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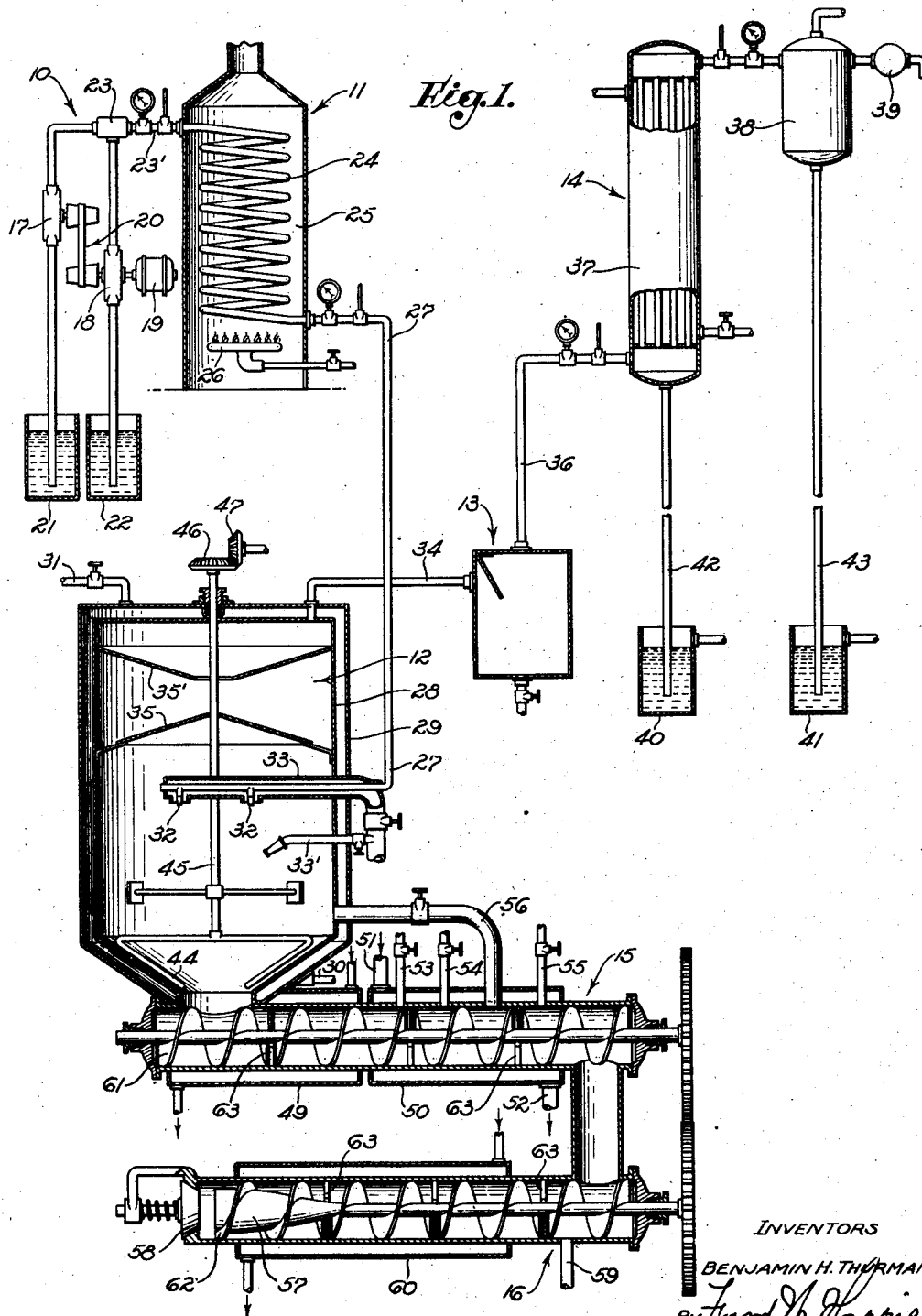
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2,142,983

PROCESS FOR MAKING SOAP AND PRODUCT

Filed Jan. 29, 1936

2 Sheets-Sheet 1



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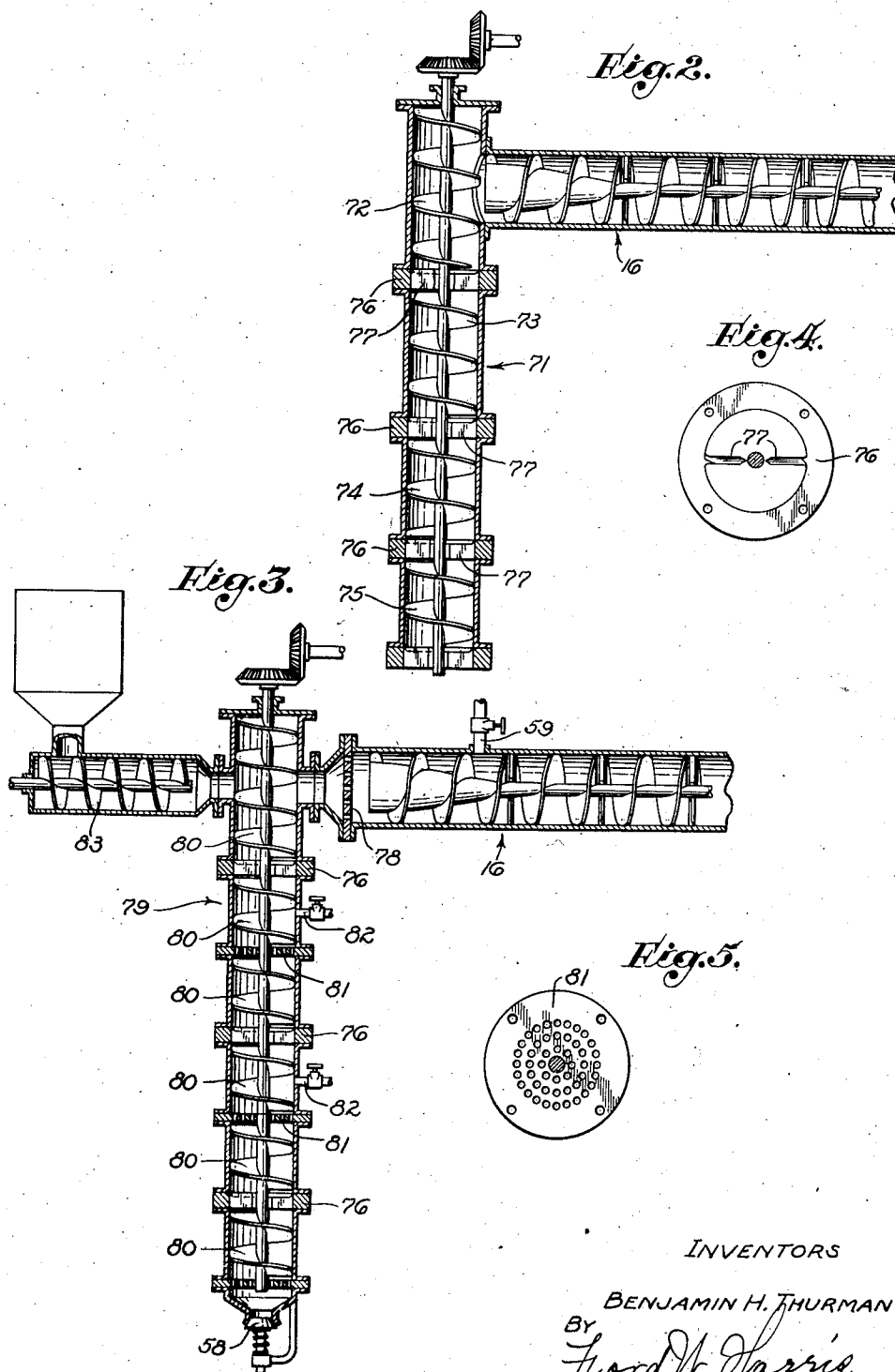
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2 Sheets-Sheet 2



