge orifice 11, which is about 10 inches wide by 2 inches high, onto a belt conveyer (not shown in the drawings), which removes the extruded soap to a cutting device which severs the continuous slab into individual slabs each about 30 inches long. These slabs are placed on racks and are cooled until the soap is sufficiently firm and solid to be cut into strips, and these strips are then cut into individual bars.

Example 4.—Aerated neat soap similar in formula to that employed in Example 3, except that its moisture content is 28%, is forced through a cooling and agitating device in which its temperature is reduced to 155° F. and is discharged into a collapsible mold 40 inches high,

14 inches wide, and 4 inches in depth from front to back. The screen (corresponding to element 3 of Figures 1 to 4) in this instance will be of 16 mesh wire in a support $3\frac{15}{16}$ inches by $13\frac{13}{16}$ inches in outside dimensions. A cover for the mold (corresponding to element 6 of Figures 1 to 3) is clamped over the mold, and the screen is pulled up and down through the soap two or three times by means of supporting structure corresponding to element 4, whereupon the screen and cover are removed and the mold quickly cooled.

It should be noted that the apparatus as described is merely exemplary and can be modified to suit various conditions.

In all these examples the bars of soap which are cut from the slabs or strips may be pressed or stamped into final design and shape in well known manner, and wrapped and packed for shipment. In general, I prefer in cutting the individual bars to have the grain run parallel to the face of the bar rather than perpendicular to the face, in order to have a bar which will have a smooth surface during use. The bars of soap as made in each of the foregoing examples are quite resistant to the formation of washstand cracks during use, and they also have the property of aging without undue warping or twisting. They are somewhat stronger and tougher than corresponding bars of soap which have not been passed through a screen or grid while in a molten or partially solidified condition. They frequently exhibit a faint grain marking, similar in appearance (except as to color) to the grain in straight grained wood. This is illustrated to exaggerated form in Figures 9 and 10 in which the soap cakes are indicated at **20** and **21**, and the grain like appearance at **20***a* and **21***a* respectively. This grain marking varies somewhat in intensity depending upon the color and nature of the soap, and its condition at the time it passed through the apertures of the grid, and upon the size and spacing of the wires or bars of the grid. Under some conditions, especially when made by a very fine screen, this grain structure is hardly noticeable. When the soap is used for washing the grain pattern in the bar tends to become accentuated, apparently due to differences in rate of solution between the soap which passed through the middle of the apertures and that which passed close to their edges.

The size of the apertures of the grid are preferably quite small; they may be as small as practical considerations permit, this limit under normal conditions being somewhere in the order of $\frac{1}{32}$ to $\frac{1}{64}$ of an inch. Apertures as large as $\frac{1}{4}$ of an inch in the smallest of their dimensions (they may be round or square or oval or oblong, for example) have a noticeable effect in reducing the cracking tendencies of the bar and in reducing its warping tendency, but above about $\frac{1}{4}$ inch these desirable effects become less pronounced. Hence, when using wire screen as the grid, I prefer to use screen having at least 3 and usually a great many more wires per linear inch.

Optimum results may be secured by passing the soap through several screens or grids one after the other, or by moving a single screen or grid back and forth through the soap two, three, four, or even more times. However, the first passage of the soap through a screen or grid of a given size produces more effect than an additional passage, and a single passage is frequently sufficient, particularly when the apertures are quite small.

The effectiveness of the process is to a large extent independent of the soap temperature, and I have obtained very satisfactory results with 31% moisture neat soap at temperatures as high as 163° F., which is well above the complete melting point of this soap. A rapid cooling or solidification of the soap following the screening operation is to be preferred to a very slow cooling, although very advantageous results have been obtained with framed soap slowly cooled in the frame.

The design of the grid or screen may be varied widely. For treating soaps that are fully fluid and not too viscous a wire screen of suitable strength may be used. For treating partially solidified soaps during extrusion greater strength may be required than is afforded by a screen, and in this case a grid made of relatively heavy bars of metal may be required. These bars are preferably relatively thin (measured perpendicular to the direction of flow) and they may if desired have an oval or streamlined cross section in order to reduce their resistance to the flow of the soap.

The invention is not limited to any particular type of soap formula, provided the formula is one which produces as a finished product a solid soap as distinguished from a paste or liquid soap.

