Oct. 29, 1968 W. G. HENRY 3,408,299

PROCESS FOR PREPARING SOAP BARS

Filed Dec. 17, 1965 2 Sheets-Sheet 1

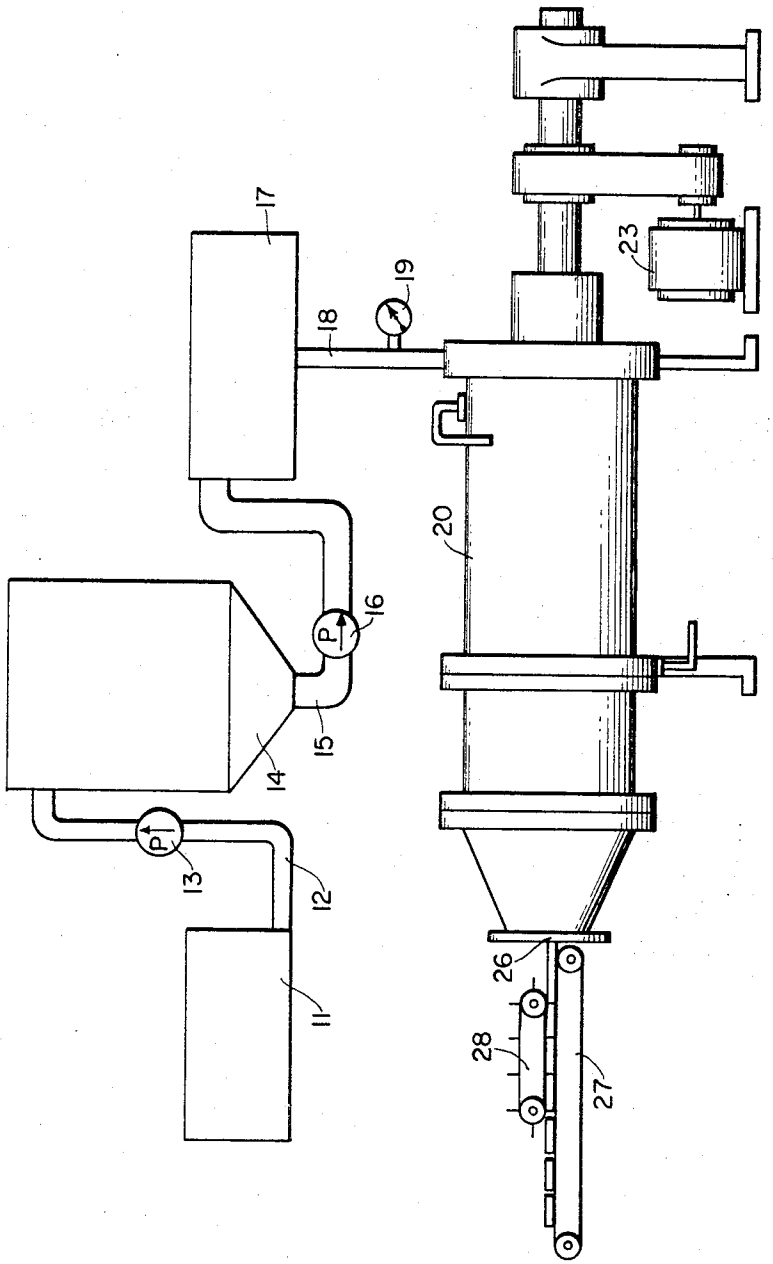


Fig. 1

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Filed Dec. 17, 1965 2 Sheets-Sheet 2

