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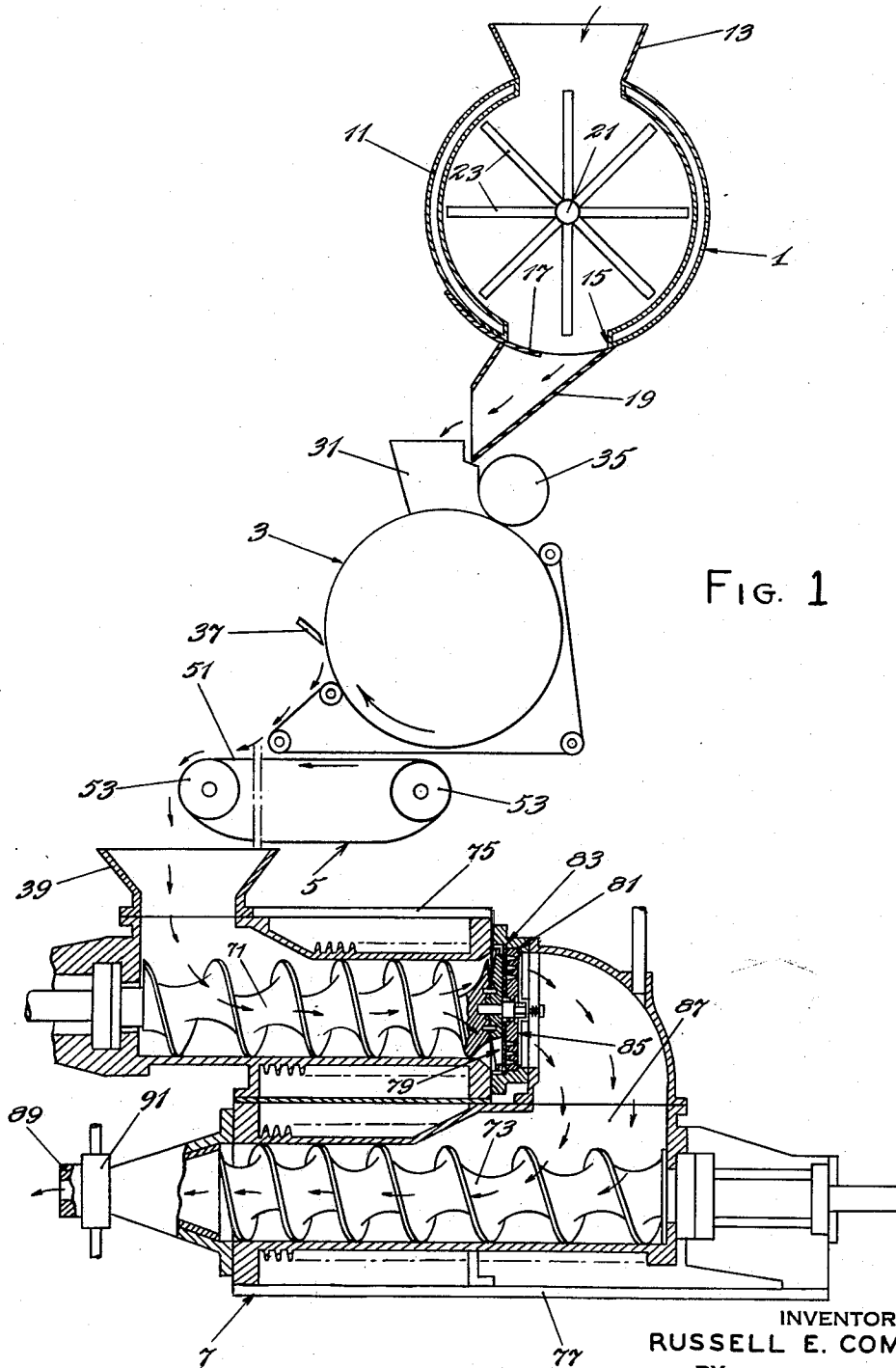
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2,649,417