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PROCESS FOR MAKING SOAP AND PRODUCT

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37 Claims. (Cl. 87-16)

This invention relates to a process for making or processing soap. More particularly the illustrated complete embodiment is directed to a process and apparatus for continuously making soap in a closed system, continuously removing the glycerine therefrom during the process, and converting the soap into marketable form or into condition for further processing to form marketable soap.

The fundamental ingredients utilized are a saponifying material, such as an aqueous alkali solution, and a saponifiable material, for example, glyceride oils, fats, rosin, etc. It will be clear, however, that various saponifying and saponifiable materials may be utilized.

In general, the preferred complete embodiment of the process of the present invention to be hereinafter described, consists of mixing in proper proportions a saponifying material and a saponifiable material, preferably by bringing together flowing streams of these materials in proper proportions; continuously flowing the mixture through a heating zone; delivering the heated products to a vapor separating zone where the water and sometimes the glycerine are removed; removing the soap from the vapor separating zone in a dehydrated or anhydrous and substantially molten or at least plastic or semi-plastic condition; cooling this soap; and, in some instances, further processing the chilled soap to produce a desired product.

It is an object of the invention to provide a process and apparatus for producing soap in a closed system and by which a desired soap product is obtained in a single continuous operation during which the glycerine may be removed from the soap.

I have discovered that if a hot soap of a molten character (within the definition of the term "molten" given herein) is cooled, usually out of contact with the atmosphere, a friable soap mass results as the temperature is reduced. By the term "molten" soap as used in this application I have reference to a hot soap having little or no moisture therein and securing what fluidity it has from the application of heat rather than from large quantities of water therein. The term as herein used is not limited to any particular degree of fluidity. It is sufficient within the meaning of the term that the soap be in a plastic or semi-plastic condition. Usually it will have some flowing properties even though its flowing tendencies are very slight, and it will be of a homogeneous nature as distinguished from a mass of individual particles. It may be substantially anhydrous, or may contain small

amounts of moisture. With most soaps this moisture content should be rather low if a friable mass is to be obtained upon cooling.

Within the meaning set forth above it is an object of the present invention to cool such molten soap in such a manner that a friable soap is produced.

It is a further object of the invention to process such a molten soap in such a manner as to form a soap in powder form.

This may be accomplished by suitably cooling to form a friable mass which is continuously broken up by mechanical means as a part of a continuous process for making powdered soap, and one of the objects of the present invention lies in the provision of a novel method and apparatus directed to this end.

On the other hand, it is sometimes possible to produce a soap mass so friable that a major portion thereof is self-disintegrating and forms a powder upon extrusion or upon being expelled from the cooling means. It is an object of the present invention to provide a novel method and apparatus for forming this type of substantially self-disintegrating soap which breaks up into a powder with little or no agitation or externally applied crushing pressure.

Another object of the invention is to provide a process and apparatus by which a friable and easily worked soap product is continuously produced.

Another object of the invention resides in the provision of a process and apparatus for continuously producing a finely powdered soap product from a saponifying material and a saponifiable material, the heat utilized in the system forming the molten soap of low moisture content and this soap being cooled out of contact with the atmosphere to form a friable product which is easily reduced to powder form.

It is also an object of the present invention to cool the soap under reduced pressure, and in many instances to cool this soap in such a manner that the moisture content of the soap is not permanently increased to any substantial degree.

Another object is to cool the soap by injecting a liquid such as water thereinto, the soap being at a temperature above the boiling point of this liquid at the existing pressure, whereby at least a portion of the liquid is vaporized, the vapors being removed before the soap is cooled sufficient to condense any major portion of these vapors while in the soap.

I find it convenient to discharge the reaction products resulting from the saponifying reaction

into a separating chamber, from which vapors are continuously withdrawn to allow the substantially anhydrous and sometimes glycerine-free soap to separate in this chamber. One of the objects of the present invention is to supply heat to this separating chamber to obtain various advantages to be pointed out hereinafter.

Another object of the invention is to provide a novel process and apparatus capable of producing a substantially bleached soap product even when used with such highly colored oil as crude or refined palm oil.

Another object of the invention is to provide a process and apparatus for continuously producing a plastic mass of soap, or a jelly-like soap product comparable to what is known in the art of kettle soap making as a finished kettle soap.

A further object is to provide a process and apparatus for continuously producing a soap product conditioned to be cut or molded into bars for detergent use.

A still further object of the invention is to provide, as an article of manufacture, a new soap product of friable nature which is self-disintegrating at least in part, or a friable soap product which is easily powdered or otherwise worked.

Other objects and advantages will be apparent to those skilled in the art from the following description.

Apparatus suitable for carrying out the process of the present invention is described in the following specification and shown in the attached drawings, of which:

Fig. 1 is a schematic drawing of an apparatus for continuously producing a friable soap product, while continuously removing the glycerine;

Fig. 2 is a schematic drawing of a modification of a portion of the apparatus for producing finely powdered soap;

Fig. 3 is a similar drawing of a modified portion of the apparatus for producing either a finished kettle soap or a soap product ready to be cut or stamped into bars;

Fig. 4 is a view of one of the knife blades used in the modifications of Figs. 2 and 3; and

Fig. 5 is a view of one of the screens or perforated plates used in the modification of Fig. 3.

Referring more particularly to the drawings, in Fig. 1, 10 indicates in general a mixing device for proportioning and mixing saponifying and saponifiable materials; 11 indicates in general a heating device for heating the mixture of saponifying and saponifiable materials; 12 indicates in general a vapor separating chamber or zone in which the water vapors and in some instances the glycerine vapors are separated from the soap; 13 indicates a catch-all or trap for removing any soap masses carried over by the vapors; 14 indicates in general a condensing system in which the glycerine and water vapors are separately condensed; 15 indicates a conveyor for removing the molten soap from the vapor separating zone 12 and chilling the same; and 16 indicates a second conveyor for receiving and, in some instances, conditioning the soap from the conveyor 15.

