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PRODUCTION OF A SOAP PRODUCT

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The present invention relates to the production of a soap product in reasonably finely divided state such that the component particles of the product are used in mass rather than as separate entities, and it has to do particularly with a novel process for the production of soap products of this general class which products, upon introduction into water as in common washing practice, exhibit the property of becoming thoroughly wetted practically immediately throughout their entire mass and of going into solution or admixture in water with particular readiness and speed and with a positive resistance to formation of slowly or difficulty soluble lumps or agglomerates. The invention also contemplates an improved soap product which possesses the properties just stated, the individual particles of which have certain novel and useful structural characteristics and physical properties not heretofore attained in products of this class. It is an object of the invention to provide process and product of the character just indicated. The present invention is, in a sense, related to the invention of my prior Patent No. 1,652,900.

It is an object of the invention to provide a soap product consisting of individually distinct separate independent particles formed as such by spraying or atomizing the soap into a spray of definitely segregated particles and maintaining this condition of separate identity of the particles by preventing such subsequent contact between the particles as would cause them to adhere, agglomerate, run together, or otherwise become physically connected so as to necessitate grinding, breaking up, crumbling or disintegrating to reduce the product to the ultimate particle condition and size attained in the finished product, and which respective separately formed particles exhibit a microscopic cellular, porous or spongeous structure within each typical average particle extending substantially throughout the body of the particle without necessarily embodying a characterizing principal interior void and without exposing an unprotected fragile structure at the surface of the particle. The production of puffed, porous or cellular soap products by puffing and solidifying a body or film of soap and then disintegrating the puffed solidified mass to form the desired product has been proposed heretofore. No product or process of this kind, as far as I am aware, has ever attained commercial success. Soap products so produced are not acceptable commercially because of such factors, among others, as non-uniform or inadequate development of the porous structure in some portions of the soap material, formation of excessively large pores or cells which act as insulation against thorough wetting and rapid dissolving, structural instability due to exposed fragile cell structure, dusting and settling in the package, ragged and non-uniform appearance, formation of a tough slow dissolving skin upon portions of the soap which are exposed to heat during processing, relatively slow speed of dissolving, and substantial residue of insoluble or very difficultly soluble material. The present invention provides a thoroughly acceptable commercial soap product free from all of the above noted objections and disadvantages which are inherent in soap products made by puffing in mass and subsequently disintegrating.

It is an object of the invention to provide for inducing and maintaining within the respective individual particles of the soap product of this invention a characterizing cellular or porous structure of the kind just referred to, the cells or pores being of microscopic size sufficiently small to promote quick access of water to every part of the soap material by capillary action and being enclosed by a protective but water permeable outer surface so that both physical stability and rapid and complete dissolving are obtained.

It is an object of the invention to provide the aforesaid characteristics in a product of the class described and, as a matter of combination, to provide said characteristics in a soap product whose particle size is sufficiently small so that the advantages possible by reason of said characteristics can be fully realized. To explain further, a product having particles averaging say one fourth inch in diameter or thickness are so large that

they dissolve but slowly even if they have a pore structure of proper size and distribution, and further it is practically impossible to make particles of this size without a toughened difficulty soluble relatively impervious outer skin and without excessively large cells. I have found that the upper particle size limit for really good wetting and dissolving properties is about two millimeters as determined by no substantial proportion of the particles of the product being retained on a standard ten mesh sieve. It may be noted in passing that very large amounts of fine floury dust-like material may also impair the dissolving properties of the product.

