Jan. 17, 1950 D. E. MARSHALL 2,494,891

PROCESS AND APPARATUS FOR MAKING FLOATING SOAP

Filed May 2, 1945 2 Sheets-Sheet 1

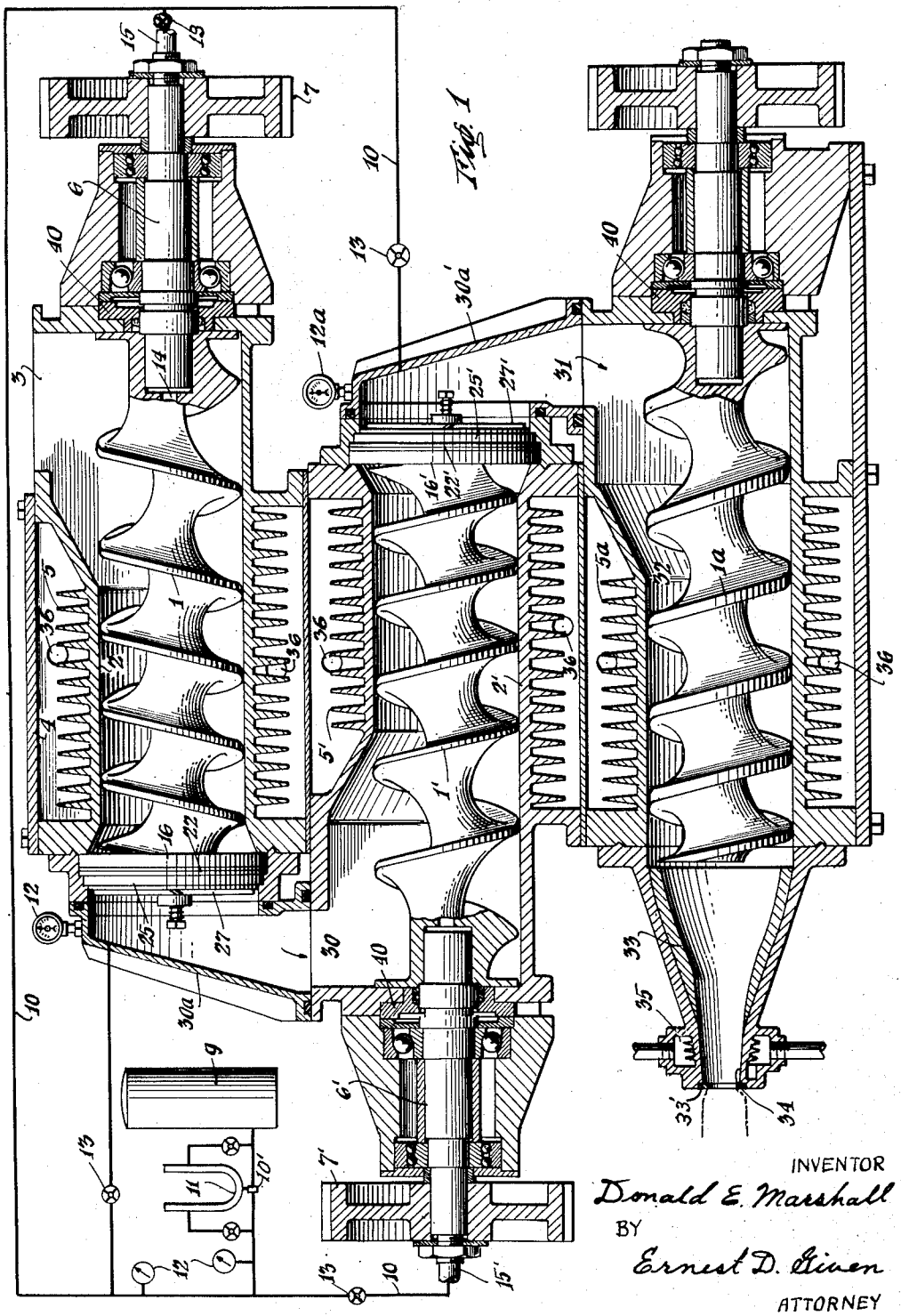

Fig. 1

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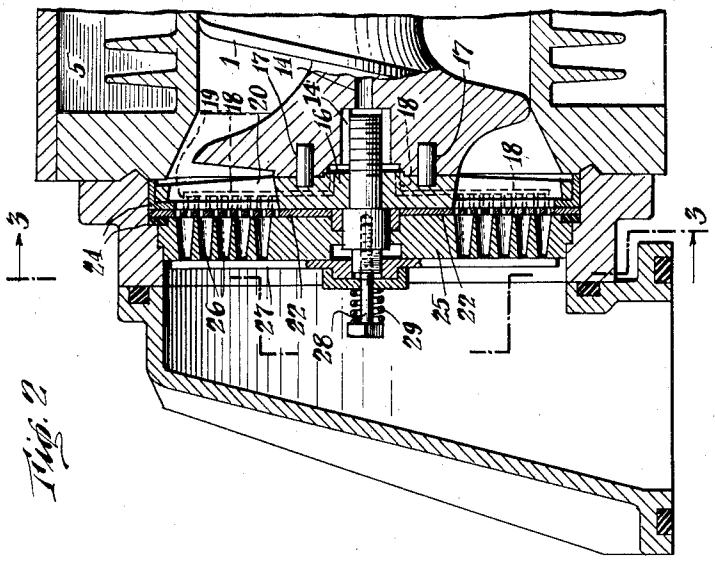

Fig. 2

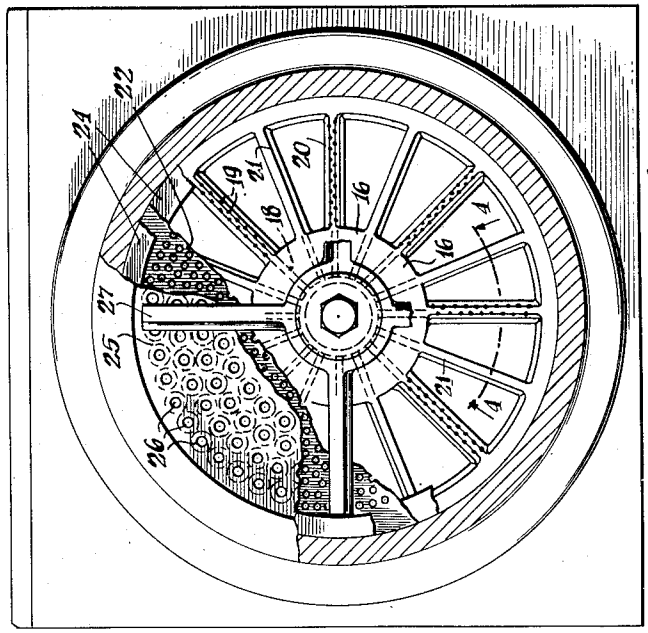

Fig. 3

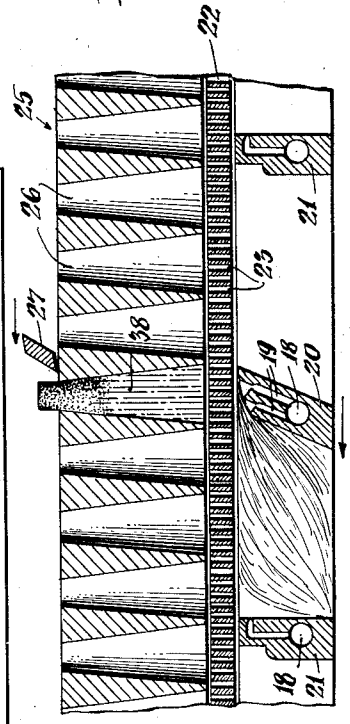

Fig. 4

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UNITED STATES PATENT OFFICE

2,494,891

PROCESS AND APPARATUS FOR MAKING FLOATING SOAP

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14 Claims. (Cl. 252—367)

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This invention relates to an important improvement in soap manufacture. With this invention floating toilet soap is produced that has texture and plastic characteristics that have been present heretofore only in fine hard-milled soaps.

Soap finishing processes can be compared to candy making to explain the importance of crystal formation. A hard-milled soap is like a smooth creamy fudge. Hot "framed" floating soaps, or, to a somewhat lesser extent, the new forms of "hot mixed" and quick-cooled low moisture floating soaps are like a "sugary" fudge. In both candy and soap, the temperature and the plasticizing govern the type of crystal formation, without any change in the formula of ingredients.