Various types of apparatus for proportioning and mixing the saponifying and saponifiable materials may be used which perform the function of effecting at least some intermixture of properly proportioned materials before introduction into the heater, the materials being introduced into the heater in the form of a continuously flowing stream. In the preferred apparatus the

proportioning-mixing device 10 includes a pair of proportioning pumps 17 and 18 driven by any variable-speed drive means such as a motor 19, a variable-speed device 20 being interposed between the pumps so that by varying the speed of the motor and the relative speeds of the pumps, a proportioned stream of a saponifying material can be drawn from a tank 21 and a proportioned stream of saponifiable material can be drawn from a tank 22 by the pumps 17 and 18 respectively. The separately pumped streams come into contacting and mixing relationship under pressure in a mixer 23, which may merely comprise a chamber into which the pumped streams move, though additional mixing means may be provided if desired. The mixture flows in a continuously moving stream to the intake connection of the heating device 11 through a pipe 23' which may be provided with suitable pressure and temperature indicating devices.

The preferred heating device includes a coil 24 positioned in a chamber 25 and externally heated as by an oil or gas burner shown at 26. Other means of heating this coil may be used. The mixture of the saponifiable and saponifying materials is thus heated as a continuously flowing stream in the reaction zone provided by the coil 24 to effect saponification. After saponification takes place the reaction products move as a continuously flowing stream to and through a means defining a vacuum zone, this vacuum zone including the vapor separating chamber 12 and usually at least a part of the conveyor system. As shown, these reaction products are conducted to the vapor separating chamber 12 through a pipe 27 which is preferably equipped with suitable devices for indicating pressure and temperature conditions of the reaction products.

The vapor separating chamber 12 is shown as comprising an air-tight casing 28 which may be completely surrounded by a heating jacket 29 through which a suitable heating medium may be circulated by means of connections 30 and 31. The pipe 27 leading from the heating device terminates in one or more nozzles 32 positioned within the chamber 12 and the saponified material from the heating device is thus continuously discharged into the vapor separating chamber.

In accordance with this invention the soap which accumulates in the lower portion of the vapor separating chamber 12 is in molten condition within the meaning of this term as previously described. This soap may thus be rather fluid or may be in a plastic or semi-plastic condition. Its temperature will be relatively high and it will be substantially anhydrous.

If desired, the temperature of the material leaving the heating zone may be maintained sufficiently high to deliver molten soap to the bottom of the vapor separating chamber 12, the heating being carried on under such conditions of temperature and pressure that all of the water is in vapor form in the pipe 27, assuming that nozzles 32 of a constricting nature are used. It is often desirable to carry the temperature high enough to liberate glycerine vapors in the reaction zone defined by the coil 24. As to the factor of pressure, a relatively high inlet pressure is maintained at the entrance of the coil 24 of the heating device 11, either by constricting the discharge of the nozzles 32 or by constructing the coil 24 of small enough diameter relative to the rate of flow therethrough so that the frictional resistance to flow maintains a relatively high inlet pressure. Even when a constricting nozzle

means is utilized, this factor of frictional resistance causes further increase in inlet pressure.

On the other hand, it is desirable in some instances to supply additional heat to the vapor separating chamber 12, though this is not always essential. For instance, if the soap mass in the vapor separating chamber 12 is below the temperature necessary to maintain the soap in the molten condition referred to, it is desirable to increase the temperature thereof to insure that the soap in the bottom of this vapor separating chamber 12 will be in this molten condition. Such additional heat may be supplied by use of the heating jacket 29 or it may be supplied in other ways such, for instance, as introducing superheated steam into the vapor separating chamber 12. As shown in Fig. 1, such steam from any suitable steam-generating source, preferably in a superheated state, may be delivered to the separating chamber adjacent the nozzles 32 by means of a pipe 33. This pipe may be positioned around that portion of the pipe 27 entering the vapor separating chamber 12 so as to maintain the temperature of the materials in this pipe or to impart additional heat thereto, the steam being discharged around the nozzles 32 by annular orifice means as shown. At the same time, or alternatively, steam may be supplied through a pipe 33' so as to be discharged near the nozzles 32. Due to the law of partial pressures the introduction of steam into the vapor separating chamber 12 makes it possible to operate the system with pressures in this chamber higher than would otherwise be the case.

It will be clear, however, that if the soap is delivered to the vapor separating chamber 12, at sufficiently high temperature, no additional heat need be supplied thereto. In this instance the heating jacket 29 surrounding this vapor separating chamber may be used to prevent heat losses from the chamber to insure maintenance of the soap in the said molten condition, or it may be used to increase the temperature therein sufficient to prevent condensation of glycerine vapors in this chamber, or liberate additional glycerine vapors therein, or it may be used only to preheat the vapor separating chamber when the apparatus is first put into operation.

In the vapor separating chamber 12 the glycerine and water vapors separate from the molten soap. If glycerine is to be removed all of the glycerine may be vaporized before the reaction products reach the vapor separating chamber 12, or a portion of the glycerine may flash into vapor form upon discharge into this chamber, or a portion of the glycerine may be converted into vapor form in this chamber by application of heat to the products therein. If glycerine is to be removed or recovered this chamber is usually maintained under a relatively high vacuum by means which will be pointed out. The vapors separated into the vapor separating chamber 12 are drawn off through a pipe 34 leading to the catch-all 13.

A plurality of baffles 35 and 35' are preferably positioned in the vapor separating chamber 12 to separate and retain therein any soap masses carried upward by the water and glycerine vapors, these baffles being so constructed that any particles of soap deposited thereupon will drain or drop back toward the bottom of the vapor separating chamber. Any steam added to the vapor separating chamber will assist in carrying off the glycerine vapors from this chamber to the catch-all 13.

The water and glycerine vapors drawn off in the pipe 34 pass first through the catch-all 13 which separates from the vapors any soap masses which might escape the baffles in the vapor separating chamber 12. The glycerine and water vapors then pass through a pipe 36 through the condensing system 14, which includes a glycerine condenser 37, a water condenser 38, and a vacuum pump 39 which maintains a low pressure in the vapor separating chamber 12. The glycerine and water condensates may be continuously moved into tanks 40 and 41 respectively through pipes 42 and 43 which may be long enough to furnish sufficient static head of water and glycerine to maintain the vacuum in the system.

The dehydrated, substantially anhydrous soap accumulating in the bottom of the vapor separating chamber 12 moves in the said molten condition (i. e. in strictly molten, plastic or semi-plastic condition) into the conveyor 15 which is in open communication with this chamber. Any suitable means may be utilized to assist this flow, Fig. 1 illustrating an agitator or scraper 44, mounted upon a shaft 45 extending vertically through the vapor separating chamber 12 and rotated from any suitable source of power through a drive means shown, for example, as gears 46 and 47. The rotating agitator 36 insures that the soap will be delivered continuously to the conveyor 15.