It is also an object to provide a novel process for establishing and maintaining the aforesaid protected microscopic cell structure in the material of the individual component particles of a spray-solidified soap product, the particles of the product being characterized either by presence or absence of principal voids, as desired, and the product as a whole being characterized by notable ease and rapidity of wetting and dissolving. It has been proposed to produce a spray dried soap product the particles of which have an internal cellular structure produced by the expansion of steam within the soap particle and not necessarily characterized by the presence of a principal void. No claim is made herein to such a process or to the product resulting therefrom, such process and product having been disclosed and claimed in my above mentioned Patent No. 1,652,900. When, pursuant to the process of that patent, the temperature is lowered sufficiently and other process conditions are adjusted to produce a relatively slightly puffed product (Figure 3 of patent), the product becomes, as described in said patent, less rapidly soluble and of heavier bulking weight. The present invention provides a process for producing particles which can be made cellular throughout without substantially impairing the dissolving properties of the product. The present process also provides a means for producing the said cellular structure more uniformly throughout the respective particles of the product than is possible by the process of the aforesaid patent when the process is so conducted that only slight puffing is produced. The process of this invention is, in a sense, an alternative and a further development upon the process of said patent.

It is a further object to provide a process of the character referred to which is feasible from a commercial standpoint as a continuous thoroughly practicable process capable of producing the product in large tonnage at reasonable cost.

The invention probably can best be described by first giving an illustration of one embodiment of the process. The following example is given as one detailed process which can be worked successfully: Hot pure soap containing about 70% solids or hot filled soap of about 60% solids, taken from the boiling pans or crutchers as it normally occurs in common soap manufacturing practice and while it is maintained at a temperature of between 180° F. and 210° F. is pumped under a pressure of between 100 lbs. per square inch and 250 lbs. per square inch through a line or pipe. A gas such as nitrogen, carbon dioxide, air or the like, is embodied in the flowing stream of soap by being introduced into contact with the soap in an amount in excess of that which the soap will retain at atmospheric pressure. The commingled flowing soap and gas are maintained in the restricted pipe under the pressure for approximately three minutes to insure a reasonably thorough distribution of the added gas throughout the entire mass of soap. A substantial amount of the gas becomes dissolved in the soap and any excess of gas becomes admixed with the soap mass in uniformly distributed finely divided condition. The soap with its contained gas is then discharged through a suitable exit means or nozzle at the pressure of between 100 lbs. per square inch and 250 lbs. per square inch which atomizes or sprays the soap in such manner as to subdivide it into great numbers of small independent definitely segregated particles. The soap with its complement of contained gas is sprayed, as just described, into a region of pressure substantially lower than that obtaining in the pipe line, thereby effecting release of the contained gas which the soap is incapable of holding at the reduced pressure. Also, the region into which the soap with its content of gas is sprayed is purposely conditioned to effect rapid conversion of the material of the small sprayed particles into form-retaining condition as, for example, by rapidly extracting the moisture from the respective sprayed particles at a relatively low temperature level of between 200° F. and 300° F. which, due to the small size of the sprayed particles, the segregated condition of the particles, and other factors, can be accomplished readily in the brief space of three or four seconds by circulating warm air intimately about the respective particles as they are formed at the spray. The result is a substantially uniform release of gas throughout the entire body of each respective small particle effecting the formation of a myriad of minute cells distributed throughout the body of each particle and maintained of microscopic dimensions by reason of the rapid conversion of the material of the particle into form-retaining condition which takes place substantially simultaneously with the gas release, thus preventing escape of the gas from the particles and preventing uniting of the small gas pockets to form excessively large cells.

A soap product produced by the process just described is an attractive appearing apparently dry product, of light color as compared to the normal color of the soap from which it was produced. The product is of particle size which is small but which is appreciably larger than the particle size of fine powders. The particles of the product are ordinarily potato shaped individually distinct units of reasonably uniform size range and generally rounded outline free from sharp angular corners, and the like, the particles being capable of ready independent relative movement without clinging together. It is immediately distinguishable from a flaked, comminuted, broken up or disintegrated product. When the product is placed in water and stirred the entire mass of the product becomes thoroughly wet practically immediately, and the product dissolves with particular readiness and speed and with a positive resistance to the formation of difficultly soluble lumps or agglomerates.