PLODDED HIGH MOISTURE SOAP AND METHOD OF MAKING SAME

Filed Aug. 5, 1946

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

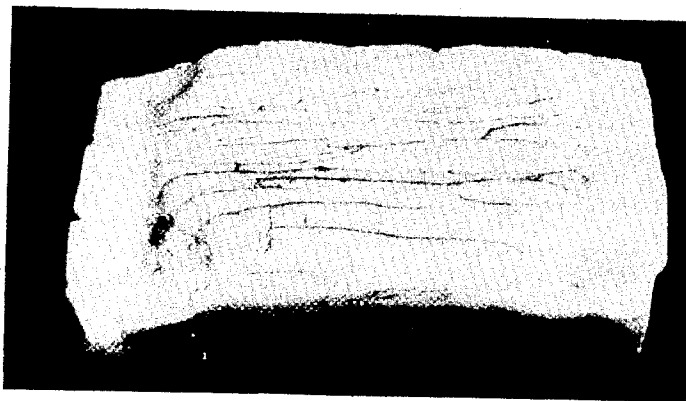


FIG. 2

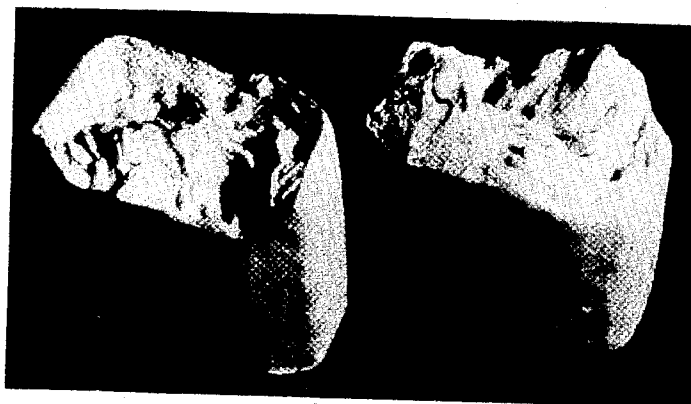


FIG. 3



FIG. 5



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2,649,417

PLODDED HIGH MOISTURE SOAP AND
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Application August 5, 1946, Serial No. 688,573

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The present invention relates to a method of making bars of dense soap of high moisture content which resemble low moisture milled soaps in texture, in resistance to warping and distortion, and in rate of solubility, and to bars of soap having these novel characteristics. While not limited to built soaps, the invention relates more particularly to laundry soap.

Soap in bar form has been made, until recent years, either by the framing or milling method. The finer toilet soaps, almost without exception, are milled whereas laundry soaps are almost exclusively framed.

Milled soaps are characterized by a moisture content less than about 15%, a firm dense texture and high resistance to warping and distortion. Milled soaps also have a somewhat translucent appearance and a rate of solubility higher than a framed soap of about the same solids composition. The conventional process of making milled soap comprises chilling settled kettle soap on a roll, removing the solidified soap from the chilling roll as ribbons, drying the ribbons to an average moisture content within the range of about 10% to 15%, mixing the dried ribbons with perfume, preservative, whitening agents, etc., milling the mixture over a plurality of rolls in order thoroughly to homogenize the materials, plodding the milled chips, cutting the bar extruded from the plodder into individual cakes, pressing and wrapping the cakes.

There are a number of disadvantages of the milling process and milled soaps. An important disadvantage is that the kettle soap has to be dried from a moisture content of around 30% to about 10%–15% before the soap can be milled. The disadvantage is not only in the cost of the energy required to evaporate the water but also in the difficulty of preventing parts of ribbons from becoming excessively dehydrated. Excessively dehydrated portions are grainy or crystalline and unless the soap is very extensively milled the grains persist and impart a rough feel to the bars. A further disadvantage is that some perfume is lost during the milling. There are also limitations on the composition of milled soaps, an important one being the amount of builder which can be incorporated in soap that is to be milled. While the maximum amount which can be tolerated varies with the type of builder, it has been recognized that soaps of laundry composition did not lend themselves to bar formation by the milling process. The milling process, furthermore, is relatively expensive.

Framed soaps are characterized by a moisture

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content of about 30% to 40% when freshly made. They have the advantage of not requiring a drying operation for the kettle soap and they may contain amounts of builders, fillers, etc., varying over a broad range. They may also be made floating or dense as desired. Framed soaps, however, all possess the common defects of warping on aging, of dissolving more slowly than milled soaps of about the same solids composition, and of having a somewhat rough and mat surface appearance.

The conventional process of making framed soaps comprises crutching kettle soap with the desired addition agents such as perfume, builder, filler, air, etc., and running the crutched mixture into a frame where it is allowed to cool and solidify at ambient temperatures. Framed soap is generally allowed to set for about five days before stripping and slabbing. The slabs in turn are cut into individual cakes, which ordinarily require some additional drying to form a skin before the soap can be satisfactorily pressed. In this process there is inevitably a high scrap loss, often amounting to as high as 30% by weight of the frame of soap. Since this scrap does not have the same composition as the kettle soap it requires special handling in reworking. The framing process requires extensive floor space for the equipment, particularly for the storage of frames during the cooling operation. The labor costs are also relatively high.

A third method of making soap has been recently introduced for making a floating soap having characteristics between those of framed and milled soaps. In this process soap of the desired solids composition and which contains about 20% moisture is agitated under pressure in the presence of air at a sufficiently elevated temperature to put the soap into a pasty or semi-fluid condition. After agitation, which is continued until air is finely and uniformly distributed throughout the mass, the soap is cooled and formed into bars or cakes.

One way of practicing this third method is to take the soap directly from the kettle, dry it to the proper moisture content, and introduce it with the desired addition agents into the apparatus used for agitating the soap in the presence of air. In this case the apparatus is provided with cooling jackets to bring the hot soap down to the proper temperature for the agitation.

Instead of introducing hot soap into the agitating apparatus, the kettle soap can be chilled and dried to the proper moisture content as described in the milling process, mixed with the

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desired addition agents and plodded to form solid pellets. These pellets can then be introduced into an agitating apparatus provided with jackets for heating fluid, to bring this material to the proper temperature for the agitation operation.

This third method suffers from a number of disadvantages, among the most important of which are that it requires drying of the kettle soap, the amount of builders, etc., which can be incorporated is limited, the process is adaptable only to the making of floating soaps and it requires special equipment not found in the conventional soap factory.

I have discovered a new process for making soap in bar form which is especially adapted for making soap for laundry and general household uses and which overcomes many of the disadvantages of the prior processes discussed hereinabove. The novel bars or cakes of soap made by my process may have a composition which heretofore could be made only by framing but in its properties it resembles a milled soap more than a framed soap.