The conveyor 15 is preferably of the screw-conveyor type. A jacket 49 is preferably provided to surround the first portion of the conveyor housing, a suitable heating medium being circulated therethrough to prevent heat loss and to maintain the soap in substantially the same condition as it was when first withdrawn from the vapor separating chamber 12. A slight cooling is sometimes not detrimental in this first portion of the conveyor 15.

The present invention contemplates cooling the molten soap, preferably while it is subjected to subatmospheric pressure. For this purpose a second jacket 50 surrounds the end of the conveyor housing remote from the vapor separating chamber 12. A suitable cooling medium, such as cold water, is circulated through this jacket 50 by means of connections 51 and 52. The rate of cooling may be varied, but in general a sudden chilling is often very desirable in forming the more friable soap products.

Other means for cooling the molten soap may be used. For instance, water or other cooling liquid may be injected directly into the cooling portion of the conveyor 15 through connections 53, 54, or 55. However, if a friable soap product is being made, it is desirable that the liquid be not permanently retained in the soap, though a small moisture content is permissible in the manufacture of certain friable soap products, as will be hereinafter pointed out. Introduction of water through the connections 53, 54, or 55 will not permanently hydrate the soap to any substantial degree, for the temperature of the soap is such that the water will be immediately vaporized when introduced, heat being extracted from the molten soap in order to chill and solidify the same. The vapors formed at this stage of the process may be carried back into the vapor separating chamber 12 through the conveyor 15 or through a vent pipe 56 which also leads back to the vapor separating chamber 12, thus preventing retention of any large quantity of vapor or moisture in the soap product as it solidifies and forms the friable mass. Any glycerine vapors which fail to be separated from the soap in the vapor sep-

arating chamber but which are separated in the conveyor 15, are also thus carried back to the vapor separating chamber. The entire conveyor 15 is thus maintained under subatmospheric pressure and the soap is cooled under these low pressure conditions and out of contact with the atmosphere. Simultaneous cooling by means of both the cooling jacket 50 and injection of cooling agents through the pipe connections 53, 54, or 55 may in some instances be desirable.

The cooled soap discharged from the first conveyor is usually a solidified, friable mass. However, it is sometimes at such a high temperature that exposure to the atmosphere would result in deleterious reactions, such as the formation of peroxides. Also it is desirable in some instances to hydrate or otherwise additionally process the soap before extrusion. The second conveyor 16 may be used in one or more of these capacities. The cooled soap is discharged from the conveyor 15 into the second conveyor 16 which is preferably of the screw type. Fig. 1 discloses this second conveyor as positioned below the conveyor 15, though it will be understood that if it is a mechanical expedient, the second conveyor may be constructed as a continuation of the first conveyor, or it may extend at right angles thereto as shown in Fig. 2. The conveyors 15 and 16 may be driven from any suitable source of power through drive connections shown, for example, as a pair of meshed gears suitably driven.

The second conveyor 16 is provided with a means for constricting the discharge therefrom. This may comprise an enlarged portion 57 of the conveyor shaft near the discharge end of the second conveyor 16. A free opening valve 58 may be provided for further constricting the discharge in certain modifications of the process herein disclosed.

One function of the second conveyor 16 is to act as a vacuum seal for the first conveyor and for the entrance portion of the second conveyor. It thus prevents entrance of air into the first conveyor and maintains the vacuum conditions therein. The pressure on the soap progressively increases in this second conveyor as the soap moves toward the valve 58.

Another function which this second conveyor 16 may serve is to further cool, and in some instances hydrate, the soap delivered thereto. Hydration and cooling may be effected by introducing water or saturated steam into the second conveyor through one or more connections 59, the amount of moisture thus added being controlled in response to the desired hydrating effect. If water is employed in this capacity, it is often desirable that the soap in the second conveyor be of sufficiently high temperature to vaporize at least a portion of the water, thus insuring a uniform distribution of water throughout the soap. However, this is not invariably necessary, for it is often possible to secure uniform distribution utilizing the agitation present in this conveyor. If the soap is not to be hydrated, cooling can be effected by circulating a cooling liquid through a jacket 60. The latter method of cooling may be used in conjunction with the addition of moisture through the connection 59 if desired. The soap may also be cooled by spraying the cooling medium upon the external surface of the housing of the conveyor 16. As the soap cools, any vapors therein will be condensed. Thus, if hydration is accomplished by adding saturated steam, or by adding water which vaporizes entirely or in part, the vapors may be condensed

before discharge of the soap so that this soap may be hydrated to any desired extent in the second conveyor.

The connection 59, or other connections or means not shown, may also be employed for introducing fillers or other soap builders into the conveyor 16, as is contemplated in certain modifications of the process herein disclosed.

It is often desirable to heat the incoming saponifiable material to a degree proportional to the temperature of the resulting soap. This may be accomplished by circulating this saponifiable material through the jacket 50, this material thus acting as a cooling medium and being in turn heated before being forced into the reaction zone. In other instances it is possible to circulate the saponifiable material or the saponifying material through the condenser 37, thus heating the material and cooling the vapors.

While continuous screws 61 and 62 may be respectively utilized in the first and second conveyors 15 and 16, I usually find it desirable to form each screw so that it provides several flights with sections therebetween into which may extend knife bars 63 or other stationary elements. Such means utilized in conjunction with the various flights of the conveyor screws serve to effectively advance the soap and also serve to agitate the soap, in some instances effecting a milling or plodding action. The latter is especially true with reference to the means interposed between the flights of the conveyor screw 62.

Several modes of operation of the apparatus hereinbefore described may be employed, depending upon the product to be produced. In general, if a neutral soap is desired, the proportioning pumps 17 and 18 are adjusted to deliver to the heater a mixture of the saponifiable and saponifying materials, the saponifying material being utilized in quantity sufficient to effect complete saponification without leaving any excess of the alkali or saponifying material in the finished soap.

The optimum temperature and pressure at the discharge end of the heater vary with the saponifiable material utilized and with the subsequent steps of the process. However, it can be stated in general that if the soap accumulating in the separating chamber 12 is to be anhydrous and substantially liquid-free, the temperature developed in the heater should be sufficient to vaporize all of the water and all or a portion of the glycerine in the reaction zone defined by the coil 24. If a constricted nozzle means is utilized, it is possible to operate the process in such a manner that any unvaporized glycerine will flash into vapor upon introduction into the vapor separating chamber 12. Further, if heat is supplied to this vapor separating chamber 12, it is possible to utilize lower temperatures in the reaction zone than would otherwise be the case.

