July 19, 1960 G. MAZZONI 2,945,819

PROCESS OF DRYING SOAP

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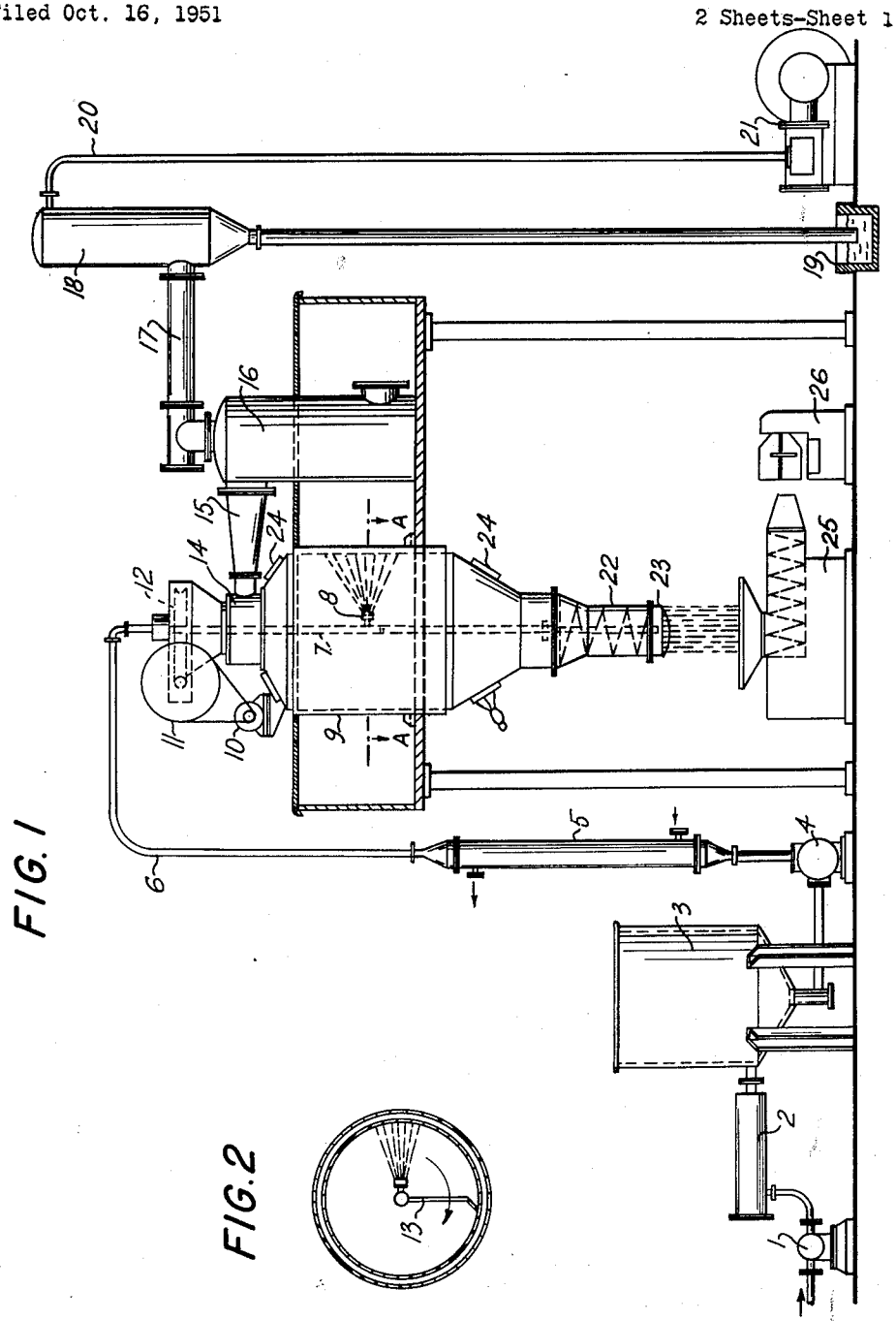