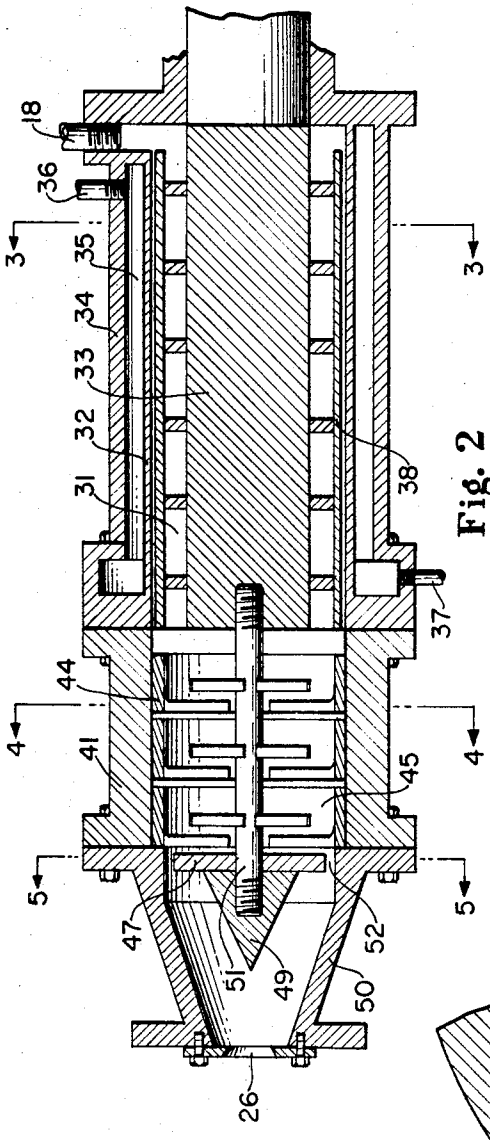


Fig. 2

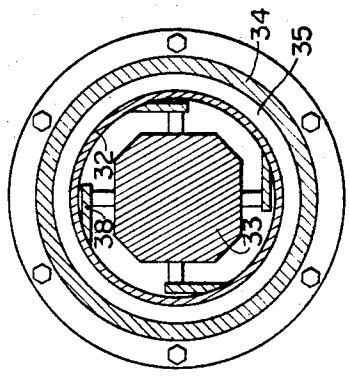


Fig. 3

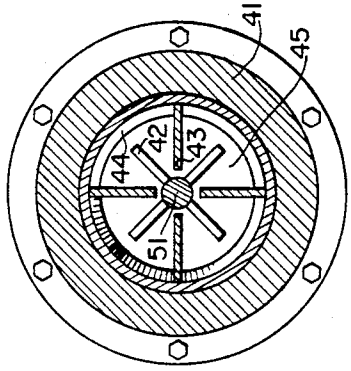


Fig. 4

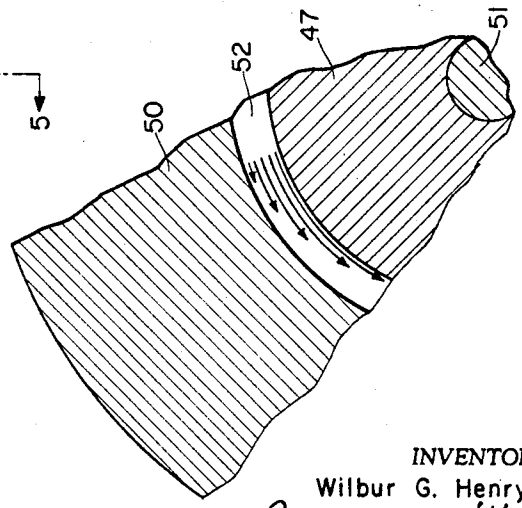


Fig. 5

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PROCESS FOR PREPARING SOAP BARS

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ABSTRACT OF THE DISCLOSURE

Process for preparing a soap bar containing an abrasive material comprising the steps of (1) forming a molten soap composition; (2) adjusting its temperature to between 170° F. and 220° F.; (3) cooling the soap composition to effect partial solidification; (4) mixing and working the soap composition; (5) extruding the soap composition while annularly rotating the soap composition; (6) forcing the soap composition into an expansion zone; and (7) extruding the soap composition in blank bar form.

This invention relates to a continuous process for preparing lump-free abrasive soap bars having no visible crystalline orientation.

Soap bars containing abrasives are desirable for a number of heavy-duty cleaning jobs, but because of the large amounts of abrasives contained in these bars, problems have been encountered in satisfactorily forming the various ingredients thereof into a solid bar.

The only extensively utilized method of making these abrasive soap bars is a batch process called framing. The framing process consists of running molten neat soap combined with the abrasive into portable frames. The soap is then allowed to solidify spontaneously in the form of large cakes. From 3 to 7 days are required for the solidification of neat soap. The solidified frames of soap are then cut into bars, subjected to a further drying step to firm the bars and, finally, the bars are stamped and wrapped. During the cutting operation, there is a high scrap loss. This scrap must be reworked before it can again be utilized in the framing process.

The framing process has the additional disadvantage of requiring vast amounts of floor space for storage of the frames during the cooling operation. Because the process is comprised of several individual processes which require a time interval between them, labor costs are necessarily high for this operation. Additionally, all framed soaps tend to possess the common defects of warping on aging, of dissolving more slowly than milled soaps of the same solids composition, and of having a somewhat rough surface appearance.

Non-abrasive aerated soap bars were, prior to about 1940, also made by framing. Bar-framing problems with such bars were substantially eliminated, however, by utilizing the process described in U.S. Letters Patent 2,295,594 issued to Mills. Therein, a molten soap composition was aerated and mechanically agitated while being cooled from a fluid state to a pasty state. The resultant soap composition was beta phase soap.

However, abrasive soap bars made by the Mills process were found to be unacceptable. The abrasive soap bars made by the Mills process were characterized either by a concentric circular crystalline structure or a stratified crystalline structure which ran laterally to the extrusion direction. When these bars were twisted axially, they would fracture along these oriented stratas. Bars made by this process were also characterized by excessive small hard lumps throughout the bar which gave it a grainy look and feeling. In addition, bars made by the Mills process were excessively soft and smeary.

Accordingly, it is an object of this invention to provide a continuous process for preparing a soap bar containing a substantial amount of abrasive. A further object of this invention is to provide a continuous process for preparing a non-warping, smooth appearing, abrasive soap bar, the process of which requires a minimum of floor space and minimizes scrap loss. Another object of this invention is to provide a continuous process for preparing an abrasive soap bar which is substantially free of concentric and stratified crystalline orientations and which is otherwise satisfactorily formed into a solid bar. Still another object of this invention is to provide a continuous process for preparing an abrasive soap bar which is substantially free of lumps and surface irregularities. A further object of this invention is to provide a continuous process for preparing an abrasive soap bar comprised of soap in the omega phase.

Still further objects and the entire scope of applicability of the present invention will become apparent from the detailed description given hereinafter. It should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only since various changes and modifications within the scope of the invention will become apparent to those skilled in the art from this detailed description.