By way of example, and without limiting myself thereto, I have found it possible to operate the process using cottonseed oil, coconut oil, and palm oil as saponifiable materials, securing a molten soap in the bottom of the vapor separating chamber 12 without continuously supplying heat thereto during the process, the reaction products flowing through the pipe 27 being at a temperature of about 540° F., the outlet pressure being in the neighborhood of 60 pounds per square inch. The pressure at the inlet end of the coil 24 will be considerably higher because of the friction developed as the materials move through this coil. Lower temperatures and pressures may be used if heat is continuously

supplied to the vapor separating chamber 12. However, no fixed limit can be set forth covering all materials and all possible modifications of the process. Regardless of where the heat is supplied, it is usually desirable that the soap accumulating in the lower end of this vapor separating chamber 12 be in molten condition within the definition of this term set forth above, if a friable soap product is to be produced. With most saponifiable materials satisfactory results can be obtained by utilizing temperatures in the pipe 27 of from 540° to 575° F., no heat being continuously supplied to the vapor separating chamber. However, these limits are set forth only as exemplary and can be made somewhat higher or lower without departing from the spirit of the present invention.

My experiments show that the soap in the bottom of the vapor separating chamber need not be in strictly molten and very fluid condition to obtain a friable product. Friable soap can also be obtained by cooling plastic or semi-plastic soap as it is withdrawn from this chamber. In this connection my experiments indicate that while there is a very definite melting point for various soaps, once the soap has been melted the temperature can be reduced many degrees below this melting point without causing the soap to become solidified. This factor gives a range of permissible temperatures in the vapor separating chamber 12, the upper temperature being considerably above the melting point of the particular soap being produced, and the lower temperature in this range being considerably below this melting temperature but above the temperature at which the mass of soap solidifies and departs from its semi-plastic, plastic or strictly molten condition.

If glycerine is to be recovered, the absolute pressure in the vapor separating chamber 12 should be relatively low. Pressures in the neighborhood of a few millimeters of mercury are satisfactory. The glycerine and water vapors may be removed from the vapor separating chamber 12 and condensed as previously set forth. It will be understood, however, that it is not essential to remove all of the glycerine in order to obtain a friable soap product of the nature contemplated.

Once the molten soap is produced in the vapor separating chamber 12, the subsequent steps will depend in large measure upon the desired characteristics of the final product. Various procedures are possible.

As the first alternative, the product may be made so friable as to be substantially self-disintegrating, to the extent that approximately 90% of the soap mass will fall from the extrusion means of the second conveyor in powdered form, the remaining 10% being also extremely friable and easily broken up by application of slight pressure. To form such a self-disintegrating soap, it is necessary to have the soap in substantially anhydrous condition, no moisture being added thereto in the first or second conveyors. So, also, it is necessary to cool the molten soap either by use of the jacket 50 or by injecting water or other liquid through the pipe 53, 54 or 55 and removing the resulting vapors through the pipe 56. Sudden cooling is more effective in forming planes of incipient fracture extending throughout the soap mass. Further, to secure this soap of substantially self-disintegrating nature, it is usually desirable to cool the soap to such a degree that the temperature is below a predetermined value. With most soaps cooling

to a temperature below 200° F. will accomplish the desired result, though in some instances it is desirable to continue the cooling to a lower temperature. With certain other soaps a satisfactory self-disintegrating soap may be obtained by cooling to a temperature which is somewhat above 200° F. With most soaps, however, this temperature will be in the range of from 180° F. to 200° F., though it will be clear that I am not limited to this range in all instances. This degree of cooling may be obtained entirely while the soap is in the first conveyor 15, or the soap may be cooled partially in the first conveyor and partially in the second conveyor. Cooling can, of course, be carried still further in the second conveyor 16 without departing from the spirit of the invention.

As a second alternative, the apparatus may be operated so as to produce a friable soap mass which is not self-disintegrating but which is of such a friable nature that the resulting product can be broken up into a powder by crushing the product or by screening the soap, or by equivalent disintegrating steps.

The apparatus shown in Fig. 1 will produce this type of soap if the molten soap is not chilled to as low a temperature as set forth in the preceding paragraph, or if the soap is somewhat hydrated during passage through the conveyors. In this modification of the process the molten, substantially anhydrous soap is moved from the vapor separating chamber 12 and is rather quickly cooled in the conveyor 15 by employing the cooling jacket 50 or by injecting water through the connection 53, 54, or 55. Any water vapors thus formed are carried back to the separating chamber 12 through the conveyor and the vent pipe 56, so that a cooled, solid, substantially anhydrous soap is delivered to the second conveyor. The soap may be further cooled in the second conveyor, and, if desired, may be hydrated to some extent therein, being discharged into the atmosphere through the valve 58 in the form of a continuously-moving stream. Cooling of the soap is carried to such a degree that upon exposure to the atmosphere, no deleterious discoloration or oxidation will result, and no peroxide will be formed, the resulting soap being neutral and extremely stable against rancidity and burning. It has been found that up to approximately 12% of water may be added to and retained in the soap before extrusion through the valve 58 without destroying the friable nature of the soap in this embodiment of the process. This water may be introduced by means of the connection 59 in the second conveyor 16. Satisfactory results may be obtained if the soap is cooled in the first conveyor 15 to a value between the critical temperature mentioned in the preceding paragraph and an upper value of 300° F. However, this temperature of 300° F. is not set forth as limiting the invention in view of the fact that with certain soaps it is possible to secure a friable product by cooling to a temperature which is somewhat above this figure.

In both of the above alternative modes of procedure the resulting soap is of a friable nature. The cooling of the molten soap forms a mass having planes of incipient fracture extending throughout and present in such degree as to make the soap mass extremely friable. The resulting products are believed to be novel irrespective of whether the mass is so friable as to be self-disintegrating or whether the mass is sufficiently friable to be readily disintegrated by

slight pressure such as by crushing between the fingers. In appearance such a friable soap mass has a glossy surface and is of a stratified character. If not self-disintegrating, it easily breaks up into small lumps and flakes which readily disintegrate upon application of pressure into smaller particles. Further, the resulting product is of light color, even when made from the darker-colored fats or oils. This unexpected result of bleaching the soap in the process is extremely valuable in making soap from such saponifiable materials as crude or refined palm oil or other naturally highly-colored oils. In addition, the soap is extremely stable and neutral and is also of a high degree of purity since at the temperatures used in the vapor separating chamber substantially all of the impurities present in the fat or other saponifiable material are destroyed or removed from the soap with the water and the glycerine vapor. By reason of the cooling of the soap before contact with the atmosphere I eliminate deleterious discoloration and oxidation, as well as formation of peroxide. One of the important features of the invention is that this cooling can be effected in a confined space out of contact with the air. The system shown also permits the cooling to be performed at subatmospheric pressures. The resulting soap formed by the alternative modes of procedure set forth above may be furnished as an article of manufacture to makers of pharmaceutical and cosmetic soaps, and the friable nature thereof obviates the difficulty heretofore encountered in grinding more or less plastic soap for such uses. Quick cooling appears to facilitate the formation of the incipient planes of fracture, resulting in a more friable product. As mentioned above, soap has a characteristic of not immediately returning to solid form when the temperature is reduced below the melting point. From this angle it will be clear that it is not essential to maintain the soap at the melting temperature while this soap is in the lower part of the vapor separating chamber 12 or in the first part of the conveyor 15. It is sufficient if the soap be cooled from molten condition (i. e., from semi-plastic, plastic or strictly molten condition). Usually I find it desirable to utilize the jacket 49 to maintain the temperature of the soap substantially the same as when withdrawn from the vapor separating chamber, though some cooling can be permitted therein. The preferable manner of forming a friable product is to not materially cool the soap until it enters the second part of the conveyor 15. It is usually satisfactory with most soaps to maintain the temperature in the first portion of the conveyor 15 above 450° F., though this figure is not invariable. As the molten soap enters the vicinity of the cooling means it is cooled from its molten condition to effect the formation of the incipient planes of fracture as the soap solidifies.