FIG. 1

FIG. 2

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FIG. 3

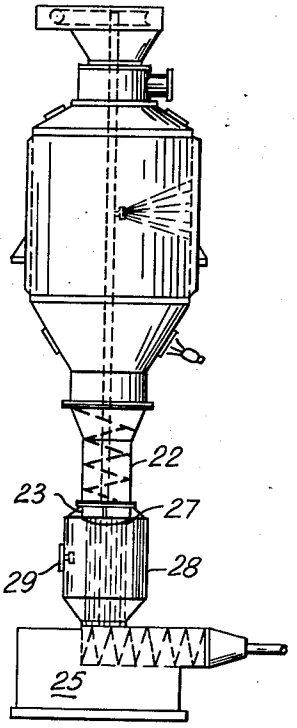


FIG. 4

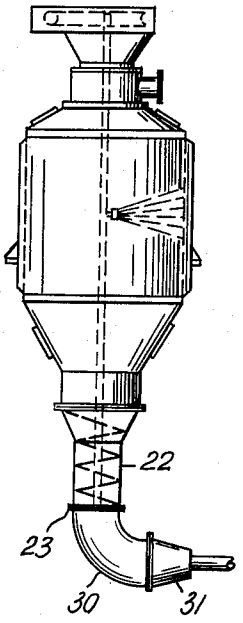


FIG. 5

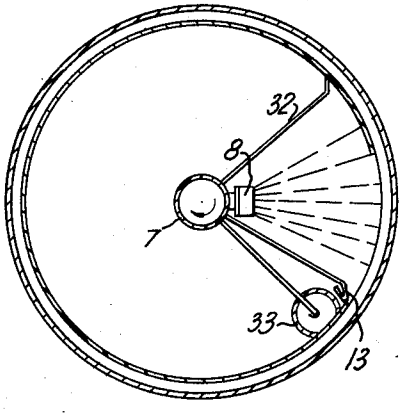
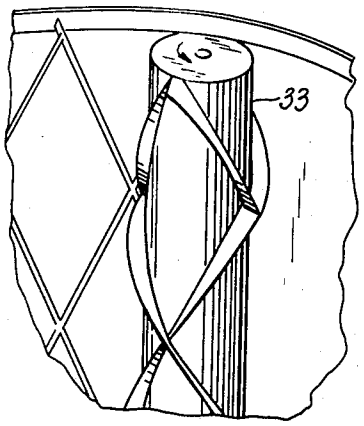


FIG. 6



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PROCESS OF DRYING SOAP

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6 Claims. (Cl. 252—367)

The present invention relates to a process and apparatus for drying, cooling, and deodorizing soap in continuous operation.

The present application is a continuation-in-part of application Serial No. 732,584, filed March 5, 1947, now abandoned and entitled Process and Apparatus for Drying, Concentrating and Distilling Products.

It is an object of the present invention to provide an apparatus which will dry, cool and deodorize soap in a single continuously operated apparatus.

It is a further object of this invention to provide one relatively small apparatus which in addition to drying, cooling and deodorizing soap can engrave said soap and perfume it in continuous operation.

It is a still further object of the present invention to provide an apparatus which can continuously dry, cool, deodorize, pulverize, perfume and form bars from soap.

The desiccation of soap is known to represent the fundamental and most difficult problem that the producer has to face and solve. In fact the quality and quantity of the soap produced is directly dependent upon proper desiccation of the soap. If this desiccation or drying step is not carried out properly, the soap may be oxidized thereby darkening and ruining this soap for commercial use. The quantity of soap production is obviously dependent on this drying step since this step is the slowest of all steps in soap production and therefore further production of the soap must wait for the conclusion of this step. This step is so slow because of the fact that the temperature of the drying air cannot be increased without correspondingly increasing other drawbacks such as oxidation of the soap.

Many processes and apparatuses have been invented for drying and cooling soap, the most interesting being those concerned with the pulverization of soap. It has been found by these pulverization processes that in order to obtain a regular product, one that is uniformly dried and cooled, the soap pulverization must be carried out in a working room in which the temperature and the pressure can be maintained at absolutely constant previously determined values.

The ideal working conditions of constant pressure and temperature is obtained practically, by effectuating the pulverization in a room wherein a certain degree of vacuuming has been established.

There are other advantages obtainable by the use of such somewhat evacuated room. Besides the drying of the soap it is possible to obtain a satisfactory cooling and deodorization of the product by means of the vacuum. Such cooling and deodorization is necessary where the desired product is to be a toilet soap.

The cooling is of course necessary in order to collect a solidified product which can be further processed into the form of a bar or any other desired shape.

It is not always possible however, even by use of the pulverizing step with constant conditions of temperature and pressure in the somewhat evacuated room, to obtain

a good commercial product. The products heretofore obtained were not always regular and identical.