It has now been discovered, according to the present invention, that the foregoing objects are attained by a process comprising the steps of:

(1) Forming a molten soap composition by mixing components which comprise, by weight of the resulting mixture thereof, from about 35% to about 60% of a saponifiable material, from about 15% to about 30% of a finely divided abrasive material, from about 10% to about 25% water and a stoichiometric quantity of a strong base which saponifies all of the saponifiable material except from about 3.0% to about 6.5% based on the weight of the molten soap composition;

(2) Adjusting the temperature of said molten composition to from about 170° F. to about 220° F.;

(3) Cooling said molten soap composition to effect partial solidification thereof in a chilling and scraping zone while chilling the perimeter of said zone to a temperature of from about 15° F. to about 60° F. and while removing from the perimeter of said zone the partially solidified soap;

(4) Mixing and working said partially solidified soap composition to a condition of pasty cohesiveness in a mixing and working zone;

(5) Advancing the soap composition of Step 4 into a first extruding zone and extruding said soap composition in a generally annular pattern while annularly rotating said soap composition whereby the angular velocity of the soap composition during such annularly rotating extrusion varies gradiently and substantially across the cross section of said annular pattern;

(6) Forcing the soap composition of Step 5 into an expansion zone;

(7) Extruding the soap composition of Step 6 in a second extruding zone in blank bar form.

The description of the process employed herein will be more clearly understood when considered in conjunction with the drawings. FIGURE 1 shows a flow diagram for utilization in the present process. FIGURE 2 is a longitudinal sectional view of the cooling and agitating device shown in FIGURE 1. FIGURE 3 is a transverse sectional view taken along the line 3—3 of FIGURE 2; FIGURE 4 is a transverse sectional view taken along the line 4—4 of FIGURE 2; FIGURE 5 is an enlarged fragmentary sectional view taken along the line 5—5 of FIGURE 2 and includes a schematic representation of the angular velocity vectors, i.e., the velocity gradient, in different portions of the product being processed.

These drawings are only intended to facilitate an understanding of one method whereby this invention may be practiced. It is understood that no limitation of the scope of this invention is intended as the use of other forms of apparatus capable of accomplishing the purposes of this invention is contemplated.

FIGURE 1 shows diagrammatically the various components which are so operated and controlled to produce the abrasive soap bar of this invention. A batch crutcher **11** is provided for the initial mixing of the various components of the molten soap composition. A pump **13** conveys the molten soap from the crutcher **11** through pipe **12** to tank **14**. The tank **14** is provided in this process to provide a readily available supply of molten soap and, in this manner, to facilitate continuous processing. Both or either of the crutcher **11** and the tank **14** can be equipped with any suitable heating medium and mixing means to maintain the soap in a molten, pumpable condition. The molten soap from tank **14** is continuously conveyed through pipe **15** by a pump **16** to a metering device **17**. The metering device **17** continuously feeds, under pressure as hereinafter defined, a predetermined amount of molten soap into cooling and agitating device **20** through pipe **18**. Gauge **19** measures the pressure within cooling and agitating device **20**. The soap composition in the cooling and agitating device **20** is then cooled and worked and finally extruded in a condition of pasty cohesiveness through an orfiice **26**. The soap composition is extruded in continuous bar form onto a traveling conveyor belt **27**. The continuous soap bar is severed into individual bars or lengths by a cutter **28** disposed above the conveyor belt **27** and driven in timed relation therewith. Other suitable means for converting the continuous bar into individual bars can be utilized; for example, a bar molding or stamping device.

As variations in the above process, any means of supplying the molten soap to the cooling and agitating device is satisfactory. The process described herein, however, has the advantage of being economical, quick, and for all practical purposes, continuous.

FIGURES 2, 3, 4 and 5 constitute sectional views of the cooling and agitating device **20**. The soap composition is delivered through pipe **18** into chamber **31**. Chamber **31** is defined by a shaft **33** and the inside wall **32** of a double-walled cylinder comprised of an outer wall **34** and an inner wall **32**. The shaft **33** is supported for rotation on the axis of the double-walled cylinder, one end of the cylinder being closed around the shaft to prevent leakage. Walls **32** and **34** are formed of heat-conducting material, preferably a noncorrosive, abrasion resistant metal, and define area **35**. Area **35** is equipped to receive a cooling medium and becomes a cooling jacket when the cooling medium is introduced through inlet port **37** and expelled through outlet port **36**.

The soap composition is forced axially through chamber **31** in a relatively thin annular layer. Optimum results are obtained in practice by the employment of a shaft **33** and an inside wall **32** of such dimensions that the thickness of this layer is of the order of one inch. A plurality ot spaced, axially extending scrapers **38** arranged, as shown in FIGURE 3 at intervals around the shaft **33**, is secured to shaft **33** and positioned to scrape the inner surface of the drum **32**. The above described section of the cooling and agitating device **20** comprises what is referred to hereinafter as the chilling and scraping zone.

Communicating with the downstream end of the double-walled cylinder is a generally cylindrical drum **41** which defines chamber **45**. Rigidly mounted within the drum **41**, see FIGURE 4, are a plurality of annular elements **44**, each of which is provided with a plurality of substantially radial, inwardly directed arms **43** which serve as baffles. A shaft **51**, which is a reduced extension of shaft **33**, is secured to the downstream end of the latter

and provided with a plurality of generally radial, outwardly directed arms **42**, disposed in proximity to the baffle arms **43** and cooperating therewith to work and mix the soap composition passing from chamber **31** through chamber **45**. The above described section of the cooling and agitating device **20** comprises what is referred to hereinafter as the mixing and working zone.