As the third alternative mode of operation of the apparatus shown in Fig. 1, it is possible to form a soap product which is not of a friable nature but which is in the form of a plastic mass or a jelly-like soap product comparable to what is known in the art of kettle soap making as a finished kettle soap. In forming this product the soap is cooled from the said molten condition, though it is not essential that the cooling be suddenly effected. If desired, the cooling may be performed in both the first and second conveyors, being carried to such a degree that the soap will not discolor or oxidize upon exposure

to the atmosphere. Further, production of this soap product is facilitated by adding additional quantities of liquid or steam to the soap in either the first or second conveyors, the quantity of liquid being usually above the 12% value hereinbefore mentioned, though not necessarily so if the soap is more slowly cooled. In this connection any desired quantity of moisture may be added to the soap to facilitate the formation of this plastic or jelly-like soap of non-friable nature expelled from the valve 58.

In the second alternative mode of operation mentioned above, in which a friable soap product is produced which is not self-disintegrating when discharged from the second conveyor, I often find it desirable to reduce this product to granular or finely powdered condition directly as a part of the continuous process, rather than discharging the soap product into storage for later subdivision. Figs. 2 and 3 illustrate modifications which can be used in this regard.

In Fig. 2 is shown such a modification including an apparatus for grinding the friable product. Instead of discharging through the valve 58, the second conveyor 16 may discharge directly into a third conveyor 71 preferably positioned at right angles to the conveyor 16. The third conveyor 71 may comprise a plurality of screw conveyor sections or flights 72, 73, 74, and 75 between which are interposed knife blade sections 76 shown in more detail in Fig. 4 and including blades 77 extending between the spaced sections of the conveyor 71. If desired, these knife blade sections may provide blades with sharp upper edges, though this is not always essential. The convolutions of the section 72 of the screw conveyor 71 take repeated shaving cuts from the end of the mass of soap being delivered into the conveyor 71 from the conveyor 16, as will be apparent from Fig. 2. The soap thus cut from the soap advancing in the conveyor 16 is forced by section 72 of the conveyor 71 against the knife blades 77 of the first knife blade section 76. The soap is thus subjected to a cutting action by the knife blades 77 due to the fact that these blades are stationary and the soap is turning in the conveyor section 72. Also, as the soap is forced through the knife blade sections 76 it is again cut by the rotating vanes of the adjacent end of the next conveyor section 73. This process is repeated as many times as necessary to secure the desired product. The number of stages will be determined by the fineness of the product desired.

If desired, the subdivided material issuing from the discharge end of the conveyor 71 may be screened, the coarser particles being returned to the first section 72 of the conveyor 71, by means not shown, in order to obtain a uniformly fine product. It is thus possible to make a finely powdered soap, suitable for pharmaceutical or cosmetic uses from the friable and brittle soap delivered from conveyor 16, or, by less intense grinding, a finely powdered or granular material marketable for certain detergent purposes.

The process of the present invention is also capable of producing finished soap in cake or bar form for detergent purposes. In the modification of the apparatus shown in Fig. 3 the conveyor 16 discharges through a perforated plate 78 into a conveyor 79 of the screw type divided into a plurality of sections 80 between which are positioned knife blade sections 76, such as shown in Fig. 4, and perforated plates 81. For this purpose the soap is ordinarily hydrated 75

to a greater extent than in preparing the powdered soap above discussed. To accomplish this water or wet steam may be introduced through the connections 59 of the conveyor 16 and also 5 may be introduced into pipe connections 82 of the conveyor 79. During its progress through the conveyors 16 and 79 the cooled soap from the conveyor 16 is plodded and repeatedly extruded by the knife blades 76 and perforated plates 81 respectively. If desired, builders or fillers may be introduced into the conveyor 79, for example, by means of a screw conveyor 83 connected to the conveyor 79. Also, perfumes and other liquid soap ingredients may be introduced 15 through the pipe connections 59 and 82. The perforated plates 81 may have successively smaller apertures toward the discharge end of the conveyor 79 and it will be understood that the perforated plates may be used alone or the knife blade sections may be used alone, or they may be used in combination as disclosed in Fig. 3. It has been found that the soap delivered from the conveyor 16, and which has been cooled from a molten and substantially anhydrous condition, 25 is of uniform consistency throughout and can be plodded and extruded with a minimum of effort.

The apparatus shown in Fig. 3 is also capable of producing a product similar to that known 30 in the soap art as finished kettle soap, which is a jelly-like hydrated soap with the glycerine substantially removed, and which carries upwards of 30% of water. By introducing the required amount of water through the pipe connections 59 and 82, and eliminating the addition of fillers and other soap builders, the soap from the conveyor 16 may be easily plodded into the jelly-like form known as finished kettle soap, which product may be then carried through the conventional framing, drying and plodding steps employed for kettle-made soap.

It will be noted that the invention above disclosed provides a process and apparatus for continuously converting saponifiable material into marketable products by continuously contacting 45 a saponifiable material and a saponifying material, continuously removing water (and, if desired, the glycerine) from the soap formed during the saponification step, and cooling the molten soap so as to render it easily convertible into desired products.

It will further be noted that all of the steps of the process from the mixing of the saponifiable and saponifying material to the discharge 55 of the desired product from the process is carried out in a closed system. There is no opportunity for air to become mixed or emulsified with the materials being treated and the heated soap being processed is prevented from contacting with the atmosphere, thus preventing discoloration and the formation of peroxides, which tend to cause rancidity and burning.

While I have herein described a complete system, it will be clear that various portions thereof are of utility and are novel irrespective of their use in the complete system. For instance, the invention comprehends a novel system of converting the molten soap into powdered or granular form which finds utility regardless of 70 how the molten soap is produced, and regardless of whether or not the intermediate friable product is produced. Sudden cooling is thus not essential in all uses of the invention, and the invention is not limited to the production of a 75 friable soap product, either as an end product

or an intermediate product. As mentioned above, the invention also comprehends in various of its aspects the products of plastic, jelly-like, or other forms of soap.

Nor is it always essential to the inventive concept that molten soap, within the definition set forth above, be formed in the system disclosed. Soap in other conditions can be formed and the cooling, conveying, and conditioning means are of utility regardless of whether or not molten soap 10 is supplied thereto.

While best results are obtained by removing glycerine from the soap, the invention is not in all instances limited thereto. Material quantities of glycerine can be allowed to remain in the soap 15 if desired.