The present invention enables us to obtain a good commercial product by the use of an apparatus which can continually process the soap from the time of its saponification to the final bar-formed soap. This continuous operation, without the soap leaving the apparatus, before being in final form, allows for the economical production of a commercial, regular, always identical product without any of the faults of prior known processes. The soap is uniformly dried, homogeneously throughout and pure white.

The processes and apparatuses heretofore known, even those utilizing the pulverization of the soap under vacuum, cannot turn out the regular fine commercial product which is produced by the present invention.

It has been found by the present invention that a perfect product can be obtained only by giving to the fluid saponified product sufficient heat content to evaporate all the water from such fluid soap so that the fatty acid content can be brought to the desired value. This is obviously necessary especially in toilet soaps since in the case of laundry or household soaps no drying but only cooling is necessary.

Toilet soap is known to have a fatty acid content between 78 and 80%. At the end of the saponification step, the undried fluid soap contains only about 62% fatty acid.

An apparatus to properly produce toilet soap must evenly and constantly supply the necessary heat to evaporate the water from the fluid soap to such degree as to yield a final product containing between 78 and 80% fatty acid. The systems heretofore used supply the necessary quantity of heat required to evaporate the desired percentage of water contained in the soap being treated, by means of hot surfaces. This was done for example by means of spraying the soap onto hollow drums, which revolve in a partially evacuated room, in which a heating medium is circulated. The soap film thus formed does not have a constant thickness and therefore does not dry evenly and homogeneously. Furthermore these apparatuses, due to the short distance between the spraying nozzle and the collecting surface, do not sufficiently decrease the temperature of the sprayed soap so as to avoid the calefaction effect. Such drying processes obviously cannot lead to a perfect final soap product because the variation of the thickness of the soap film changes the rate of desiccation of the soap leaving a product which is not uniformly dried.

The present invention provides an apparatus which spreads the sprayed soap uniformly on a drying and collecting surface and by having an adequate distance between the spraying nozzle and the surface on which the product is collected, the temperature of the soap as it reaches the collecting surface is lowered to such degree, corresponding to the degree of vacuum, that the calefaction effect is avoided entirely. The present apparatus utilizes a closed chamber having a proper degree of vacuum therein, an adequate distance between the spraying nozzle and the surface on which the sprayed soap is collected, and a proper pulverized jet (one having a finely granular structure of the particles forming the soap jet). By utilization of the above, the soap particles reach the collecting surface at a temperature corresponding to the existing degree of vacuum within the chamber.

It is also possible by the present invention to maintain the temperature of the collecting surface constant and approximately equal to the temperature of the sprayed soap as it reaches the collecting surface. This is accomplished by means of some heated or cooled medium, as the case may be, circulating through a jacket surrounding the collecting surface. In this manner, incidental differences of thickness of the soap film have no importance because

there is no evaporating effect on the collecting surface, nor any exchange of heat between the soap film and said collecting surface.

The thermal conductivity of soap is, in general, very low. Therefore, if an efficient transfer of heat between the heated surface and the soap film is desired, it is necessary to keep the thickness of the soap film as reduced as possible. The necessity for keeping the film of soap very thin presents the problem that any slight alteration in the thickness of the film will cause unevenness of drying and consequent faults in the final soap product.

It has been found that the temperature of soap solution steam at various pressures is practically equivalent to the temperature of steam from water alone at the same pressure. It is therefore possible to easily calculate the temperature of the soap film by knowing the degree of vacuum in the chamber.

The fluid soap stream must be submitted to a convenient heating by means of a proper preheater before the fluid soap reaches the spray nozzle. This is necessary in order to give to the fluid soap the required heat content, during the serial path of the fluid soap coming out of the spray nozzle and running towards the collecting surface. It is the water vaporization from the hot fluid soap, which has been heated by the preheater, that causes the lowering of the temperature of the soap down to the desired temperature, which desired temperature is controlled by the degree of vacuum in the chamber. It is therefore necessary to have a sufficient distance between the spray nozzle and the collecting surface, so that, a sufficient amount of vaporization can take place, which will bring the fluid soap immediately down to the temperature which will correspond to the degree of vacuum utilized in the chamber.