The advantages of the present product as a commercial article are due to several controlling physical charcateristics, no one of which alone is sufficient but which, in combination, give rise to the present product. Among these several physical requisites are average particle mass and certain limits of maximum and minimum particle mass and size. The particles of the preferred product are of small individual mass but nevertheless contain sufficient amounts of soap so that they are capable of ready independent relative movement and are readily separable upon agitation of the product as by pouring into water. The minimum permissible particle mass is that which is just large enough to insure freedom from tendency of the particles to cling together and to form small lumps or spots in water which do not quickly dissolve. Irrespective of the average particle mass, it is also desirable that the product should not contain an excessive amount of fine dust or a large proportion of unduly large particles. The particles of the general run of the preferred product are sufficiently small so that, when introduced into water, the water can practically immediately proceed by capillary action to the inner portions of the particles, thus quickly permeating the entire body of the particle and dissolving the product in a few seconds. It will be understood that there is a considerable range available between the preferred maximum and minimum limits above specified. In a product made according to the process outlined above, a satisfactory general run of particle size is between 80 mesh and 20 mesh as determined by the major portion of the product being retained on a standard 80 mesh sieve and passing a standard 20 mesh sieve. It is preferable that the product should not contain large amounts of material which pass a 100 mesh sieve and should not contain substantial amounts of product which are retained on a 10 mesh sieve. The above specifications as to particle size and mass are given largely by way of example as a guide to the production of a preferred product, and they will vary to a certain extent depending upon the characteristic internal structure of the particle and other factors, it being understood that the satisfactory action of the product in water is the ultimate essential to which the product must conform.

In combination with the requirements of particle mass and size given above, it is important that the component particles of the product be separate individually formed units as distinguished from particles, fragments or portions derived by comminuting or breaking up a larger mass of soap which itself is in solidified or self-sustaining condition. The particles of the present product are characterized by relatively smooth exterior surfaces free from exposed fragile cell structure.

In combination with the various structural particle characteristics described above, the product of the present invention may be made to consist of particles which, as a matter of general run, comprise a capillary or cell structure which extends throughout the particle and which consists of great numbers of tiny cells distributed throughout the body of each small particle. This interior capillary or cell structure terminates exteriorly in a substantially continuous surface or outer portion which covers and protects the fragile interior cell structure but through which, under the microscope, the above described cell structure is visible. This protective outer portion is extremely permeable to water and is not in any sense a tough difficultly soluble skin such as is produced on soaps puffed in the form of a cake or film. When any particle or group of particles is brought into proximity with water, the water is absorbed readily and rapidly and the product becomes immediately wet. In the product wherein the microscopic cell structure extends throughout the body of the particle without the presence of a characterizing primary void, maximum wetting properties and maximum readiness and speed of solubility in a product of given bulking weight are obtained. The continuous connected cell structure of microscopic dimensions extending throughout the body of the particle facilitates access of water to all portions of the particle and insures quick wetting and quick solubility. The minute size of the cells and the presence of great numbers of cells extending throughout the entire body of each small sprayed particle provide a structure of optimum characteristics for water absorption, a result not heretofore obtained uniformly throughout a product composed of

particles not characterized by a principal void.

Referring back to the outline of the process given above, the relation of the respective steps of the process to the characteristics of the ultimate product can now be better described, as can also certain variations and modifications of the process and the resulting product. The present invention relates to soap, and the kinds of soap primarily conplated by the invention are pure soap as ordinarily produced by the usual methods of commercial manufacture, such soaps in admixture with various amounts of certain appropriate alkaline materials as, for example, common laundry soaps, soap powders which usually consist of soap and relatively large proportions of sodium carbonate, and in general any material which is a soap product primarily adapted for cleansing purposes and which comprises a proportion of soap sufficiently large to enable it, under the conditions of the process, to attain and maintain the physical structure above described. Soap, as it occurs in the boiling pans in the regular course of manufacture, normally contains about 70% of solids. When such soap is admixed with various alkaline materials, according to common manufacturing practice, this concentration of solids is ordinarily somewhat diminished, for example, to the general neighborhood of 60%. Such soaps as just referred to are, as they normally occur in the regular course of manufacture, hot or warm heavy flowing liquids partaking of a somewhat plastic character, short as distinguished from viscid, but nevertheless capable of flowing readily through pumps and pipe lines, seeking a substantially level surface in a container, and spraying readily through an appropriate atomizer. It is such relatively high solid content soap which is preferable for use in the present process. In carrying out the process with ordinary filled laundry soaps, a solid content of approximately 60% is satisfactory. The soap, as delivered to the present process, is maintained sufficiently hot so that it will flow readily through pipe lines and will break up into a satisfactory spray. A soap temperature of from say 180° F. to 210° F. is a good average working temperature, although it will be understood that the lower temperature limit at which the soap will spray satisfactorily varies with soaps of different composition and water content and can readily be determined by experiment with any particular soap. The figures given above do not represent limits; they merely specify a range within which satisfactory results can be obtained. Some soaps of regular commercial manufacture can be sprayed satisfactorily at temperatures of as low as 150° or 160° F. Also, soap temperatures substantially higher than the 210° F. figure given above can be employed satisfactorily, and substantial increase of the soap temperature has a certain effect on the product which will be described below.