I believe it to be novel to cool the substantially anhydrous soap as it moves in a continuously-advancing stream, and also to inject water into such a moving soap mass without permanently 20 hydrating the soap, removing the vapors as they are formed. So also, certain features of the system herein shown for saponification and vapor-separation are believed to be new without reference to the complete system. For instance, the 25 systems for heating and introducing steam into the vapor separating chamber are novel irrespective of how the soap is thereafter processed, and irrespective of whether the soap is collected in the bottom of the vapor separating chamber in 30 molten condition. Such features find utility in saponifying systems even when insufficient temperatures are developed or maintained to insure that the soap in the lower end of this chamber is in molten condition. 35

Various other features of the invention are novel independent of the complete combination, and I believe that the friable products produced are novel.

It is to be understood that the invention is not limited to the details herein disclosed, but may be varied within the scope of the following claims. 40

This application is a continuation in part of application Serial No. 42,348, filed September 26, 1935, entitled Apparatus for making, removing, 45 and processing soap.

The term "friable" as employed in the product claim hereof is intended to define a soap product which can be reduced to a powder by such slight pressure as is produced by rubbing a portion of said soap between the thumb and finger. 50

I claim as my invention:

1. A method of making a friable soap from a hot and substantially anhydrous soap retained in a closed container out of contact with the atmosphere, which method includes the steps of: 55 withdrawing a stream of said substantially anhydrous soap from said container; cooling the substantially anhydrous soap in said stream out of contact with the atmosphere by injecting a liquid thereinto while said soap is at a temperature above the boiling point of said liquid, thereby forming vapors and forming said soap into a friable mass; and removing said vapors before condensation of any large proportion thereof 65 while in said soap.

2. A method of making a powdered or granular soap, which method includes the steps of: forming a body of substantially anhydrous molten soap in a chamber from which air is excluded; 70 cooling said molten soap while substantially anhydrous out of contact with the atmosphere to form a friable mass; and reducing the cooled soap to subdivided form by extrusion.

3. A method of making a powdered or granu- 75

lar soap, which method includes the steps of: forming a body of molten and substantially anhydrous soap in a chamber from which air is excluded and which chamber is maintained at sub-atmospheric pressure; withdrawing a stream of said molten and substantially anhydrous soap from said chamber without substantially impairing the sub-atmospheric pressure; moving said stream of substantially anhydrous soap thus withdrawn through a cooling zone wherein said stream is cooled while still under sub-atmospheric pressure and out of contact with the atmosphere; increasing the pressure on said stream of soap; and continuously converting the cooled soap into subdivided form.

4. A method of making soap, which includes the steps of: forming a mass of substantially anhydrous soap in a molten, plastic, or semi-plastic condition; removing a stream of said soap from said mass, and cooling said stream of said soap while in substantially anhydrous condition and while in a space confined from the atmosphere to form a friable soap which is directly and substantially uniformly hydratable by adding moisture thereto.

5. A method of making soap, which includes the steps of: forming a mass of substantially anhydrous soap in a molten, plastic, or semi-plastic condition; removing a stream of said soap from said mass; cooling said stream of said soap while in substantially anhydrous condition and while in a space confined from the atmosphere to form a friable soap which is directly and substantially uniformly hydratable by adding moisture thereto; and then adding moisture thereto in controlled amount to hydrate said soap to a desired extent.

6. A method of making soap, which includes the steps of: forming a mass of substantially anhydrous soap in a molten, plastic, or semi-plastic condition; removing a stream of said soap from said mass; cooling said stream of said soap while in substantially anhydrous condition and while in a space confined from the atmosphere to form a friable soap which is directly and substantially uniformly hydratable by adding moisture thereto; and continuously breaking up said friable soap as fast as produced.

7. A method of making a friable soap from a hot substantially anhydrous soap in molten, plastic or semi-plastic condition and existing in a closed container under vacuum, which method includes the steps of: forcibly withdrawing from said container a stream of the soap while still in molten, plastic or semi-plastic condition and without impairing the vacuum in said container; and cooling this stream of soap while still in substantially anhydrous condition and in sufficient degree to form same into a friable mass capable of substantially uniformly absorbing water.

8. A method of making soap, which includes the steps of: heating a mixture of a saponifiable material and a saponifying material to form reaction products including soap and vapor; separating the vapor to leave a mass of substantially anhydrous soap in molten, plastic or semi-plastic condition; and forming this soap into a friable mass which will substantially uniformly absorb water by removing a stream of said soap from said mass and cooling the soap from its molten, plastic or semi-plastic condition while in substantially anhydrous condition and while in a space closed from the atmosphere.

9. A new soap product comprising a friable and substantially anhydrous soap capable of di-

rectly and uniformly absorbing moisture, said soap having been formed by removing a stream of molten, plastic or semi-plastic substantially anhydrous soap from a mass thereof and cooling said soap out of contact with the atmosphere and while still substantially anhydrous.

10. In a method of treating soap, the steps which comprise, heating a mixture of soap and vaporizable impurities out of contact with the atmosphere to a temperature sufficient to render the soap at least plastic when anhydrous, separating vaporizable impurities in the form of vapor from said heated mixture to produce substantially anhydrous soap in at least plastic form, forming an advancing stream of the resulting soap and cooling said stream while said soap is still substantially anhydrous and before contacting the same with the atmosphere to form substantially anhydrous soap which will substantially uniformly absorb moisture.

11. A method of making soap which comprises withdrawing soap in molten, plastic or semi-plastic condition from a chamber containing the same, and forming this soap into an anhydrous mass which will substantially uniformly absorb moisture by cooling the soap from its molten, plastic or semi-plastic condition while in substantially anhydrous condition and in a space substantially closed from the atmosphere.

12. The process as defined in claim 11 in which the thus cooled anhydrous soap is hydrated by adding water thereto after being cooled.

13. A process of producing soap and recovering vaporizable materials therefrom which comprises the steps of introducing a heated mixture of soap and vaporizable material into a vaporizing chamber, withdrawing the vapors from said chamber at a rate sufficient to maintain a vacuum, maintaining sufficient temperature in said chamber to produce substantially anhydrous soap in molten, plastic or semi-plastic condition, continuously withdrawing said soap from said chamber without breaking said vacuum, cooling the thus withdrawn soap from its molten, plastic or semi-plastic condition while in substantially anhydrous condition and while in a space closed to the atmosphere to form substantially anhydrous soap which will substantially uniformly absorb water.

14. In a method of producing soap which comprises withdrawing a stream of soap from a mass of substantially anhydrous soap in molten, plastic or semi-plastic condition, continuously cooling said soap moving in said stream while still substantially anhydrous to form a friable mass capable of substantially uniformly absorbing water when added thereto.

15. A method of continuously making soap, which includes the steps of: continuously heating a mixture of a saponifiable material and a saponifying material to form reaction products including soap and vapor; continuously introducing said reaction products into a separating chamber maintained under vacuum; continuously removing vapor from said chamber to leave therein substantially anhydrous soap in molten, plastic or semi-plastic condition; and continuously withdrawing a stream of this soap from said chamber and cooling same while still substantially anhydrous and from its molten, plastic or semi-plastic condition to form a mass of friable soap which will directly and uniformly absorb water.