It has also been found that, by operating at a sufficient degree of vacuum, the vaporization of water from the fluid soap will be sufficient to drop the temperature of the soap to a temperature below its solidification point. The degree of vacuum should be controlled to the extent necessary to cause the fluid soap to drop to a low enough temperature to solidify on the walls of the collecting surface. It is then possible to collect the solid soap and further treat it by perfuming, if desired, and finally extrude it in the shape of a bar.

Therefore, in order to obtain the desired solidification of the fluid soap, with such amount of water evaporated therefrom that the solid soap has the desired percentage of fatty acid content, it is necessary to operate at a degree of vacuum corresponding to the characteristics of the soap being treated. It has been found that for working, laundry or household soap having a normal fatty acid content but a low solidification point, a very high degree of vacuum should be utilized in the chamber. The above type soap is made by a mixture of raw materials having a low value, which is determined by the difference between the saponification value (NS) and the iodine value (NJ). For working, laundry or household soaps having a normal fatty acid content but a high NS—NJ, a lower degree of vacuum is required, i.e. one corresponding to about 40 mm./Hg. Of course a lower degree of vacuum is necessary for some dried or half dried household soaps and especially so for toilet soaps.

By the present invention it is possible to control the drying and the cooling of a fluid soap stream, previously heated to an adequate temperature by means of a proper preheater device, and the pulverization of the soap, by spraying it against an inner surface of a vessel in which a certain degree of vacuum is affected, according to the characteristics of the soap being treated, to such extent as to yield a solidified product at a predetermined temperature and having a predetermined quantity of moisture.

The present invention also provides means for perfuming the soap as it is leaving the chamber, thus avoiding the necessity of using separate apparatuses for the perfuming. The present invention also provides means for extruding the product in the form of small rods, vermicelli or if desired, bar-shaped, before or after perfuming.

The present invention further provides means whereby the soap, before its removal from the inner surface of the vessel, is shaped, scaled, or engraved by the use of a roller operating on the soap film before the soap film is scraped from the collecting surface of the vessel.

The process of the present invention for drying, cooling and deodorizing soap includes a step of treatment under vacuum without requiring a degree of vacuum exceeding that which is advantageously obtainable in industrial practice. This is done by means of a proper heating of the soap paste before feeding the same into the pulverizing apparatus. By this step the soap paste remains at this temperature extremely fluid and is led under vacuum through spraying nozzles from which it is rapidly spread on the collecting surface of a vessel.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a schematic diagram of an apparatus according to the present invention;

Fig. 2 is a partially sectional view of the structure of Fig. 1 taken along the line A—A and looking in the direction of the arrows;

Fig. 3 illustrates the apparatus in which the device for continuous perfuming of the soap may be seen;

Fig. 4 illustrates the apparatus having a device for directly extruding the soap in bar form without prior perfuming;

Fig. 5 is a partially sectional view of the apparatus of Fig. 1 taken along line A—A and looking in the direction of the arrows, showing the device according to the invention of producing soap scales; and

Fig. 6 is a detailed view in perspective of an engraving roller which may be used for obtaining said soap scales.

More precisely and referring to Fig. 1 the fluid soap, after having been produced by any normal saponification process, i.e. the usual boiling process, is sucked by pump **1**, electrically driven, and sent through the filtering box **2**, to the feed tank **3**. This feed tank **3** is jacketed as schematically shown in the diagram and the heating medium such as steam can be circulated in said jacket in order to maintain the soap at a temperature adequate for keeping it in fluid condition. Said tank **3** can also be provided with a stirring device i.e. crutchers, if a stirring action on the fluid soap is desired.

A pump **4**, electrically driven, takes the fluid soap from the feed tank **3** and pumps it to the preheater **5** where the soap temperature is brought up to a 100° C. or more depending on the type of soap to be treated and the final product. The heating step of the soap in the preheater is obtained by means of steam or other medium circulating around the nest of tubes placed, as commonly used in heat exchangers, inside said preheater in which fluid soap pushed by pump **4** passes through.

The rising of temperature of the soap passing through said preheater is regulated by controlling the temperature of the medium circulating inside the preheater through the nest of tubes.