Generally circular disk **47**, see FIGURE 5, creates a resistance to the flow of the soap composition and, accordingly, maintains the pressure within the chamber **31** and chamber **45** which is measured at meter **19**. Disk **47** should be constructed of an abrasion resistant, noncorrosive metal of at least about one-quarter inch in thickness to provide necessary strength. Disk **47** can be considerably thicker, however; thicknesses of about two inches work well in this process. Disk **47**, at its center, is threaded onto or otherwise rigidly attached perpendicularly to shaft **51**. Conical member **49** gives added support to circular disk **47** and is likewise threated onto or otherwise rigidly attached to shaft **51**. Conical member **49** can, alternatively, be incorporated into and made a part of circular disk **47**. The soap composition from chamber **45** is forced in an annular pattern around disk **47** through annular opening **52**. A motor **23** (see FIGURE 1) or other suitable driving means is employed to rotate the shaft **33**, its reduced extension, shaft **51**, and the circular disk **47** shown in FIGURE 2. The above described section, i.e., from the downstream end of chamber **45** through disk **47**, comprises what is referred to hereinafter as the first extruding zone,

The soap composition is thereafter introduced into an expansion zone defined by frusto-conically tapered discharge housing **50** and the downstream side of the generally circular disk **47**. Finally, the composition is extruded through orifice **26**, which is hereinafter referred to as the second extruding zone.

It can, therefore, be seen that the section extending from the upstream end of circular disk **47** through the extrusion orifice **26** is an extrusion and expansion apparatus comprising a housing having an axially extending, frustoconical passageway therethrough which terminates at an outlet end in an extrusion orifice and which has an inlet end of cylindrical configuration, a circular disk rotatably mounted coaxially of the cylindrically configured portion of said passageway and means to rotate said disk. As hereinafter described, the ratio of the outside diameter of the disk to the inside diameter of the cylindrical passageway is from about 6.0:8.0 to about 7.9:8.0.

The first step of the process of this invention is forming a molten soap composition by mixing components which comprise, by weight of the resulting mixture thereof, from about 35% to about 60% of a saponifiable material, from about 15% to about 30% of a finely divided abrasive material, from about 10% to about 25% water and a stoichiometric quantity of a strong base which saponifies all of the saponifiable material except from about 3.0% to about 6.5% based on the weight of the molten soap composition.

The saponifiable materials used herein to form soap can be fatty acids, and/or their triglycerides, diglycerides, or monoglycerides. These materials can be derived synthetically or utilized in naturally occurring forms. The saponifiable materials must, however, be selected in accordance with well known prior art practice so as to yield the desired quantities of stability, hardness, solubility, and ease of lathering in the final soap product. The acyl groups of these materials can be saturated or unsaturated and range in carbon atom content from C_{10}–C_{20}. These materials can be utilized in various combinations for various specific purposes.

The finely divided abrasive of this invention will not remain dispersed in the fatty acid herein described per se but it will remain dispersed in the glycerides herein described per se and mixtures of fatty acids and glycerides.

When mixtures of fatty acids and glycerides are used in this process, it is preferred that not more than 10% of the mixture be comprised of the fatty acids. In some cases, however, larger amounts of fatty acid can be tolerated. It is, therefore, understood that the glycerides can be utilized per se as a starting material or in combination with fatty acids as described above. Fatty acids per se, however, should not be used as a starting material.

Specific examples of the various saponifiable materials suitable for use herein are: beef tallow, mutton tallow, soybean oil, cottonseed oil, coconut oil, corn oil, castor oil, peanut oil, palm kernel oil, linseed oil, sesame oil, oleo oil, olive oil, cohune oil, neatsfoot oil, tallow, whale and fish oils, stearic acid, palmitic acid, myristic acid, caprylic acid, capric acid, lauric acid and oleic acid and any mixtures of such acids, e.g., those derived from natural glycerides. In a preferred embodiment of this invention, however, glycerides are utilized, coconut oil and palm kernel oil being especially preferred glycerides.

The saponifiable material, according to this invention, comprises from about 35% to about 60% by weight of the mixture of components utilized in forming the molten soap composition. Preferably, the saponifiable material comprises from about 40% to about 55% of this mixture of components.

The finely divided abrasive can be selected from a large number of abrasive compounds. Examples of these abrasive compounds are: pumice, pumicite, talc, silica, china clay, bentonite, diatomaceous earth, whiting and feldspar. These compounds can be utilized per se or in any of various combinations. In a preferred embodiment of this invention, however, pumice is utilized. Finely divided, as used herein, means that none of the abrasive will be retained on a Tyler Standard 100 mesh screen, and only about 1% of the abrasive will be retained on a Tyler Standard 150 mesh screen. It is preferred that less than 6% of the abrasive be retained on a Tyler Standard 270 mesh screen.

The abrasive compounds comprise from about 15% to about 30% by weight of the mixture of components utilized in forming the molten soap composition. As a preferred embodiment, the abrasive compounds comprise from about 20% to about 25% of this mixture of components. Within this preferred range, the abrasive is present in amounts sufficient to afford maximum cleaning efficiency with a minimum of processing problems.

The strong base utilized herein is preferably sodium hydroxide or sodium oxide. The saponifiable material will also readily react with many other strong bases, for example, potassium oxides and sodium and potassium carbonates and potassium hydroxide.