The soap is then placed under pressure, and incorporation of gas therein is effected. The pressure may vary over wide limits depending upon the results desired. The pressure has a bearing on the character of the spray where a pressure spray is used and therefore must be sufficiently high to produce a satisfactory spray of well separated particles of appropriate size and uniformity of size. Very high pressures at the spray nozzle give rise to particles of excessively small size, produce objectionable wear on pumps and nozzles and increase the power cost of the operation. Very low pressures ordinarily give rise to a ragged spray resulting in a wide range of particle size and production of excessively large particles or fragments at the spray which cannot be thoroughly treated to form a satisfactory product and which often fall upon and stick to the parts of the apparatus. The amount of gas released from solution within the respective sprayed particles depends somewhat upon the pressure difference which the soap experiences, and thereby has a definite effect on product characteristics as described more fully below. The vigor with which the contained gas is released and the kind of cell structure produced by it within the individual soap particles is dependent upon the pressure drop to which the soap is subjected. The pressure employed should be sufficiently high so that the respective particles of the finished product exhibit a well defined microscopic cell structure and possess the above described desired properties of rapid wetting and dissolving in water. Ordinarily, relatively low pressures produce entirely satisfactory particle characteristics and are perhaps preferable from an operating standpoint. Pressures of from 100 to 250 pounds per square inch employed in conjunction with a pressure spray having an orifice of from 1 to 2 mm. in diameter will, when employed in combination with the process conditions set forth above, give satisfactory results. This data is, of course, given merely as an illustration of specific conditions under which satisfactory results can be obtained.

The gas is preferably introduced, as described, into a flowing stream of the soap, and the admixed soap and gas are carried along through a length of pipe under desired pressure for a period of time sufficient to insure reasonably complete distribution of the gas throughout the body of soap and dissolving of a substantial amount of the gas in the soap. Satisfactory results have been obtained by drawing in gas at the suction side of the soap pump, but it is to be understood that the soap may be charged with gas in any desired manner either with or without the use of an air compressor, gas stored in pressure

cylinders, or mixing apparatus. By way of example, it may be stated that passage of the admixed soap and air through a three-quarter inch line under pressure for about three minutes has given satisfactory results. The determining factor is proper dissolving and distribution of the gas in the soap as evidenced by the presence of the desired type of cellular structure in the typical particles of the finished product. If the gas is not uniformly incorporated throughout the soap, the desired structure will be present in some of the particles and will be absent or insufficiently developed in some of the particles. It will be understood that the gas may be introduced into a more or less non-flowing body of the soap if desired and that any feasible means of introducing the gas to secure the results herein described may be used, the introduction of the gas into a flowing stream of soap, as described, being given as an illustration of a process which is practicable for commercial operation.