Fluid soap coming out of preheater **5** and pushed by pump **4** reaches, by the feeding pipe **6** first the hollow shaft **7** pivoted inside the vessel **9**, and then the spray nozzle **8**, or a plurality of nozzles fitted on said shaft **7** and communicating with the inner part of the same shaft. It is not necessary for the chamber **9** and the shaft **7** running therethrough to be vertical. However, it is preferable to have such vertical arrangement as shown in

the diagram so that the soap sprayed from the nozzle 8 or a series of nozzles on shaft 7 may be more evenly distributed on the collecting walls of the vessel 9 and also to facilitate further treatment of the dried soap. The vertical arrangement allows for such more even spraying of the soap as the shaft 7 and nozzles attached thereto are continuously rotated. A particular coupling of the feeding pipe 6 to the upper part of the hollow shaft 7 assures the necessary packing and tightness.

The vertical shaft 7, pivoted inside the vessel 9, revolves on its axis and is driven by an electric motor 10 by means of the pulley 11 and the helicoidal couple 12. Thus, the fluid soap coming out of the nozzle 8 or a series of nozzles located on and communicating with the inner part of the hollow shaft 7 is sprayed continuously on the inner surface of the cylindrical portion of the vessel 9, where it is laid down as a film on the inner collecting surface of said vessel. The knife scraper 13, shown in Fig. 2, fitted on the shaft 7 and rotating together with said shaft and spray nozzles attached thereto, scrapes off from the inner surface of the vessel the soap film sprayed thereon.

The scraper 13 is fitted on the revolving shaft 7 ahead of the nozzle 8 (as shown in Fig. 2) so that it scrapes off the soap film from the inner surface of the vessel after the soap has been sprayed and has solidified thereon.

The vessel 9 which may be made of any suitable material such as steel, is a container preferably placed vertically for the reasons given above, on a supporting structure, as sketched in Fig. 1, having a central cylindrical zone and two conical zones at the extremities.

The central cylindrical zone may be jacketed so that a heating medium such as water, coming from any source, can be circulated around said cylindrical zone at a rate and temperature according to the working conditions required. As previously stated, the medium circulating in said jacket will be regulated so that it will have the temperature approximately equal to that of the sprayed soap after the water has instantaneously vaporized from said sprayed soap as the soap comes out of the spraying nozzle 8. The temperature inside the vessel 9 owing to this instantaneous vaporization of the water from the fluid soap runs about 20° C. Consequently, an abrupt drying and cooling of the sprayed soap is obtained.

As stated before, it is necessary to have a certain distance between the spray nozzle 8, fitted to the rotating shaft 7, and the inner collecting surface of the cylindrical zone of the vessel 9, where the sprayed soap is collected, in order that the soap particles can lose during their aerial path from the nozzle 8 to the collecting surface, the desired quantity of heat and percentage of moisture. This is of course controlled by the degree of vacuum. The above also works a remarkable deodorization of the sprayed soap and a soap is obtained which is very finely crystalline causing the soap to take on a mother of pearl-like aspect.

The danger of oxidation is also avoided because the treatment of this soap is thoroughly developed far from any contact with the atmosphere. The soap temperature drops abruptly, due to the vaporization of the water from the soap, thereby utilizing almost entirely the heat content of the sprayed fluid soap. This vaporization increases, as may be easily understood, the pulverizing of the soap in the course of treatment.

The upper zone of the vessel 9 is closed by a kind of dome 14, which communicates by pipe 15 with the powder separator 16. A vacuum pump 21 connected by pipe 20 with the barometric colum 18 which is connected to the pipe 17, pipe 17 being connected to the powder separator 16, exerts when in motion, in the interior of the vessel 9, the desired vacuum effect. The barometric column 18 is connected to the water container 19.

A plodder 22 which is vertical when the vessel 9 is vertical, is fitted to the lower part of the vessel 9 so that, as the soap which is removed from the inner collecting

surface of the vessel 9 by the scraper 13 falls down to the bottom of the container 9, it is immediately taken by the screw of said vertical plodder 22, which is driven along with and connected to the rotating shaft 7, and pushed against the perforated plate 23, from which said soap is extruded in form of small vermicelli-like rods.

In such manner the desired vacuum effect exerted in the interior of the vessel by means of the pump 21 can be maintained while the soap is constantly being extruded, because the plodder 22 forms a kind of plug which avoids contact between the interior of the vessel 9 and the surrounding atmosphere.

Calorific radiations can be satisfactorily transmitted inside the container 9 for increasing when necessary, the drying action on the sprayed soap. For such purpose the container 9 can be provided with some proper ports 24 as shown on Fig. 1, through which any kind of radiations such as infra-red rays, etc., coming from said proper radiating devices fitted outside said ports 24 can be conveyed inside the container 9 against the soap, in the course of treatment.