The strong bases must be added in such stoichiometric quantities as to saponify all of the saponifiable material except from about 3.0% to about 6.5% based on the weight of the molten soap composition. The unsaponified fatty content is understood to be unreacted saponifiable material such as fatty acids, and the triglycerides, diglycerides and monoglycerides of such fatty acids. In a further preferred embodiment of this invention, the strong bases are added in such stoichiometric amounts so as to attain an unsaponified fatty content of from 3.7% to 5.5% by weight of the molten soap composition.

Water is necessarily present in order to create desirable properties in the finished soap bar. Water can be present in this soap composition in amounts from about 10% to about 25% by weight of the mixture of components utilized in forming the molten soap composition. Preferably, however, water comprises from about 15% to about 20% by weight of this mixture of components.

Many materials which make the product more effective or more attractive can be added to the molten soap composition with no detriment to this process. These materials include minor amounts of salt, perfumes, whiteners such as titanium dioxide, bacteriostatic agents, emollients, dyes and various builders such as described generally in U.S. Letters Patent 3,159,581.

The molten soap composition of Step 1 can be prepared in several ways. In the following discussion, all percentages are by weight of the mixture of components utilized in forming the molten soap composition. The saponifiable material is mixed with from about 15% to about 30% of a suitable abrasive as described above. The various minor components such as titanium dioxide, dyes, etc., are advantageously admixed at this time. To this mixture is added a sodium hydroxide-water solution in the stoichiometric amounts hereinbefore delineated. The resulting mixture is heated to a temperature of from about 180° F. to about 210° F. by both a heating device and the heat of reaction caused by saponification. This temperature is maintained until the optimum unsaponified fatty content is attained.

As another variation of this preparation, the strong base can be added in such proportions as to saponify all of the saponifiable material; the saponifiable material should not contain over 10% fatty acid. Before complete saponification is attained, fatty acid corresponding stoichiometrically to the desired unsaponified fatty content is added to the molten soap composition. The free fatty acids react more readily with strong bases than do the glycerides. Accordingly, fatty acid reacts quickly with the remaining strong base, which leaves the glycerides as the unsaponified fatty material. This method, thus, decreases preparation time.

The unsaponified fatty content can be attained in yet another manner. Hydrochloric or other suitable acid, in correct stoichiometric quantities, can be allowed to react with completely saponified soap. The reaction product is free fatty acid and a salt.

Surprisingly, it has been found essential that the molten soap composition have an unsaponified fatty content which usually consists primarily of glycerides but which can consist of fatty acids or mixtures of glycerides and fatty acids of from about 3.0% to about 6.5% by weight of the molten soap composition to prevent the undesirable formation of small hard lumps throughout the finished bar. While the exact composition and cause of these undesired lumps is not known, it has been found that maintaining an unsaponified fatty content of about 3.0% to about 6.5% is essential to prevent them. This fatty content is also essential to provide good bar texture. Below the 3.0% level, the bar will be susceptible to cracking; above the 6.5% level, the bar will be too soft to be acceptable.

The temperature of the molten soap composition is then adjusted to from about 170° F. to 220° F. just prior to introducing the molten soap composition into the chilling and agitating device. In a preferred embodiment of this invention, the temperature of the molten soap composition is adjusted to from 185° F. to 205° F.

In the third step of this process, the molten soap composition is introduced under pressure, as hereinafter defined, into a chilling and scraping zone wherein the molten soap composition is cooled and partially solidified. The perimeter of this zone is continuously chilled to a temperature of from about 15° F. to about 60° F. to partially solidify the soap composition. The lower described temperature of the perimeter of the chilling and scraping zone is critical, while the upper limit is an economical limit to the cooling process. If temperatures below 15° F. are utilized, small hard lumps will form throughout the bar even though the unsaponified fatty content range hereinbefore described is utilized. Conversely, even though the temperature is within the above-prescribed range, the lumps appear if the unsaponified fatty content is not within the delineated range. Therefore, it should be understood that the conditions of Step 1 and Step 3 are critical and coextensive in eliminating the undesirable small hard lumps in the finished bar.

As a preferred embodiment of this invention, the tem-

perature of the perimeter of the chilling and scraping zone is maintained at from about 25° F. to about 40° F.

When apparatus similar to that shown in the drawing is utilized in this process, it has been found advantageous to use liquid coolants such as water, brine or ammonia to cool the perimeter of the chilling and scraping zone.

This step also involves scraping the perimeter of the chilling and scraping zone to remove the cooled and partially solidified soap from said perimeter and advancing this soap composition axially towards a mixing and working zone. In this step, the soap that is solidified or partially solidified in thin sheets on the perimeter of the cooling and scraping zone is continuously removed therefrom and mixed with the molten soap on the inside of this chilling and scraping zone. This mixture is thereupon again contacted with the chilled perimeter. This intermixing by cooling and scraping and axially advancement continues until the soap composition is entirely in a partially solidified form at the downstream end of chamber **31**. During this entire step, the soap composition is advanced axially towards the mixing and working zone.

The fourth step of this process involves mixing and working the partially solidified soap composition in the mixing and working zone. The mixing and mechanical working transforms the partially solidified soap composition of Step 3 into a homogeneous condition of pasty cohesiveness. It is understood that the soap composition when in a condition of pasty cohesiveness is a soft, plastic composition, the particles of which cling together in a homogeneous form-retaining mass. In this condition, freshly separated masses of the soap when again brought together will reunite without the application of high pressures such as are employed in plodding milled soap.