Among the objects of my invention are to provide a process of making bars or cakes of soap directly from kettle soap with or without builders, fillers, and other addition agents which overcomes or minimizes the disadvantages of the framing method; to provide a process of making laundry and household soap on conventional soap making machinery at lower cost than by framing; to provide bars or cakes of laundry and household soap having characteristics similar to milled soap, particularly in texture, resistance to warping and distortion, and rate of solubility.

Other objects and advantages of the present invention will become apparent from the following detailed description, taken in conjunction with the drawing in which:

Fig. 1 represents diagrammatically pieces of conventional soap making machinery associated for carrying out the process of the present invention;

Fig. 2 is a reproduction of a photograph of a piece of soap made by the process of the invention which had been twisted back and forth several times beyond the elastic limit of the soap to illustrate the longitudinal grain structure possessed by soap made in this way;

Fig. 3 is a reproduction of a photograph of a similar piece of soap broken across the grain by bending to show the conchoidal fracture;

Fig. 4 is a reproduction of a broken piece of framed soap showing the granular fracture characteristic of framed soaps which have no grain; and

Fig. 5 is a reproduction of a photograph of a piece of soap bent to V-shape to show the remarkable absence of shortness, and the strength possessed by freshly made soap of the invention.

Generally speaking, the process of the invention comprises compacting, under vacuum, solidified soap particles of high moisture content which may contain builders, fillers, perfume, whitening or other coloring agents, etc. Any suitable device may be used to compact the soap particles, e. g., an extrusion press provided with one or more pistons which may be mechanically or hydraulically driven to exert sufficient pressure on deaerated soap particles in the chamber to compact and extrude them from the chamber through an orifice of desired size and shape. Extrusion presses of this general type are well known in the extrusion art and may be adapted to the requirements of the present process. A convenient

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and preferred method of compacting the soap particles comprises introducing them into a plodder through an evacuated space, plodding the soap at a temperature within a range hereafter defined and extruding the soap from the plodder as a bar which may then be cut into cakes, pressed and wrapped. In a preferred embodiment of my invention, kettle soap is crutched with desired addition agents to form a mixture suitable for a laundry or household bar, the mixture is chilled without substantial drying to solid form, and the solidified soap, which may be taken from a chilling roll in the form of ribbons, is then compacted under vacuum. The crutcher mix, however, is not limited as to moisture content to the amount normally present in kettle soap plus whatever is contained in the added materials. The invention contemplates variation in moisture content of the solidified soap during the compacting operation within a range of about 20% to about 40% exclusive of any moisture present as water of crystallization in any of the builders and/or fillers incorporated in the soap.

The product produced by the process of the invention is a bar of dense soap having a moisture content, exclusive of water of crystallization, within the range of about 20% to about 40%, a characteristic texture similar to milled soaps and high resistance to warping and distortion on drying. It may be essentially unbuildt or it may contain up to about 25%-30% of builders, fillers, etc. Its base may be either a white soap or a rosin-containing soap.

Referring now more particularly to Fig. 1 of the drawing, reference numeral 1 represents a crutcher, 3 a chilling roll, 5 a conveyor, and 7 a plodder. The crutcher illustrated is a horizontal shaft type having a jacketed casing 11, a funnel shaped inlet 13, an outlet 15, removably closed by a gate 17, a spout 19, and a shaft 21 having blades 23 secured thereto. Means (not shown) are provided for driving the shaft at a suitable speed for thoroughly mixing the ingredients which are introduced into the soap in the crutcher.

The chilling roll 3 is provided with a trough 31 and a spreader roll 35 for distributing soap in a thin, uniform film over the surface of the chilling roll 3 as it rotates. A doctor blade 37 is provided to remove the film of soap from the chilling roll, preferably in the form of ribbons and to deposit the ribbons on a conveyor or other device for transporting them to the plodder hopper 39. The conveyor 5 is illustrated as having an endless belt 51, mounted on pulleys 53, at least one of which is driven.

The plodder illustrated in the drawing is substantially like that of the Schwantes U. S. Patent 2,146,770. It comprises two worms, an upper worm 71 and a lower worm 73 in casings 75 and 77, respectively. The casings may be, and preferably are, jacketed to provide for circulation of liquid so as to control the temperature of the soap during plodding. The jackets may be connected to different sources of liquid, if desired, whereby the temperature of operation in one barrel may be controlled independently of the other. At the discharge end of the upper worm 71 is a grinding head 79, a backing plate 81 having relatively large openings, a foraminous plate or screen 83 having relatively small openings, and a knife 85 for cutting off the soap as it leaves the backing plate 81. The soap is discharged from the upper worm into a vacuum chamber 87 through which it falls on to the lower worm 73. At the discharge end of the lower worm is a nozzle 89,

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provided with a nozzle jacket 91, having suitable connections (not shown) with a source of heating fluid.