Although the invention described and claimed herein is not dependent upon any theory, it is my belief that the reason that soap made by my process is improved as to wet cracking is because such cracks as do start to form are interrupted whenever they reach one of the numerous grain lines or surfaces created by the flow of soap through the apertures of the grid, and that the improvement in shape stability, particularly in the case of framed soaps, is due to minimizing unequal shrinkage of the soap as it dries out.

In the following claims the term "grid" is employed generically and includes wire screens as well as grids of heavier construction.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. The improvement in processes for making bar soap which include preparing a mass of soap which is at least partially in the neat soap phase and chilling said soap while in a mass of at least slab size until fully solidified, which comprises: causing a mass of soap of uniform composition to flow through a grid having numerous small closely placed apertures, and causing the soap strands emerging from said apertures to reunite into an integral mass, the soap mass during said flow being at a temperature above that point at which the soap substantially loses its pasty cohesiveness as a result of solidification and being within the temperature range in which the soap is at least partially in the neat phase, and thereafter cooling said soap until fully solidified, whereby the finished bars of soap cut from the mass have a materially reduced tendency to develop cracks during use.

2. In the process of making framed bar soap, the steps which comprise causing the entire soap mass, while in the frame, to flow through a moving grid having numerous small closely placed apertures while the soap is at a temperature such that it is at least predominantly in the neat phase, and thereafter cooling the frame of soap until fully solidified.

3. In the process of making framed bar soap, the steps of pushing a screen having not less than 3 mesh per linear inch through soap in the frame, while said soap is predominantly in the neat phase, thereupon cooling the frame of soap

until fully solidified, and cutting the solidified soap into bars, whereby the finished bars have a materially reduced tendency to develop cracks during use.

4. In the process of manufacturing bar soap by processes which include agitating a continuously flowing stream of said soap while in a condition and at a temperature at which the soap mass is at least partially in the neat phase and is not fully solidified and extruding said soap from an agitating zone while still in said condition and at said temperature, the step of passing said extruding soap through a grid having closely spaced apertures not over ¼ inch in minimum dimension, prior to the emergence of said soap from the extrusion aperture.

5. In the process of manufacturing detergent bar soap containing a substantial amount of soap in the beta phase made by effectively agitating a soap mass while said mass is at least partially in the neat phase and is within a temperature range in which the beta phase of said soap is formed in substantial amount upon agitating and while about that temperature below which said mass loses its pasty cohesiveness as a result of solidification, the steps which comprise extruding said agitated mass in continuous slab form while within the aforesaid temperature range and passing said extruding mass, before it reaches the extrusion orifice, through a grid having numerous small closely placed apertures and promptly chilling the extruded slab to an extent sufficient to stabilize the phase composition of the soap.

6. Detergent bar soap, having a reduced tendency to develop cracks during use, having a grain

structure such as is caused by passing said soap while at least partially in the neat phase and not fully solidified through a grid having closely spaced apertures not over ¼ inch in their smallest dimension, shortly prior to solidification of said soap.

7. Framed bar soap, having a reduced tendency to develop cracks during use, having a grain structure such as is caused by pushing through neat soap, shortly prior to its solidification in a frame, a screen having not less than 3 mesh per linear inch.

8. Extruded bar soap, having a reduced tendency to develop cracks during use, having a grain structure such as is caused by passing said soap while at least partially in the neat phase through a grid having closly spaced apertures not over ¼ inch in their smallest dimension, just prior to extrusion and shortly prior to solidification of said soap.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
276,326	Atkiss	Apr. 24, 1883
786,125	Hinkle	Mar. 28, 1905
2,013,025	Bottoms	Sept. 3, 1935
2,213,772	Strain	Sept. 3, 1940
2,295,594	Mills	Sept. 15, 1942
2,310,931	Bodman	Feb. 16, 1943

Certificate of Correction

Patent No. 2,484,098 October 11, 1949

ALVIN H. KNOLL

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 5, lines 4 and 5, for "$13\frac{13}{15}$ inches" read *$13\frac{15}{16}$ inches*; column 7, line 24, for the word "about" read *above*; column 8, line 17, for "closly" read *closely*;

and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 21st day of February, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.