The soap with its contained gas is then sprayed, the soap mass thus being subdivided into great numbers of separate individual particles. The spray of soap particles is directed into an open chamber or space sufficiently large so that the spray may spread out to its full extent without impinging upon parts of the apparatus or other obstructions and so that the particles formed float freely away from the spray and remain dispersed in the atmosphere of treating gas within the spray chamber without coming into contact with the walls, bottom or any other apparatus parts until treatment of the particles is completed. Separate formation and segregation of the particles of the product are thus effected, and the particles maintain their separate nature in the finished product.

The chamber into which the gas containing soap is sprayed is maintained at a pressure substantially lower than the pressure on the soap prior to spraying. The excess of gas which the soap is incapable of retaining at this reduced pressure thereupon releases itself within the respective individual particles. The subdivision of the soap into individual particles occurs substantially immediately at the spray, and the release of gas from solution probably takes place largely within the respective individual particles after they have been formed and segregated, as evidenced by the cellular structure of microscopic dimensions formed within the body of the particle enclosed by a relatively smooth finished exterior. The release of gas occurs very uniformly throughout the body of the particles, and the result is the formation of a myriad of microscopic gas cells distributed throughout the body of each small particle of the product.

An atmosphere or current of warm gas, such as air, which promotes rapid drying of the sprayed particles into form-retaining condition is maintained in the spray chamber. The small sprayed particles are entirely enveloped in this gas, and in a manner of a very short time the particles are reduced to form-retaining condition throughout their entire body. This quick drying and conversion of the entire substance of the respective individual particles takes place substantially concurrently with the release of gas within the respective particles and the formation of such released gas into minute cells, and hence has the effect of solidifying the particles into permanent form and maintaining the cells formed by the gas release of microscopic dimensions, not allowing them to escape or combine and thus form relatively large voids within the particles. The surfaces of the particles entirely enclose and protect the fragile cellular internal structure; no fragile cell structure projects itself to the exterior of the particle. With other conditions of the process as set forth above, drying air of say 200° F. and upward can be employed successfully in the production of the product as described.

From the above description it will be observed that the process of the present invention comprises a relatively large number of variables which may be made use of in controlling and varying the characteristics of the product within certain limits. The principle variables, assuming that the process is being applied to a given kind of soap product of the class defined above, are proportion of solids in the soap, temperature of the soap, pressure applied to the soap relative to the pressure into which the soap is sprayed, amount of gas incorporated in the soap, size of particles produced at the spray, and effective temperature level of the atmosphere in the spray chamber during the conversion of the soap particles into form-retaining condition. In the description of the process given above, a value for each of these variables has been stated by way of illustration. The invention is not, however, confined to this particular form of product and is not confined to the limits of the several variables specifically set forth above. The considerations given immediately below with respect to the several principal variables will aid in defining the scope of the invention and in pointing out its possible variations and adaptations.

Soap containing a lesser content of solids than that given by way of specific example above, even water solutions of soap, may be treated according to the present process if desired. When soap masses or solutions of extremely high water content are processed, the particles of the finished product may assume the form of thin walled hollow somewhat glassy appearing particles resembling solidified soap bubbles. The particles of

such a product are of small average mass, thus promoting clinging of the particles and somewhat impairing the solubility characteristics of the product. This, it will be understood, is an extreme illustration, and is not ordinarily encountered with any soap products which occur in the ordinary course of regular manufacture. Particle structures intermediate this extreme and the above described preferred product may be obtained from soaps of various water contents and consistencies. Soap containing a greater percentage of solids than that stated in the specific example given above can be handled satisfactorily, there being no objection to the treatment of soaps of high solid content provided that the soap can be satisfactorily handled and sprayed. Soaps of relatively high solid content lend themselves more readily to spraying into particles of the proper average mass as above described, thus facilitating production of a product of desired characteristics and properties in water. It is difficult to produce a product of sufficiently great average particle mass when very dilute solutions of soap are employed. As a general rule, the present process is adapted to take the soap in substantially the same condition as it occurs in regular commercial manufacture and to produce therefrom a soap product the particles of which exhibit the characterizing microscopic cellular structure as described, either with or without the presence of primary voids, control of which is described more fully below.