The soap as it leaves the plodder nozzle, particularly where the moisture content is about 30% or higher, may not be in condition for immediate pressing. My invention contemplates subjecting the extruded bar to a conditioning step prior to the pressing operation, if desired. This conditioning operation may precede or follow the cutting of the extruded bar into individual cakes and it may be carried out in any one or more of a number of different ways. For example, the bar may be cut into individual cakes and the cakes placed on a rack for drying either in an ordinary room or in a room provided with a heated and/or dried atmosphere to facilitate more rapid conditioning. A preferred method is to subject the extruded bar, either before or after cutting into cakes, to infra red radiation while simultaneously blasting with air, as disclosed and claimed in the copending application Serial No. 688,419, filed August 5, 1946, by Robert F. Heald, Charles Sutter, and Russell E. Compa, now U. S. Patent No. 2,527,062, granted October 24, 1950. A suitable apparatus for this conditioning operation is disclosed in application Serial No. 688,574, filed August 5, 1946, by Russell E. Compa and Charles F. Fischer, now abandoned. Soap cakes treated in this manner are placed in condition for pressing in a very short time of the order of a few minutes.

In the present process the soap base may be prepared from the fats and oils customarily used in making household and laundry soaps. The kettle soap can be made from 100% tallow or with substitution of coconut oil, palm oil, palm kernel oil, babassu oil, hardened linseed oil, etc. for all or any part of the tallow. While it is possible to substitute unsaturated stocks such as cottonseed oil, olive oil, linseed oil, fish oils, etc., for part of the tallow, it is preferable under ordinary conditions not to use highly unsaturated oils or fats in substantial amounts in the kettle soap composition. The kettle soap composition may also include rosin soap, although, as is well known, the presence of a rosin soap has a softening effect and in the present process of the content of rosin soap is too high difficulty may be experienced in plodding. For this reason I prefer not to use more than about 7% rosin soap in the finished bar where kettle soap is used without drying. By reducing the moisture content, larger percentages of rosin soap may be employed.

It is customary to incorporate various builders in soap for laundry use, including alkali metal silicates, such as sodium silicate, which is more widely used and in larger quantity than any other builder; alkali metal carbonates, such as soda ash; and alkali metal phosphates, such as the various sodium phosphates, including trisodium phosphate, tetrasodium pyrophosphate, sodium hexametaphosphate, tripolyphosphate, etc. The amounts of such builders customarily employed in laundry soap manufacture can readily be added to soaps made by the process of the present invention. In fact, soaps can be made by the present process having compositions which cannot be made by the framing method. An outstanding example is the addition of common salt (NaCl) which is considered incompatible with laundry soap compositions made by the framing method but which can be added with advantage to soaps of the same com-

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position made by the present process to which it imparts firmness and whiteness.

The amount of common salt which can be added to soap composition made in accordance with the present invention varies with the nature and content of the builder. With no sodium silicate present, salt can be used up to about 4% or higher. When sodium silicate is present the salt, if it exceeds a critical amount which varies with the silicate content, causes the silicate to coagulate in rubbery-like masses within the soap mix. With N-silicate, which has a ratio of $\text{Na}_2\text{O}:\text{SiO}_2$ of about 1:3.22, present in the soap in the absence of other builders I have found salt to be compatible in the following amounts:

Percent N-Silicate	Maximum Percent Salt (NaCl)
27.5	1
17.5	2
8.5	3
1.6	4

For intermediate silicate values the amount of salt can be determined by interpolation.

I have discovered that the presence of alkaline salts, such as soda ash, trisodium phosphate, etc., tends to prevent the coagulating effect of salt on silicate. Thus, about 3% soda ash prevents up to 2% NaCl from coagulating the silicate in a crutcher mix containing about 27.5% silicate. For larger amounts of salt a greater relative amount of soda ash, or a combination of soda ash and sodium phosphate, e. g., trisodium phosphate, was found to be necessary to prevent silicate coagulation. With a builder mix comprising about 82.5% N-silicate, 10% trisodium phosphate and 7.5% soda ash, for example, a soap composition containing about 30% builder was found capable of tolerating as much as 4% NaCl without formation of silicate lumps in the crutcher mix. The alkaline salts were also found to contribute to the firmness of the extruded soap but not to the same degree as sodium chloride. These salts, however, if present in too large amounts make the bar short, i. e., instead of being plastic and flexible the bar breaks if bent more than a few degrees. The total amount of salt (NaCl) that can be added before the soap becomes too short for satisfactory handling depends upon the soap base, and upon the amount of other builders, etc., which exert a shortening action. With tallow laundry soaps or laundry soaps made of blends of tallow with vegetable oils it is advisable to keep the salt content under 3% and preferably under 2%. If rosin soap is present above about 2.5% the presence of salt is advantageous to counteract the softening effect of the rosin soap, and with a rosin soap content of about 7% salt can be tolerated up to about 4% before the bar becomes too short.

It is not uncommon to incorporate filler materials in laundry soaps for the purpose of reducing the cost per given weight. The process of my invention can be used for making filled soaps. Any of the fillers conventionally used in soap making can be employed in my invention. In some cases, filler materials may assist in obtaining a firmer textured bar. This may be due to lowering of the moisture content. I have found, for example, that a soap containing 68% to 73% kettle soap is normally more firm as extruded than a soap containing 61.5% kettle soap, both soaps having the same builder con-

tent. The increased softness of the latter soap probably is due to its higher moisture content and it can be made firmer by the addition of a dry inert filler, such as Snowflake White (ground marble).

With the proper choice of addition agents such as builders, fillers, etc., in accordance with the principles explained hereinabove, a satisfactory bar can be obtained by the process of the present invention regardless of what kettle soap is used, with the exception that the content of rosin soap should not be so high as to produce excessive softening. The amount of such addition agents employed can be varied from zero to about 30% (solids basis) in the crutcher mix. Using kettle soap without any drying whatsoever, the moisture content of these soaps falls within the range of about 30% to 41%.