In order to obtain a smooth, plastic hard-milled bar of toilet soap, the milling and plodding of the soap must be performed in water-cooled equipment, which prevents general or local overheating. Milling plasticizes the crystals of soap, which had been formed on the flake-chilling rolls before the drying stage, and produces ribbons of a smooth amorphous micro-crystalline texture known in the trade as hard-milled soap, and scientifically as Beta phase crystal structure. When a plasticized, milled textured soap mass is overheated, it reverts to a hard crystal structure and loses much that has been gained by milling. The conventional way of incorporating air in low-moisture, floating soaps is by working air into the soap while it is heated above a point where it is fluid enough to "beat" and then, in some instances, quickly cooling while it is still being mixed. This does not produce the desired results of good water-cooled milling of the present invention, but yields a different soap structure which is not like the present moldable plastic milled soap which, because of its crystalline structure, cannot be stamped into toilet soap tablet shapes.

With the present invention smooth, plastic textured ribbons are taken from the conventional milling process and are passed through a special multi-barreled, water-cooled plodder in such a manner that finely divided bubbles of air are incorporated in the soap without "working" or "beating" the soap mass materially. In this way the crystalline structure that would result from overheating is avoided.

In carrying out this invention a milled soap mass is plodded and extruded into very fine threads of, say about 0.030" diameter without materially elevating its temperature, and a measured, though very small amount of air is introduced within this finely shredded soap mass. Then while the soap is kept under regulated air

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pressure, the shredded soap mass is compacted progressively so as to become hard without allowing the escape of the occluded air.

The stages of successive shredding, aerating and compacting are repeated one or more times to provide uniformity. Then the aerated mass of soap is extruded through a nozzle and a sizing plate to obtain the cross-section that is desired for the cut bar, preliminary to stamping.

In carrying out the process, the soap is repeatedly shredded, aerated and compacted under moderate air pressure, and the air is not allowed to escape at any step, until the air is uniformly dispersed and locked into the milled soap mass, without materially elevating the temperature of the soap. Overheating is avoided by the minimized "working" of the soap mass and by utilizing water-cooling to dissipate the heat of friction along the plodder barrel and worm.

It is well known in this art that the process of de-aeration consists of reducing a liquid cream or plastic material to be de-aerated to a finely divided form and then subjecting the finely divided material to a vacuum.

With the present invention air is occluded in soap by adapting this procedure of first reducing the plastic soap mass to threads, and then injecting air into the threads and slowly compacting the same under air pressure.

In carrying out the present invention for manufacturing milled floating soap, conventional practices are used for processing the soap up to the plodder stage. With such processes kettle soap is passed over chilling rolls to congeal and deliver the soap in ribbons onto a screen conveyor of a drying oven where moisture is removed under moderate heat and ventilation, so that the flakes are dried as uniformly as possible to a moisture content of approximately 10–18%, depending on the quality of the finished bar desired. The dried flakes are then mixed with the desired perfume and preservatives and milled to an extensive degree and at reduced temperatures.

The extensive milling to which I refer is obtained by passing the flake mixture through two sets of Lehman #916 5-roll steel mills in tandem, set closely and so as to get good coverage and yet deliver only 3,000#—3,300 pounds per hour of milled ribbons. Also, I prefer to keep the cooling water so that the ribbons are maintained at room temperatures—approximately 70° F. All of this is conventional practice where high quality fine textured hard-milled toilet soap is manufactured, but particular emphasis is placed on the

temperatures necessary to get the micro-crystalline amorphous texture desired.

These milled ribbons are then fed to an aerating plodder, in accordance with this invention in which

Fig. 1 is a longitudinal view partly in section through an illustrated embodiment of the invention, parts being shown diagrammatically;

Fig. 2 is a broken-away section of Fig. 1 shown on a larger scale;

Fig. 3 is a section along the line 3—3 of Fig. 2;

Fig. 4 is a section on a large scale along the line 4—4 of Fig. 3.

In the drawings, reference character 1 indicates a screw that is revolubly located in the barrel 2 of a plodding machine that is provided with a feed opening 3. A cooling jacket 4 surrounds the barrel 2 and fins 5 are provided in this jacket.

A drive shaft 6 is attached to the worm 1 and a pulley 7 is provided on the shaft. A compressed air supply 9 is provided with air lines 10, a calibrated orifice 10', a manometer 11, gauges 12 and valves 13 and supplies compressed air in regulated amounts as indicated.