16. In the method of treating soap, the steps which comprise introducing a heated mixture including soap and water into a vapor separating chamber, separating vapors from said soap in said

chamber, removing said vapors from said chamber at a rate sufficient to maintain a vacuum therein, maintaining a temperature in said chamber sufficiently high to produce liquid substantially anhydrous soap, withdrawing said liquid soap from said chamber, cooling said soap while still substantially anhydrous during said withdrawal sufficient to increase its viscosity and pushing said cooled soap through a restricted passage in order to seal said chamber from the atmosphere and produce a substantially anhydrous soap which will substantially uniformly absorb water.

17. A method of making soap which comprises withdrawing soap in a molten, plastic or semi-plastic condition from a chamber containing the same, cooling the soap, before damage by contact with the air, to condition the same for hydration and adding moisture to hydrate the same to the desired extent.

18. A method of making soap which comprises withdrawing soap in a molten, plastic or semi-plastic condition from a chamber containing the same, cooling the same in the absence of direct contact with moisture and before the same has been damaged by contact with the air to condition the same for hydration, and hydrating the cooled soap to the desired extent.

19. The process as defined in claim 18 in which hydration is accomplished by incorporating steam into the thus cooled soap and condensing the same.

20. A method of making soap which comprises withdrawing soap in a molten, plastic or semi-plastic condition from a chamber containing the same, adding water directly thereto before the same has been damaged by contact with the air and removing vapors therefrom, thereby to cool the soap and to condition the same for hydration, and adding moisture to the soap whereby to hydrate the same to the desired extent.

21. The method of making soap which comprises withdrawing soap in a molten, plastic or semi-plastic condition from a chamber containing the same and simultaneously cooling and hydrating the soap, in a space substantially closed from the atmosphere, by adding a stream of water to a moving stream of said soap.

22. The method of making soap which comprises withdrawing soap in a molten, plastic or semi-plastic condition from a vapor separating chamber maintained under a vacuum, cooling the soap before it is damaged by contact with the air by adding water to a stream of the withdrawn soap while maintaining a sub-atmospheric pressure whereby to facilitate the vaporization of the water therefrom and returning the vapors to said vapor separating chamber.

23. The process as defined in claim 22 in which water is added to hydrate the cooled soap to a desired extent.

24. The process of making soap which comprises withdrawing a heated stream of anhydrous soap from a vapor separating zone, introducing the same to a cooling zone, cooling the same before damaging exposure to the atmosphere by adding water to said stream and vaporizing the same therefrom while maintaining a sub-atmospheric pressure and thereafter advancing the cooled stream of soap to a hydration zone and adding moisture thereto while maintaining a higher pressure than that maintained in said cooling zone.

25. A method of making soap which comprises withdrawing a stream of soap from a mass of substantially anhydrous soap in a molten, plastic

or semi-plastic condition, continuously cooling said soap moving in said stream by directly adding a stream of water to said stream of soap before the heated soap has been damaged by contact with the atmosphere.

26. The process as defined in claim 25 in which the stream of soap is simultaneously indirectly cooled while the water is being added thereto.

27. A process of making soap which comprises the steps of withdrawing a stream of hot anhydrous soap from a receptacle containing the same, adding a stream of water to said stream of soap and reducing the temperature of said soap by vaporizing a desired amount of water therefrom before the stream of soap has been damaged by contact with the air.

28. The process as defined in claim 27 in which substantially all of the water is vaporized whereby to produce a cooled, dry soap.

29. A process of cooling and hydrating soap from a dry, melted condition at a higher temperature to a lower temperature which comprises the steps of withdrawing a stream of said highly heated, dry soap from a chamber containing the same and cooling said soap, before the same has been damaged by contact with the air, by adding an excess of water over that desired in the final product and vaporizing said excess whereby to cool the soap and to hydrate the same to any desired moisture content.

30. In the art of making soap which comprises the steps of forcing a stream of dry, highly heated soap from a vapor separating chamber and cooling said soap, before the same has been damaged by contact with the air, by introducing a current of cooling liquid to the advancing stream substantially before discharge to the atmosphere and while the stream is maintained under super-atmospheric pressure.

31. A method of making soap which comprises withdrawing a stream of highly heated anhydrous soap from a vapor separating chamber, cooling said stream of soap while in anhydrous condition and before the same has been damaged by contact with the air during the advancement of said stream from said chamber.

32. The process as defined in claim 31 in which the soap is maintained in a state of agitation during the cooling step.

33. The process as defined in claim 31 in which a current of steam is added to the advancing stream of cooled soap whereby to hydrate the same to the desired extent.

34. The process of making soap which comprises withdrawing a stream of soap in a highly heated, substantially anhydrous condition from a chamber containing the same, cooling said soap, before damaging exposure to the atmosphere, by bringing a stream of water directly into contact therewith while the soap is at a temperature sufficiently high to vaporize said water and vaporizing at least a portion of said water immediately upon contact with said soap whereby to cool the soap.

35. In the art of making soap and recovering glycerine wherein the saponifiable and saponifying materials are heated to effect separation of the glycerine from the soap in a vapor separating zone sufficiently to cause the soap to be in a substantially anhydrous, molten, plastic or semi-plastic condition, the step of quickly removing the said soap as a stream from said vapor separating zone by pushing the same therefrom and continuously cooling said stream of substantially anhydrous soap during the quick withdrawal thereof

whereby to thicken the same sufficiently to cause the stream to seal said vapor separating zone against the entrance of air, thereby to continuously cool the stream of the highly heated anhydrous soap before damage by contact with the air.

36. A method of continuously making soap which method includes the steps of: continuously withdrawing a stream of hot anhydrous soap from a vapor separating chamber while still in a molten

condition and cooling the soap in the stream while under sub-atmospheric pressure to solid form.

37. A method of continuously making soap which comprises withdrawing molten soap from a vapor separating chamber and cooling said molten soap thus withdrawn by adding a liquid thereto while said molten soap is above the boiling point of said liquid to form vapors in said soap and separating the vapors thus formed from said soap.

BENJAMIN H. THURMAN. 10

CERTIFICATE OF CORRECTION.

Patent No. 2,142,983.

January 3, 1939.

BENJAMIN H. THURMAN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, line 32, for "ssytem" read system; line 62, for "into" read in; page 7, second column, line 3, for the word "products" read production; line 14, for "quanties" read quantities; line 36, for "varous" read various; line 45, for "1835" read 1935; line 73, claim 2, for "fraible" read friable; page 8, first column, line 6, claim 3, for "substanially" read substantially; line 12, same claim, for "atmopshere" read atmosphere; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 28th day of February, A. D. 1939.

Henry Van Arsdale.

(Seal)

Acting Commissioner of Patents