Sodium silicate serves not only as a water softener when the soap is dissolved in water, but it appears also to have a preservative action in the soap. Even in unbuilt soaps, a small amount of sodium silicate, e. g., about 1 to 3%, may advantageously be added for its preservative action. A satisfactory formula for an unbuilt soap bar comprises kettle soap to which is added about 1.6% N-silicate as a preservative and about 2% NaCl as a hardening or firming agent. Common salt has the additional important property of imparting a whiter appearance to bars made from a white soap base. The soap may also contain customary amounts of perfume and whitening or other coloring agents.

While the process of the present invention preferably is carried out using kettle soap without drying, it has great utility also in the production of dense bars of soap having a somewhat lower though still high moisture content of at least about 20%. Where the bars are to have a moisture content within the range of about 20% to 30%, soap of desired moisture content may be obtained in any one of a number of different ways. Kettle soap, for example, may be flash evaporated to reduce the moisture content to any desired level. Similarly, such soap may be solidified and formed into ribbons in the usual manner for making toilet soaps and dried down to a desired moisture content. The soap base may also be made by saponification of fatty acids and/or fatty esters, e. g., by a continuous saponification process yielding soap of the desired moisture content. My invention also contemplates rehydration of soap containing less than the desired amount of moisture in order to obtain a soap base having the desired moisture content for my invention. A particularly advantageous way of obtaining soap of lower moisture content from kettle soap is to spray dry a portion and mix it with the balance. Thus if about $\frac{1}{3}$ of the kettle of soap is spray dried to a moisture content of about 6% and then united with the remaining $\frac{2}{3}$, the moisture content of the mixture amounts to about 23.5%. By varying the ratio of spray dried soap in the mixture, the moisture content is readily adjusted to any desired value. It is preferred to crutch soap of the proper moisture content with the desired addition agents and form this mixture into ribbons on a chilling roll for plodding, but the addition agents can be incorporated in the soap before the drying step, e. g., where ribbons are passed through a drier.

A very satisfactory way of practicing the invention is to chill the soap from the crutcher to a temperature below about 100° F. so that it may be fed into the plodder hopper at about 95°

F. or lower. The soap should not rise substantially above this temperature during the plodding operation and to accomplish this result cooling water may, if necessary, be run through the jackets surrounding the plodder barrels to control the temperature. The plodding operation can be carried out successfully from room temperature (about 70° F.) up to about 95° F. for soap of almost any builder and moisture content, although for products made from kettle soap without drying it is preferred to plod the soap within the range of 70° to 90° F. For soap of lower moisture content the upper limit of the temperature range is higher, and at about 20% moisture the plodder temperature may be of the order of about 120° F., but, in general, even with such soap, it is recommended that the plodding operation be carried out below about 100° F.

The extruded bar can be given a very pleasing smooth polished appearance by heating the plodder nozzle. The optimum temperature, which will vary somewhat with the composition of the soap and the rate of extrusion, is easily determined by observing the condition of the surface of the bar as it leaves the plodder. If the temperature is too high the soap may melt at the surface, particularly if the plodder is running slow or is shut down for any reason. If the temperature is too low the smooth finish that can be obtained within the optimum range is not obtained. A satisfactory temperature range for soaps of customary laundry bar analysis is about 130 to 137° F.

An ordinary mercury thermometer imbedded in the soap extruded from the nozzle shows the soap temperature under the foregoing preferred conditions ranges between about 80 to 92° F. The preferred extrusion temperature of the soap is approximately 80 to 85° F. and it should be kept below about 95° F. as a maximum for soap of 30% or more moisture. With lower moisture content, somewhat higher soap temperatures are permissible.

The evacuation of air from the soap particles that are compacted is an essential feature of my invention. In operating plodder 7 under otherwise identical conditions, the extruded bar is tacky, soft, brittle or short in texture and difficult to handle without breaking when chamber 87 is not evacuated whereas when vacuum is applied the extruded soap is plastic, has good body, is firm and far less tacky or sticky. Satisfactory results have been obtained with the vacuum at about 25 inches of mercury. The preferred range is about 22 to 26 inches and the vacuum should not be allowed to fall lower than 20 inches for any length of time.

In order to press the soap extruded from the plodder at a rate satisfactory for commercial operation it is necessary to subject it to a conditioning treatment. I have found that if the soap is exposed for about 10 to 18 hours in an atmosphere at about 125 to 132° F. it becomes much harder to the touch and has a sufficient "skin" formed on the surface that the soap can be pressed satisfactorily. If the soap is exposed to the air at normal temperatures, a somewhat longer conditioning period may be necessary. I prefer, however, to subject the soap to infra red radiation and simultaneous blasting with air as disclosed in the Heald, Sutter, and Compa application Serial No. 688,419, now Patent No. 2,527,062, and in the apparatus disclosed in the Compa and Fischer application Serial No. 688,574, now abandoned, referred to above. By

this method the necessary conditioning is accomplished in a short time, e. g., of the order of about two to five minutes. This method of conditioning has the advantage of requiring no floor space for prolonged drying and permits the smooth flow of materials from kettle house to warehouse.