A longitudinal central opening 14 is provided in the worm 1 and an inlet tube for the compressed air with a proper gland is connected to the outer end. A comminuting head 16 (Fig. 3) is connected by pins 17 (Fig. 2) so as to revolve with the worm 1. Radial channels 18 are provided in the head 16 and communicate with axially-extending branches 19. These channels also communicate with the central opening 14 through ports 14'. The channels 18 extend inside of the comminuting blades 20 and 21 of the head 16.

A foraminous plate 22 (Fig. 2) with numerous small holes 23 therethrough is anchored by clamping rings 24 which hold it in close proximity to the head 16. A thick pressure plate 25 which serves as a backing for the plate 22 is provided. It is anchored in contact with this plate. Conically-shaped openings 26 extend transversely through the pressure plate 25. Cutter blades 27 which are attached so as to revolve with the screw 1 are in contact with the outer side of the pressure plate 25. A stud screw 28 and spring 29 are provided to keep the blades 21 resiliently in place.

The passageway 30 provided by an airtight removable closure 30a extends from the exit end of the first plodder to a second stage plodder that is like it. Corresponding parts of this plodder are referred to by the same reference characters with primes, as used above. A passageway 31 also provided by an airtight removable closure 30'a leads from the exit end of the second stage plodder to the barrel 32 that is provided with a worm 1a.

At the outlet of barrel 32 a converging section 33 is provided with a sizing and shaping outlet 34 having an orifice 33' that is shaped in such a manner that the cross-section of the soap that is extruded therethrough has the desired shape and size. Reference character 35 indicates a heater at the end of section 33.

Reference character 36 indicates tubes for circulating cooling water in contact with the fins 5, 5' and 5a to keep the soap that is being treated at the proper temperature.

The enlarged partly broken away detail, Fig. 4, shows how the blades 20 of the comminuting wheel 16 wipe the soap and air that is introduced through channels 19 through holes 23. The blades 21 scrape the plate surrounding these openings clean. This Fig. 4 also shows how the extruded threads 38 of soap are compacted gradually as they pass through the tapered holes 26 of the pressure plate 25. This figure also shows how the threads become integrated before they emerge and are cut off as compacted pellets by the blades 27.

Glands 40 are provided on the worm shafts 1, 1' and 1a to prevent the escape of air.

In carrying out this process the milled soap ribbons produced as described above are fed to the first plodder stage through opening 3 and are compacted by worm 1 into a solid soap mass and the pressure developed in forcing the soap through the pressure plate 25 effectively seals the space between worm 1 and barrel 2 so as to prevent backward escape of air that is introduced through the comminuting head 16. This head 16 works the soap mass through the foraminous plate 22, which is provided with holes or openings 23' (Fig. 4), assisted by the pressure developed by the worm 1. The blades 20 are so inclined that the soap mass is positively forced through the openings 23. At the same time air entering through branches 19 is pocketed as small bubbles in the soap threads. The exits of the air orifices are offset so that bubbles of air are entrained with the flowing soap.

The edges of the blades 21 are at right angles to the plate 22 so that the surface of this plate is scraped clean of obstructions as very frequent intervals. Also, air is introduced at the trailing edges of these blades 21 so as to distribute the air more evenly in the soap mas. In order to obtain a uniformly textured soap, the plate 22 should have about 300 to 400 holes per square inch and this plate is about 18 gauge metal.

The extruded and aerated threads leaving the holes 23 pass into the conical openings 26 in the pressure plate 25 where this restriction is sufficient to compact the aerated threads into pellets. The pressure in exit chamber 30a is sufficient to prevent de-aeration of these pellets.

In order to aerate the soap to the degree of fineness desired, one or more additional aerating stages may be utilized as indicated by barrel 2' and worm 1' which operate similarly to the preceding one. However, in this stage the feed is already under pressure and leakage near the shaft is prevented by packed gland 40.

When the aerated soap, which is still held under the desired pressure, enters the final plodding stage it is gradually compressed by the worm 1a which is shaped so as to compress the soap sufficiently so that when the mass reaches the exit end it is well compacted and is extruded as a homogenous stream which is free from cracks or striations. The soap then has a structure that retains the exceedingly fine particles of air, even though a certain amount of expansion takes place as the soap stream leaves the orifice plate 33'.