In most cases, mixing and mechanical working, such as contemplated by the Mills process employing ordinary soap, initiates a phase transformation from the omega phase to the beta phase. The omega phase is characterized by a less readily soluble soap which is desired for an abrasive type bar, but not for a non-abrasive bar. The beta phase is a more soluble soap which tends to become slushy and smeary when contacted for long periods of time with water. Such a tendency is tolerable because of the desirable toilet bar features which are obtained with beta phase soap.

Surprisingly, it has been discovered that by utilizing the essential ingredients herein set forth, the mixing and mechanical working steps can be utilized to attain a soap composition in a homogeneous condition of pasty cohesiveness without also effecting transformation of omega phase soap to beta phase soap which is not desirable for an abrasive bar. The bar produced by this process, as it is less soluble than beta phase soap, exerts the excellent abrasive action needed for heavy-duty cleaning and does not become soft and slushy.

Step 5 of this process involves introducing the soap composition in a condition of pasty cohesiveness into a first extruding zone and extruding said soap composition in a generally annular pattern while annularly rotating said soap composition whereby the angular velocity of the soap composition during such annularly rotating extrusion varies gradiently and substantially across the cross section of said annular pattern.

This extruding step is critical in this process to alleviate the problems of concentric circular crystalline structure and stratified crystalline structure in the abrasive soap bars made by the Mills' process but not following the essential features of this invention.

The schematic representation of the angular velocity vectors in different portions of the product being processed as shown by FIGURE 5 further illustrates this concept. In FIGURE 5, it is assumed that the circular disk **47** is rotating counterclockwise while the discharge housing **50** is stationary. The counterclockwise movement of the disk **47** imparts similar but slightly slower counterclockwise movement in a very thin layer of the soap composition. The movement in this thin layer of soap causes similar but again slightly slower movement in the next layer, etc. The amount of movement or angular velocity of a particle in these various layers of soap is represented in FIGURE 5. It is understood that, as represented, the soap particles or layers nearest to the rotating disk will have the highest angular velocity while those nearest to the stationary discharge housing will have the lowest angular velocity. Thus, it should be understood that, when the angular velocity is said to vary gradiently, the velocity vectors or angular velocity of the soap composition continuously changes across the cross section of the annular pattern. Angular velocity, as herein used, is understood to be the velocity of soap particles in a closed or substantially circular pattern perpendicular to the axial direction of flow.

The angular velocity must also vary substantially across the cross section of said annular pattern. In other words, the angular velocity of soap particles near the rotating disk must be substantially greater than the angular velocity near the stationary discharge housing. If the dimensions of the annular opening and the pressure within the chilling and agitating device fall within the hereinafter specified ranges, substantial variance can be attained by rotating the disk at from about 50 to about 250 revolutions per minute.

Step 5 can be accomplished by several different means. A rotating disk, e.g., circular disk **47**, can be so mounted as to cause the inside portion of the annular pattern to attain a greater angular velocity than the outside portion of the annular pattern. The outside containing wall corresponding to discharge housing **50** can, conversely, be rotated while a stationary plate is maintained inside said housing to cause the outside portion of the annular pattern to attain an angular velocity greater than the inside portion. The rotating portion should rotate at from 50 revolutions per minute to 250 revolutions per minute to obtain substantial variance in angular velocity across the cross section of the annular soap pattern.

In order to attain the desirable effect of this step, as hereinbefore set forth, a pressure must be continuously maintained on the soap entering the first extruding zone. The source of this pressure is the means utilized in introducing the molten soap composition into the cooling and agitating device **20**. The pressure can be supplied by a gravity feed system or a pump or similar equipment well known in the art. This pressure should be maintained at from about 8 pounds per square inch gauge to about 70 pounds per square inch gauge. The preferred pressure is from about 10 to about 25 pounds per square inch gauge; the pressure can be measured at gauge **19**. This pressure prevents the formation of voids in the product and is the driving force for the extrusion step.

An important feature of Step 5 involves the ratio of the diameter of the inner portion of the annular opening **52** to the diameter of the outer portion of the annular opening **52** or; in other words, the ratio of the outside diameter of the circular disk **47** to the inside diameter of the discharge housing **50**. This ratio, for proper functioning of this step of the process, should be from about 6.0:8.0 to about 7.9:8.0. Preferably, however, this ratio is from about 7.4:8.0 to about 7.7:8.0.

As hereinbefore mentioned, this step alleviates problems of the concentric circular crystalline structure and the stratified crystalline structure in abrasive soap bars made by the Mills process but without observing the conditions herein described. While not wishing to be bound by a theory for this particular result, it appears that the soap composition is subjected to an internal mechanical shearing action by the angular rotation of the soap composition. This shearing force apparently mixes the soap composition more uniformly than can be accomplished by ordinary mixing and working.

As the sixth step in the process of this invention, the soap composition is introduced into an expansion zone.

In the expansion zone, the soap composition homogenizes so that on final extrusion there will be no voids or air pockets in the bar.

Finally, the soap composition, still in a condition of pasty cohesiveness, is extruded in Step 7 in blank bar form in a second extruding zone. The temperature of the soap compsition in extruding zone two is generally from about 120° F. to about 150° F. At these temperatures the correct condition of pasty cohesiveness is generally obtained. However, it should be understood that the extrusion temperature limits are governed only by the temperatures at which the soap composition loses its condition of pasty cohesiveness or shape retention.