The following specific examples are given for the purpose of illustrating the operation of the process and the advantages which accrue from its use. They are not to be considered as limitations on the scope of the process.

Example I

Into a steam jacketed 200-pound horizontal crutcher is flowed about 61.5% or 123 pounds of a kettle soap made of a blend of 75% tallow and 25% coconut oil to which is added about 37.9% or 76.0% pounds of silicate mix composed of about 82.5% N-silicate, 10.0% trisodium phosphate, and 7.5% soda ash and the contents in the crutcher are mixed. While mixing is being continued about 0.3% or 10 oz. of citronella type perfume is added, and also about 0.3% or 10 oz. of titanium dioxide. Crutching is continued until the soap-silicate mixture is uniform when it is dropped into the trough of a chilling roll. A spreader roll distributes the soap-silicate mix over the surface of the chill roll in a film of desired thickness. The spreader roll is kept around 180° F., at which temperature it helps keep soap in the trough in molten condition. The chill roll temperature is maintained within the range of about 70 to 85° F. to insure that soap ribbons are removed from the roll by the knife edge at a temperature not more than about 90° F. Good ribbon formation is achieved under these conditions. The film thickness and speed of roll can be varied through a considerable range and still give good ribbon formation.

The soap ribbons thus formed are transported to the hopper 39 and fed onto the top worm 71 of the plodder. As the plodder operates the soap fills the upper cylinder and is pressed through the foraminous plate and the backing up plate into the vacuum chamber 87 where it is cut off and allowed to fall onto the lower worm 73. The particles are again compressed by that worm into a compact mass which extrudes as a bar from the nozzle plate. The plodder barrels are not allowed to rise to a temperature exceeding about 90° F. and preferably are kept around 75 to 80° F. The vacuum chamber is kept under about 24 to 26 inches vacuum. By keeping the plodder nozzle at a temperature around 132 to 135° F., the bar is given a smooth polished appearance. The bar, which has a cross-section about 1 inch by 2½ inches, is cut into desired lengths, conditioned to facilitate pressing and subsequently pressed.

Example II

Into a steam jacketed 200-pound horizontal crutcher is flowed 191 pounds of a kettle soap made from a blend of fats containing 75% tallow and 25% coconut oil to which are added 3¼ pounds N-silicate, 4 pounds NaCl, 10 ounces citronella type perfume and 10 ounces titanium dioxide. The crutcher mixture is then treated as Example I. The silicate serves as a preservative, the NaCl as a hardening and whitening agent and the titanium dioxide as a whitening agent. The cakes produced are substantially pure soap with high moisture content of about 30%.

Example III

A crutcher mix is prepared consisting of about 68% kettle soap, 27% N-silicate, 2% NaCl and 3% soda ash. The kettle soap, which is a blend of 75% tallow and 25% babassu oil soaps, is flowed into the crutcher, the N-silicate is added followed by a slurry of the soda ash and finally the salt in dry form. The shaft 21 is rotated during the addition of the various ingredients. There is no separation or precipitation of silicate lumps in the soap in the crutcher. The crutcher mix is treated in the same manner as described in Example I. The extruded bar contains about 40.5% moisture, presses well after conditioning, has a translucent white appearance similar to milled toilet soap, does not warp or distort on aging and dissolves in water at about the same rate as milled soap.

Example IV

Kettle soap made from a blend of 75% tallow and 25% coconut oil is mixed in a crutcher with a silicate mix in the ratio of about 68 parts by weight of kettle soap to 31.5 parts silicate. The silicate mix contains about 82.5% N-silicate, 10% trisodium phosphate and 7.5% soda ash. Titanium dioxide (0.5 part) is added during crutching. The mixture is treated as described in Example I. The finished cakes contain about 37% moisture.

Example V

61.5 parts kettle soap and 32.9 parts silicate mix of the same type used in Example IV were crutched with 5 parts Snowflake White (ground marble), 0.3 part titanium dioxide and 0.3 part citronella type perfume. The crutcher mix was treated as described in Example I, yielding firm bars of good appearance containing about 37.4% moisture and having a density of about 1.2.

Example VI

73 parts kettle soap made from tallow are crutched with 27 parts silicate mix of the same composition as that used in Example I. The crutcher mix is treated in the manner described in Example I. The extruded bar is firm, despite a moisture content of about 37%, has good appearance and is pressed after conditioning in air at room temperature.

Example VII

43 parts kettle soap made from tallow and 30 parts kettle soap made from a blend of tallow and rosin (about 38% rosin soap and 62% tallow) are crutched with 23 parts of silicate mix having the same composition as that of Example I, and about 4% dry NaCl. The crutcher mix is treated in the same manner described in Example IV. The bar produced contains about 7.2% rosin soap and 34% moisture.

Example VIII

61.5 parts kettle soap made from a blend of 75% No. 5 tallow and 25% coconut oil foots is crutched with 33.65 parts N-silicate, 2.5 parts trisodium phosphate, 1.9 parts soda ash, 0.3 part citronella type perfume and 0.15 part laundry brown color. The crutcher mix is treated as described in Example I. The bar has the usual color of yellow laundry soap made by the framing process except that there is a translucency or sheen to it which is not found in framed soaps. It dissolves in water faster than framed soaps of

comparable composition. It ages without distortion or warping.