With this multi-stage plodder the soap mass is processed without heating the soap materially since the soap is preferably kept at a temperature below 80° F. during the plodding and aerating operation.

The floating milled soap produced by this process, possesses most of the qualities imparted by low-temperature hard-milling; it can be stamped or molded into tablet shapes, and in addition possesses the quick solubility and white color of high quality floating soaps.

With this invention soap is compacted around small air particles instead of air particles being

beaten into the soap mass. The resulting product is an extruded uniformly aerated soap that has not been heated enough to make it sticky. Therefore it can be immediately cut and stamped after it has been produced without any need of further drying or cooling.

While this invention is particularly described in connection with making a low moisture floating soap, it is obvious that it can be used in different ways. For example, it may be used to produce a high moisture, say between 18% and 30% floating soap that has not been milled nor dried to milled soap water content, by extruding chilled ribbons of such soap and by omitting most or all of the drying and all of the milling operation. Also, an aerated laundry bar formulated in the usual manner using "builders" and having a moisture content of between 18 and 42 per cent can be extruded from chilled ribbons of such soap by omitting most or all of the drying and all milling operation. In the latter case the resulting soap may not float but the aeration increases the size of the bar and produces a desirable texture.

In the case of "built" laundry soap the ingredients must be strained through a very fine screen before chilling so as to avoid stopping the holes in the plodder plate **22**.

In some cases of formulas containing over 18% moisture it may be necessary to "skin dry" the extruded and cut soap before stamping.

What is claimed is:

1. In an apparatus for homogenizing, compacting and extruding a material such as soap, the combination which comprises a plodder having a barrel and a worm operating in the barrel for compacting and feeding forward a material supplied to the plodder, a comminuting head located at the end of the worm for spreading the material being fed forward by the worm, a drive for said comminuting head, a foraminous plate located behind the comminuting head and upon which the material is spread and then forced through by said comminuting head, means located at the comminuting head for injecting a compatible gas into the material as said material is spread on and forced through the foraminous plate whereby particles of the gas are incorporated in and uniformly distributed throughout the material.

2. An apparatus as defined in claim 1, including mechanical compacting and extruding means for integrating the material discharged from the foraminous plate under mechanical pressure, a sealed, pressurized chamber connecting said lastmentioned compacting means with the discharge side of the foraminous plate and means for supplying a gas to said pressurized chamber whereby the material being compacted may be maintained under pressure to prevent the escape of the gas particles incorporated in the material due to the mechanical pressures of compacting and extruding the material.

3. An apparatus for homogenizing, compacting and extruding a material such as soap, which comprises the combination of a plodder having a barrel and a worm operating in the barrel for compacting and feeding forward a material supplied to the plodder, a comminuting head including a radially extending blade located at the end of said worm for progressively spreading the material being fed forward by the worm, a drive for said comminuting head and a foraminous plate located behind the comminuting head and upon which the material is spread and forced through by the blade of the comminuting head, said blade having outlet ports connected to a supply of gas along one face thereof for injecting a gas into the material spread on and forced through the foraminous plate whereby particles of the gas are incorporated in and distributed throughout the material.

4. An apparatus for homogenizing, compacting and extruding a material such as soap, which comprises the combination of a plodder having a barrel and a worm operating in the barrel for compacting and feeding forward a material supplied to the plodder, a comminuting head including a radially extending blade located at the end of said worm for progressively spreading the material being fed forward by the worm, a drive for said comminuting head and a foraminous plate located behind the comminuting head and upon which the material is spread and forced through by the blade of the comminuting head, said blade having outlet ports connected to a supply of gas along one face thereof for injecting a gas into the material spread on and forced through the foraminous plate whereby particles of the gas are incorporated in and distributed throughout the material, a mechanical compacting and extruding means for integrating the material discharged from the foraminous plate under mechanical pressure and a sealed chamber connecting said mechanical compacting means with the discharge side of the foraminous plate, said chamber being connected to a supply of gas under pressure for maintaining a gas pressure in said chamber to prevent escape of the particles of gas incorporated in the material under the pressures of the mechanical compacting.

5. An apparatus as defined in claim 4 including a cutter located on the discharge side of the foraminous plate and a drive for said cutter.