The soap, pushed outward by the vertical plodder 22 and coming out through vertical plate 23 shaped as small rods, falls continuously, if laundering or household soaps are wanted, into the hopper of a horizontal plodder 25, which transforms said little rods of soap into a continuous soap bar of any desired size and shape. For this work it is preferable to use a double screwed plodder type which, having two powerful counter-rotating screws, gives to the soap, a good degree of homogeneity.

The laundry or household ploddered soap bar pushed out of the plodder 25 passes continuously and directly with the facing automatic cutter 26, which can be any normal type, and by which the soap bar is continuously cut into cakes of any desired size.

If a perfumed toilet soap is desired, then the present invention provides for a different working step. Referring to Fig. 3, the small rods of soap pushed outward by the vertical plodder 22 through the perforated plate 23 are immediately cut by a rotating knife 27, driven by a prolongation of the axis of said plodder, the rods being cut into the form of thin sliced discs.

The sliced discs of soap then fall downward into the container 28 inside which a desired perfume is sprinkled or sprayed by means of a proper spray nozzle 29 so that said container is filled with a perfumed haze, the discs of soap falling downward being scented by absorption of the perfume.

The container 28 is tightly joined in this case to the horizontal plodder 25 which immediately and continuously transforms the scented discs of soap into a bar to be cut into cakes as heretofore described.

In addition to the apparatus above described, the devices 30 and 31 as shown in Fig. 4 are provided for extruding directly without the use of a horizontal plodder 25, bars of laundry or household soaps. In fact, referring to Fig. 4, the soap collected at the conical bottom of vessel 9, and pushed through the perforated plate 23 by the vertical plodder 22 and in the form of small rods, passes continuously inside the band of pipe 30 into the nozzle 31, from which the soap which is constantly pushed forward by the plodder 22, comes out extruded in the form of a continuous bar.

By the present invention, it is also possible to produce soap scales by the attachment of a proper device, the attachment being fitted as shown in Fig. 5 ahead of the knife scraper 13. As shown in Fig. 5 a blade 32 supported by a proper arm is fitted to the revolving shaft 7 in order to smooth the soap film sprayed on the inner surface of the vessel 9 through the nozzle 8. A roller 33, pivoted and shown in detail in Fig. 6, at the end of an arm also fitted to revolving shaft 7, engraves by its ribs or projections, during its revolution, the smooth soap film lying on the inner walls of the vessel 9, so that the scraper 13, rotating together but behind the roller 33,

can remove the collected soap film which has been subdivided into scales of any desired shape or size.

The operation of the apparatus may be outlined as follows:

First, the vacuum pump **21** is put in motion and the perforated plate **23** must be closed by any suitable covering lid, until soap rods begin to peep out through said plate. This is done in order to have and maintain inside the vessel **9** the desired degree of vacuum. Any suitable vacuum gauge connected with the inner part of said vessel can be used for determining the degree of vacuum inside the vessel, the degree of vacuum being controlled by the pump.

After this, some water, steam or any other suitable fluid heating medium supplied by any source must be sent into the jackets surrounding the feeding tank **3** and the preheater **5** at a rate sufficient to create therein a temperature high enough to maintain the stream of soap passing through in the desired fluid condition.

Then the motor **10**, driven by the pulley **11** and the helicoidal couple **12**, the revolving shaft **7** and the nozzle means **8** is put into motion. At this moment the fluid soap, sucked from any suitable system of saponification by the pump **1** and pushed through the filtering device **2** enters the tank **3**, is taken by the pump **4** and continuously sent through the preheater **5**, which has been adjusted to the desired temperature, through the spraying nozzle **8**, inside the vessel **9** and onto the inner collecting surface of said vessel **9** for the desired treatment.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of soap treating apparatuses differing from the types described above.

While the invention has been illustrated and described as embodied in a soap drying, cooling and deodorizing apparatus, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A process of drying soap, comprising the steps of heating an aqueous-soap mass to a predetermined elevated temperature above the temperature at which said aqueous soap mass is substantially fluid; spraying a continuous stream of the thus heated fluid aqueous-soap mass against a collecting surface a sufficient distance through a partial vacuum to evaporate a sufficient portion of the water therefrom to dry the same to a fatty acid content in the range of laundry and toilet soaps and be cooled to a sufficiently low temperature during passage through said partial vacuum to be solidified upon reaching said collecting surface; maintaining said collecting surface at a temperature substantially equal to said lower temperature at which said soap solidifies on said collecting surface; and continuously removing the dried solidified soap from said collecting surface so as to continuously obtain a homogeneously dried, solid soap of uniform fatty acid content.