Example IX

74.79 parts kettle soap made from a blend of 90% tallow and 10% babassu oil is crutched with 25 parts finely ground pumice, 0.2% perfume and 0.01% lamp black. The crutcher mix is treated as described in Example I. Pumice soap made by the process of the invention may contain up to about 40% pumice (dry basis).

By the above described method of manufacture, laundry and household soap bars having the appearance and general properties of a milled soap, but having a high percentage of moisture and, if desired, addition agents such as builders, fillers, etc., can be made and handled satisfactorily. Pure soap bars without builders and suitable for general household use can be provided which have a moisture content as high as about 36%. Built laundry type soap bars having desired amounts of builders, fillers, etc., can be provided with a moisture content, exclusive of any water of crystallization, as high as about 41%. The bars of soap embodying the present invention and made by the described process are improved not only in appearance, as compared to the usual framed soap bars, but also in other important features such as quality, aging properties, resistance to warping and distortion, more rapid solubility, etc.

The new soap bars have an appearance much closer to that of a toilet soap than a framed soap. The soap bar or cake has a smooth glossy surface much like milled toilet soaps and a certain translucency not present in a framed cake having the same composition. There is a distinct difference in the texture of framed soap and the new plodded soap. The new soap has a grain in the direction of extrusion which, while not noticeable, can be developed by wracking or twisting a comparatively fresh bar back and forth several times around the axis of extrusion. This causes the soap to cleave along generally parallel longitudinal lines, as indicated in Fig. 2. This bar had been exposed to air for about 24 hours before it was grasped at its ends and twisted. The cracks were dusted with carbon black so as to make them stand out in the photograph. A bar of soap cut from a frame of soap after standing a similar length of time before wracking in the same way breaks along random lines usually generally angularly from corner to corner. This difference in texture is also noticeable if comparable bars are bent sufficiently to fracture. The new soap when broken across the grain shows a conchoidal fracture of which Fig. 3 is typical whereas framed soap, regardless of the direction of break, shows a granular fracture of which Fig. 4 is typical. The remarkable flexibility and tenacity of the new soap is illustrated in Fig. 5 which shows a bar of freshly extruded soap bent almost double without breaking off. The grain structure is evident not only in the conchoidal surfaces of the edge cracks but also in the middle regions where the soap stretched under the tension stresses. A comparable piece of framed soap breaks cleanly when bent only a few degrees.

The increased rate of solubility possessed by the new soap is particularly of advantage, as compared to a framed bar of the same composition, since this makes possible a more rapid formation of suds, which is considered desirable by most housewives. Various tests may be used to determine relative rates of solubility. A very

satisfactory test, developed in the organic chemicals laboratory of my assignee, comprises determining the electrical conductivity of a solution in distilled water of 0.3% concentration of each soap being tested and then swirling a cylinder of soap of fixed dimensions by means of a motor driven arm in distilled water until its conductivity corresponds with the predetermined value for that soap. The respective lengths of time required to reach this value are indicative of the relative rates of solubility of the tested soaps. A soap comprising 54% kettle soap (90% tallow and 10% coconut oil), 6% polyphosphate, 34.75% N-silicate, 3% soda ash, and 2.25% trisodium phosphate when framed required about 9 minutes whereas when chilled and plodded required only about 4 minutes to reach the value, indicating the greatly increased solubility of the new soap. The time varies greatly with composition, e. g., a chilled and plodded soap comprising 60% kettle soap (75% tallow, 25% coconut oil), 34.75% N-silicate, 3% soda ash and 2.25% trisodium phosphate required only 1.7 minutes to reach the value, but practically the same relative difference in solubility rate obtains for plodded vs. framed soaps of the same composition. An important advantage of the invention in times of short coconut oil supply is that the coconut oil content can be greatly reduced without adversely affecting rate of solubility. Thus, a plodded soap made from a blend of 75% tallow and 25% coconut oil was found to dissolve at about the same rate as a framed soap made from a blend of 45% tallow and 55% coconut oil.

The increased solubility appears to be imparted in the plodding operation and not to be dependent on the rate of cooling. Thus a framed soap, like that requiring about 9 minutes to reach the predetermined conductivity value was henkled, plodded, retested for solubility rate and found to require only about 4 minutes to reach the same value. The solubility rate also seems to be unaffected by the vacuum, plodded soaps made with and without vacuum having approximately the same rate of solubility.

A very important property possessed by soap made by the present process which distinguishes it from a framed soap bar of like composition is the ability to age and lose moisture without warping or distortion. Bars of soap having high moisture content as made dry out on aging and with loss of moisture they necessarily decrease in size. This is true of framed soap and soap of the present invention but there is a distinct difference in shrinkage characteristics. In cakes of soap of the present invention shrinking is much greater across than along the grain. Since the cross-section of the extruded bar usually corresponds to the width and thickness of the cake, the shrinkage in width and thickness is greater percentage-wise than in length. Careful measurements on aged bars of the new plodded soap showed an average shrinkage in length of about 5.8% as compared with about 10% in width and thickness. Framed bars, on the contrary, showed an average shrinkage in length of about 13.5% and in width and thickness of about 11%. The most pronounced difference is that the bars of the invention shrink without warping or distortion whereas framed bars almost invariably warp and distort badly.