The above-described steps describe a continuous process for preparing an abrasive soap bar. The following examples are intended to further explain and illustrate the present invention. These examples are not intended to limit this invention in any manner.

Example I

In this example, the cooling and agitating device previously described in detail was utilized. The chamber of this device was six inches in internal diameter and 18 inches long. The shaft rotated at about 120 revolutions per minute and was equipped with a rotating circular disk **47** with a diameter of $5\frac{11}{16}$ inches. Accordingly, the ratio of the diameter of the inner portion of the annular opening to the diameter of the outer portion of the annular opening was about 7.58:8.00. Cooling brine at a temperature of 27° F. was continually introduced through inlet port **37** and expelled at outlet port **36**.

The following components were intimately and thoroughly mixed in a batch crutcher.

Component:	Parts by weight
Middle-cut coconut oil	48.0
Pumice abrasive	25.0
Sodium hydroxide	7.0
Water	17.8
Titanium dioxide	1.5
Sodium chloride	0.7

It is to be understood that middle-cut coconut oil refers to a coconut oil fraction obtained by distillation and containing the following approximate distribution of carbon chain lengths: 1%—C_{10}, 68%—C_{12}, 24%—C_{14} and 7%—C_{16}. The pumice abrasive was finely divided; only about 6% of the abrasive was retained on a Tyler Standard 270 mesh screen.

These various ingredients were charged into a crutcher and intimately mixed and heated by the heat of reaction of the sodium hydroxide with the coconut oil and by a heat exchange device. In this manner, a temperature of 200° F. was attained. As saponification was not completed in the crutcher, the mixture was allowed to age or saponify for two hours until an optimum fatty content of about 5.0% based on the weight of the molten soap composition was reached. This soap composition was then pumped into a storage tank and then metered into the cooling and agitating device. The temperature of the molten soap composition was adjusted to 195° F. just prior to the introduction of the molten soap composition into the cooling and agitating device.

The molten soap composition was first introduced into the chilling and scraping zone of the apparatus hereinbefore described which was being cooled by the 27° F. brine. The soap composition was partially solidified when it contacted the cold wall **32**. As the soap partially solidified on the wall, it was scraped therefrom and admixed with the molten composition. This procedure was repeated until the soap composition was nearly entirely in a partially solidified state.

The partially solidified soap composition was then advanced into a mixing and working zone. The soap composition was worked in this zone until it attained a condition of pasty cohesiveness.

The soap composition was further advanced into a first extruding zone which comprised the circular disk **47** and the inside wall of the discharge housing. As hereinbefore mentioned, the shaft was rotated at about 120 revolutions per minute; the discharge housing was stationary. The angular velocity of the soap composition varied both gradiently and substantially across the cross section of the annular soap pattern. The pressure within the cooling and agitating device was held at about 19 pounds per square inch gauge throughout the process.

From the first extruding zone, the soap composition was advanced into an expansion zone wherein the composition was homogenized. Finally, the soap composition was extruded in a second extruding zone in blank bar form.

The soap in the final solid bars was 100% omega phase. These abrasive soap bars were smooth and contained no lumps or surface irregularities. No visible crystalline orientation or stratification was seen. These bars did not warp during a lengthy storage period. The process herein described was continuous from the time molten soap was placed in the storage tank until the bars were finally cut.

Example II

The following components were mixed in a batch crutcher.

Component:	Parts by weight
Coconut Oil [1]	48.2
Pumice [1]	23.5
Sodium oxide (Na_2O)	6.1
Water	20.0
Titanium dioxide	1.5
Sodium chloride	0.7

[1] See Example I for a more complete definition.

A solution was made of the Na_2O and water. About one-half of this solution was added to a mixture of the coconut oil, titanium dioxide and sodium chloride. As saponification began, the pumice was blended into the slurry. The remainder of the Na_2O-water solution was then added to the crutcher mix and thoroughly blended therein. Throughout this blending and mixing process, the crutcher mix was maintained at about 193° F.

This molten soap composition was then aged a suitable time in order to attain the preferred fatty content level and then fed into the cooling and agitating device described in Example I at a rate of 450 pounds per hour. A constant pressure was maintained within this device of about 11 pounds per square inch gauge. The inlet temperature of the brine coolant was 31° F. The outlet temperature of the soap was 148° F. The soap composition was processed through the cooling and agitating device substantially as described in Example I.

The bar made by this process was free of lumps and did not contain the objectionable crystalline orientation. The soap comprising this bar was 100% omega phase soap.

The inlet temperature of the brine coolant was then dropped to —8° F. The soap bar made at this temperature according to the above process contained small hard lumps throughout the bar and was pocked by surface irregularities.

Example III

A soap bar with the following initial composition was made by the process of this invention in the cooling and agitating device described in Example I.

Component:	Parts by weight
Coconut oil [1]	44.10
Pumice [1]	23.50
Sodium oxide	6.24
Water	19.86
Glycerine	0.23
Titanium dioxide	1.50

Component:	Parts by weight
Coconut fatty acid	3.87
Sodium chloride	0.70

[1] See Example I for a more complete definition.

All of the above components with the exception of the coconut fatty acid were thoroughly mixed in a batch crutcher. The temperature of this crutcher mix was maintained at 186° F. After the coconut oil had saponified sufficiently to cause a viscosity increase in the crutcher mix and thus keep the pumice dispersed, the coconut fatty acid was admixed. The crutcher mix attained the desired fatty content level more rapidly than in the previous examples.