6. An apparatus for aerating and extruding a material such as soap without beating or appreciably working the mass of said material, comprising an extrusion worm operating in a plodder barrel for initially compacting and feeding a particulated material, a comminuting head associated with said worm for moving compacted material across the openings in a foraminous plate and to spread said material and force it into said openings, a gas-introducing means for causing gas to be introduced into said openings together with said material whereby particles of the gas are enveloped by said material forming aerated shreds of the material being forced through openings in said foraminous plate, a sealed chamber for receiving the aerated material passing through said foraminous plate, means for mechanically compacting and extruding said aerated material and means for maintaining gas pressure in said sealed chamber for preventing escape of the gas cells under the mechanical pressure of compacting and extruding said material.

7. An apparatus as defined in claim 6, wherein said gas is introduced through openings in the blades of said comminuting head so as to be entrained with the materials in the openings of said foraminous plate.

8. Apparatus for aerating and compacting a material such as soap which comprises a plodder having a barrel and a worm operating in the barrel for compacting and feeding forward a material supplied to the plodder, a foraminous plate at the end of the worm, a comminuting head rotatable with said worm including alternate spreading blades and cleaning blades, each spreading blade having a forwardly inclined leading face operating to progressively spread the material being fed forward by the worm over

the foraminous plate and force the same therethrough and having gas supply passages with outlet ports on said inclined leading face for injecting gas into the material spread on and forced through the foraminous plate, and said cleaning blades operating to scrape the surface of the foraminous plate clean and having gas supply passages with outlet ports on the trailing side thereof for distribution of gas in the soap mass, whereby particles of gas are incorporated in and distributed through the material.

9. A process for aerating milled soap, comprising the steps of continuously compacting unheated milled soap chips and progressively feeding said compacted soap chips forward, shredding and aerating the soap by forcing the compacted soap through openings in a foraminous plate extending across the direction of flow of said soap and forcing particles of gas with the soap through said openings whereby the particles of gas are enveloped by said soap to form aerated shreds of said soap, maintaining gas pressure on the gas containing soap shreds leaving said plate to retain occluded gas, and then mechanically compacting said shreds into bars of aerated milled soap which float, said process being carried out while maintaining the soap in solidified condition.

10. The process of claim 9, wherein said aerated shreds are mechanically compacted under gas pressure, said gas pressure opposing the escape of gas cells from said aerated shreds due to said mechanical compacting until a sufficient mass of said shreds is integrated to prevent such escape, and then extruding the soap as uniformly aerated milled soap which floats.

11. The process of claim 9, wherein the temperature of the unheated milled soap chips is kept below 80° F. during the shredding and aerating whereby the aerated soap retains the micro-crystalline state and compactness of a hard milled soap.

12. The process for continuously producing an aerated soap having the compactness and crystalline structure of a milled soap which comprises the steps of progressively compacting milled soap flakes into a mass and feeding the compacted soap mass forward, then shredding the soap mass while maintaining the soap in solidified condition

by progressively spreading the compacted soap mass on a foraminous plate, forcing it through the openings in said foraminous plate to form threads or shreds while simultaneously supplying a gas to and occluding particles of gas in the soap threads or shreds, and mechanically compacting and extruding the soap threads or shreds with particles of gas occluded therein while maintaining the soap under a gas pressure sufficient to prevent escape of the gas particles from the compacted mass due to the pressure of said mechanical compacting.

13. The process of continuously producing an aerated soap which comprises compacting a soap stock into a uniform mass while feeding the compacted mass progressively forward, shredding said compacted mass of soap stock by progressively forcing the soap stock through a foraminous plate while maintaining the soap stock in solidified condition and supplying a gas thereto adjacent to said foraminous plate and prior to passage therethrough, whereby a gas is passed through said foraminous plate with the soap to incorporate and uniformly distribute particles of gas in the soap shreds, then mechanically compacting the comminuted and aerated soap shreds into a uniform, integrated mass while maintaining the soap under a gas pressure sufficient to prevent escape due to the mechanical pressures of the compacting of the occluded gas particles and then extruding said mass through a discharge orifice.

14. The process as defined in claim 13 wherein the aerated soap mass is cut and formed into finished bars as it is extruded.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
2,048,286	Pease	July 21, 1936
2,210,924	Hood	Aug. 13, 1940
2,295,594	Mills	Sept. 15, 1942
2,377,424	Ittner	June 5, 1945
2,398,776	Bodman	Apr. 23, 1946