Outstanding advantages from a manufacturing standpoint of the process of the present invention result from the elimination of scrap, the reduction in labor and handling costs, and the reduction in floor space required. The high scrap

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losses which are inherent in the framing process are eliminated by the present process in which the amount of scrap is no higher than in the ordinary milling process. Any scrap formed can be immediately worked back into the line without loss of any appreciable time. The number of men required for the production of a given quantity of soap by the present process is substantially reduced as compared with the framing process. The new process requires not more than about 20% of the floor space required for producing the equivalent amount of soap by the framing process.

Although the present invention has been described and illustrated in connection with certain apparatus and specific examples, it will be understood that modifications and variations can be made without departing from the scope of the invention as defined in the following claims.

I claim:

1. The process of making dense high moisture plodded soap cakes which comprises rapidly chilling a molten soap mixture having a moisture content of about 20% to 40% to form a film of solid soap at a temperature of about 70° to 120° F. and while maintaining substantially said moisture content, shredding said film into ribbons, forcing said ribbons under pressure through a foraminous plate into an evacuated space maintained under a vacuum of at least about 20 inches of mercury, said soap passing from said space directly into a plodder, plodding said soap at a temperature within said range to form a continuous bar, and cutting said bar into cakes.

2. The process of making cakes of dense soap of high moisture content which comprises cooling a molten soap mixture containing about 20% to 40% moisture to a temperature within the range of about 70° to 120° F. and thereby converting it to solid form while retaining substantially said moisture content, introducing particles of said solid soap into a plodder through a space maintained under a vacuum of at least about 20 inches of mercury, plodding said particles at a temperature within said range whereby they are compacted into a continuous bar, and cutting said bar into cakes.

3. The process as set forth in claim 2 in which said molten soap mixture consists essentially of soap, 20% to 40% moisture, and an amount of preservative sufficient to retard rancidification.

4. The process as set forth in claim 2 in which said molten soap mixture consists essentially of soap, up to about 30% of addition agents from the group consisting of water soluble alkali metal silicates, alkali metal carbonates and alkali metal phosphates to form a laundry bar composition, and about 30% to 40% of moisture.

5. The process of making cakes of laundry soap which comprises crutching kettle soap with at least one builder from the group consisting of water soluble alkali metal silicates, alkali metal carbonates and alkali metal phosphates to form a molten mixture of laundry bar composition having a moisture content of about 30% to 40% exclusive of any water of crystallization, cooling said mixture against a cold surface to solidify it as a film of substantially the same moisture content, removing said film of solid soap from said surface at a temperature of about 70° to 120° F., forcing said solid soap without milling through a foraminous plate into a space maintained under a vacuum of at least about 20 inches of mercury, introducing the soap while still under said vacuum into a plodder, plodding said par-

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ticles at a temperature within said range to compact them into a dense continuous bar, and cutting said bar into cakes.

6. The process as set forth in claim 5 in which said kettle soap includes rosin soap in such amount that the final bar contains up to about 7% by weight thereof.

7. The process as set forth in claim 5 in which said molten mixture has a builder content comprising principally sodium silicate with minor proportions of sodium phosphate, sodium carbonate and sodium chloride.

8. The process of making cakes of plodded pumice soap which comprises crutching molten kettle soap with up to about 40% by weight (dry basis) of powdered pumice, rapidly cooling the crutcher mix to solid form at a temperature within the range of about 70° to 100° F. while substantially maintaining the moisture content, feeding said solid soap in the form of particles through a space maintained under a vacuum of at least about 20 inches of mercury into the inlet of a plodder, plodding said soap within said temperature range to form a continuous bar, and cutting said bar into cakes.

9. The process of making dense unbuilt high moisture plodded soap cakes which comprises rapidly chilling molten kettle soap to solid form at a temperature within the range of about 70° to 100° F. while maintaining substantially its moisture content, feeding said soap in the form of filamentary particles through a space maintained under a vacuum of at least about 20 inches of mercury into the inlet of a plodder, plodding said soap within said temperature range to form a continuous bar, and cutting said bar into cakes.

10. A cake of dense high moisture plodded soap produced in accordance with the process of claim 2.

11. A cake of dense high moisture plodded soap produced in accordance with the process of claim 5.

12. A cake of dense high moisture plodded soap produced in accordance with the process of claim 6.

13. A cake of dense high moisture plodded soap produced in accordance with the process of claim 8.

14. A cake of dense high moisture plodded soap produced in accordance with the process of claim 9.

15. The process of making cakes of laundry soap which comprises rapidly chilling a molten soap mixture of laundry bar composition having a moisture content of about 30% to 40% exclusive of any water of crystallization to solid form at a temperature within the range of about 70° to 100° F. while substantially retaining the moisture content, passing said solid soap in the form of particles through a space maintained under a vacuum of at least about 20 inches of mercury into the inlet of a plodder, plodding said soap within said temperature range to form a continuous bar, and cutting said bar into cakes.

16. A cake of laundry soap produced in accordance with the process of claim 15.

17. The process of making dense high moisture plodded soap cakes which comprises rapidly chilling a molten soap mixture having a moisture content of kettle soap to form a film of solid soap at a temperature of about 70° to 120° F., and while maintaining said moisture content substantially constant, shredding said film into ribbons, forcing said ribbons under pressure through a foraminous plate into an evacuated space

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maintained under a vacuum of at least about 20 inches of mercury, said soap passing from said space directly into a plodder, plodding said soap at a temperature within said range to form a continuous bar, and cutting said bar into cakes. 5

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