This soap composition was processed through the cooling and agitating device substantially as described in Example I at about 360 pounds per hour under a pressure of about 13 pounds per square inch gauge. The outlet temperature of the extruded soap strip was 122° F.

The soap contained in the bars of this example was 100% omega phase soap. They contained no lumps and, additionally, did not contain the objectionable crystalline orientation.

When stationary plates designed according to the drawings in U.S. Patent 3,089,197 were utilized in place of the rotating disk utilized in this example, the resulting bars contained concentric circular crystalline structures. When these bars were twisted axially, they fractured along these oriented lines.

As hereinbefore mentioned, other materials may be added to the components described in these examples without adversely affecting the process. Such materials as sodium chloride, titanium dioxide, perfumes, dyes, emollients, builders and bacteriostatic agents can be effectively utilized in these bars.

The foregoing description of the invention has been presented describing certain operable and preferred embodiments. It is not intended that the invention should be so limited since variations and modifications thereof will be obvious to those skilled in the art, all of which are within the spirit and scope of this invention.

What is claimed is:

1. A continuous process for preparing a soap bar containing an abrasive material comprising the steps of

(A) forming a molten soap composition by mixing components which comprise, by weight of the resulting mixture thereof, from about 35% to about 60% of a saponifiable material selected from the group consisting of fatty acid, monoglycerides, diglycerides and triglycerides of fatty acids and mixtures thereof wherein the acyl groups are saturated or unsaturated and contain from about 10 carbon atoms to about 20 carbon atoms, from about 15% to about 30% of a finely divided abrasive material, from about 10% to about 25% water, and a stoichiometric quantity of a strong base selected from the group consisting of sodium hydroxide, sodium oxide, sodium carbonate, potassium hydroxide, potassium oxide and potassium carbonate which saponifies all of the saponifiable material except from about 3.0% to about 6.5% based on the weight of the molten soap composition;

(B) adjusting the temperature of said molten composition to from about 170° F. to about 220° F.;

(C) cooling said molten soap composition to effect partial solidification thereof in a chilling and scraping zone while chilling the perimeter of said zone to a temperature of from about 15° F. to about 60° F. and while removing from the perimeter of said zone the partially solidified soap;

(D) mixing and working said partially solidified soap composition to a condition of pasty cohesiveness in a mixing and working zone;

(E) advancing the soap composition of Step (D) into a first extruding zone and extruding said soap composition in a generally annular pattern while annularly rotating said soap composition whereby the angular velocity of the soap composition during such annularly rotating extrusion varies gradiently and substantially across the cross section of said annular pattern;

(F) forcing the soap composition of Step (E) into an expansion zone;

(G) extruding the soap composition of Step (F) in a second extruding zone in blank bar form.

2. The process of claim 1 wherein a stoichiometric quantity of the strong base which saponifies all of the saponifiable material except from about 3.7% to about 5.5% based on the weight of the molten soap composition is added to the mixture of components.

3. The process of claim 2 wherein the perimeter of the chilling and scraping zone is cooled to from about 25° F. to about 40° F.

4. The process of claim 3 wherein the soap composition is advanced under a pressure of from about 8 to about 70 pounds per square inch gauge in a condition of pasty cohesiveness into the first extruding zone (Step E) and extruded in a generally annular pattern while annularly rotating said soap composition whereby the angular velocity of the soap composition during such annularly rotating extrusion varies gradiently and substantially across the cross section of said annular pattern and wherein the ratio of the inside diameter of the said annular pattern to the outside diameter of the said annular pattern is from about 6.0:8.0 to about 7.9:8.0.

5. The process of claim 4 wherein the soap in the bar at the completion of the process is omega phase soap.

6. The process of claim 5 wherein the molten soap composition of Step (A) is formed by mixing components which comprise, by weight of the resulting mixture thereof, from about 40% to about 55% of a saponifiable material selected from the group consisting of monoglycerides, diglycerides, and triglycerides of fatty acids and mixtures thereof and mixtures of fatty acids and glycerides selected from the group consisting of monoglycerides, and triglycerides of fatty acids and mixtures thereof, wherein the acyl groups of the saponifiable materials are saturated or unsaturated and contain from about 10 carbon atoms to about 20 carbon atoms, from about 20% to about 25% of a finely divided abrasive material selected from the group consisting of pumice pumicite, talc, silica, china clay, bentonite, diatomaceous earth, whiting and feldspar, from about 15% to about 20% water, and a stoichiometric quantity of the strong base which saponifies all except from about 3.7% to about 5.5% of the saponifiable material based on the weight of the molten soap composition; and wherein the soap composition is advanced under a pressure of from about 10 to about 25 pounds per square inch gauge in a condition of pasty cohesiveness into the first extruding zone (Step E) and extruded in a generally annular pattern while annularly rotating said soap composition whereby the angular velocity of the soap composition during such annularly rotating extrusion varies gradiently and substantially across the cross section of said annular pattern and wherein the ratio of the inside diameter of the said annular pattern to the outside diameter of the said annular pattern is from about 7.4:8.0 to about 7.7:8.0.

7. The process of claim 6 wherein less than 1% of the finely divided abrasive is retained on a Tyler Standard 150 mesh screen and wherein the abrasive is selected from the group consisting of silica and pumice.

8. A soap bar made by the process of claim 1.

No references cited.

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