2. A process of drying soap, comprising the steps of heating an aqueous-soap mass to a temperature of at least 100° C. being above the temperature at which said aqueous soap mass is substantially fluid; spraying a continuous stream of the thus heated fluid aqueous-soap mass against a collecting surface a sufficient distance through a partial vacuum to evaporate a sufficient portion of the water therefrom to dry the same to a fatty acid content in the range of laundry and toilet soaps and be cooled to a sufficiently low temperature during passage through said partial vacuum to be solidified upon reaching said collecting surface; maintaining said collecting surface at a temperature substantially equal to said lower temperature at which said soap solidifies on said collecting surface; and continuously removing the dried solidified soap from said collecting surface so as to continuously obtain a homogeneously dried, solid soap of uniform fatty acid content.

3. A process of drying soap, comprising the steps of heating an aqueous-soap mass to a predetermined elevated temperature above the temperature at which said aqueous soap mass is substantially fluid; spraying a continuous stream of the thus heated fluid aqueous-soap mass against a collecting surface a sufficient distance through a partial vacuum to evaporate a sufficient portion of the water therefrom to dry the same to a fatty acid content in the range of laundry and toilet soaps and be cooled to a sufficiently low temperature of about 20° C. during passage through said partial vacuum to be solidified upon reaching said collecting surface; maintaining said collecting surface at a temperature substantially equal to said lower temperature at which said soap solidifies on said collecting surface; and continuously removing the dried solidified soap from said collecting surface so as to continuously obtain a homogeneously dried, solid soap of uniform fatty acid content.

4. A process of drying soap, comprising the steps of heating an aqueous-soap mass to a temperature of at least 100° C. being above the temperature at which said aqueous soap mass is substantially fluid; spraying a continuous stream of the thus heated fluid aqueous-soap mass against a collecting surface a sufficient distance through a partial vacuum to evaporate a sufficient portion of the water therefrom to dry the same to a fatty acid content in the range of laundry and toilet soaps and be cooled to a sufficiently low temperature of about 20° C. during passage through said partial vacuum to be solidified upon reaching said collecting surface; maintaining said collecting surface at a temperature substantially equal to said lower temperature at which said soap solidifies on said collecting surface; and continuously removing the dried solidified soap from said collecting surface so as to continuously obtain a homogeneously dried, solid soap of uniform fatty acid content.

5. A process of drying soap, comprising the steps of heating an aqueous-soap mass to a temperature of at least 100° C. being above the temperature at which said aqueous soap mass is substantially fluid; spraying a continuous stream of the thus heated fluid aqueous-soap mass against a collecting surface a sufficient distance through a partial vacuum of about 40 mm. Hg pressure to evaporate a sufficient portion of the water therefrom to dry the same to a fatty acid content in the range of laundry and toilet soaps and be cooled to a sufficiently low temperature of about 20° C. during passage through said partial vacuum to be solidified upon reaching said collecting surface; maintaining said collecting surface at a temperature substantially equal to said lower temperature at which said soap solidifies on said collecting surface; and continuously removing the dried solidified soap from said collecting surface so as to continuously obtain a homogeneously dried, solid soap of uniform fatty acid content.

6. A process of drying soap, comprising the steps of heating an aqueous-soap mass to a predetermined elevated temperature above the temperature at which said aqueous soap mass is substantially fluid; spraying a continuous stream of the thus heated fluid aqueous-soap mass against a collecting surface a sufficient distance through a partial vacuum to evaporate a sufficient portion of the water therefrom to dry the same to a fatty acid content in the range of laundry and toilet soaps

and be cooled to a sufficiently low temperature during passage through said partial vacuum to be solidified upon reaching said collecting surface; maintaining said collecting surface at a temperature substantially equal to said lower temperature at which said soap solidifies on said collecting surface; and continuously removing the dried solidified soap from said collecting surface and shaping the soap into cakes, thereby continuously obtaining dried, solid soap cakes of uniform fatty acid content.

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