The minimum permissible limit of soap temperature is largely, as stated above, determined by the ability of the soap to break up into a satisfactory spray, and should be sufficiently high to provide for this result. In the specific example given above, the soap temperatures as stated were below atmospheric boiling point; i. e., below the boiling point of water at the pressure into which the soap is sprayed. The liquidity of the soap increases somewhat with increase in temperature, and to promote the uniform distribution of minute cells throughout the entire body of the individual particles of the finished product a relatively low soap temperature is preferred. At such relatively low temperature, the soap material of the individual particles is somewhat more resistant to the formation of cells of substantial size upon release of the gas and to the union of such cells to form primary voids. It will be observed, therefore, that control of soap temperature affords one means of controlling the average size of the cells within the respective particles and of controlling, within certain limits, the presence of a principal void or voids. There is no objection to employing soap temperatures considerably above the atmospheric boiling point, and the invention contemplates the use of such relatively high soap temperatures when desired. It is, however, desirable that the soap temperature should not substantially exceed the boiling point corresponding to the pressure on the soap prior to spraying for the reason that generation of steam in the pipe lines leading to the spray is conducive to irregularities in operation. If soap temperatures substantially above the boiling point corresponding to the pressure into which the soap is sprayed are employed, a certain amount of steam generation and vapor release will take place within the soap particles by reason of the excess of sensible heat in the soap which it cannot contain at the reduced pressure. While the amount of steam which can thus be generated and released is not great for any practicable temperature to which the soap can be heated without injury prior to spraying, it nevertheless has a cumulative effect in the formation of the cellular structure. This effect, coupled with its liquefying effect on the soap, tends to promote formation of larger cells within the respective soap particles, particularly at the inner portions of the particles. In carrying out the process, the soap temperature may be controlled in accordance with the facts just stated to thereby aid in the production of a product of desired characteristics. Whether the soap temperature be high or low, the product obtained from the process will exhibit the ready wetting and solubility characteristics above described.

The extent of the pressure to which the soap is subjected prior to spraying and particularly the pressure differential which the soap experiences during spraying are important in determining product characteristics. With a high pressure on the soap before spraying and a high pressure differential during spraying, correspondingly large quantities of gas can be dissolved in the soap, the air in physical admixture with the soap will be compressed into small volume, a correspondingly vigorous gas release upon reduction in pressure will occur, greater inflation of the particle and a more pronounced cell formation within the particle will result. The minimum desirable pressure is ordinarily that below which the spray will not operate satisfactorily or below which insufficient development of the cell structure within the respective particles results. Higher pressures, with correspondingly increased amount and rate of gas release, tend to produce somewhat larger cells before the particle attains self-sustaining condition, although this condition can be counteracted by lowering the soap temperature, employing a heavier soap, supplying a larger quantity of solidifying gas to the spray chamber, and in general by regulating the other conditions of the process to effect rapid conversion of the sprayed particles to form-retaining condition, thereby

utilizing a greater amount and rate of gas release to effect formation of a greater number of cells within the particle rather than to produce larger cells. Thus, control of the soap pressure affords a means of controlling the nature of the cell structure within the particles of the product, and may be employed to aid in the production of particles containing larger or smaller cells, as desired. In the above discussion, the use of a pressure spray has been assumed, but it will be understood that other types of atomizing devices can be employed with good results. With this arrangement the pressure can be applied by means of the pump which delivers the soap to the spraying equipment and pressure release can be effected, for example, just ahead of the spray.

Further control of the particle structure can be effected by controlling the amount of gas which is incorporated with the soap. In general, the more gas that is incorporated the greater will be its effect in expanding and forming cells in the product. It will be understood that an excess of gas over that which the soap can completely dissolve may be used. The presence of the gas in the soap, particularly the excess which cannot be contained in solution, may be looked upon as a compressible medium incorporated throughout the soap under pressure which, when released from such pressure, expands and effects inflation of the particles and which, if properly distributed throughout the soap in finely divided condition and held in such finely divided condition by quick solidification of the soap particles to form-retaining condition, will produce a cellular structure of the character described within the respective particles. A great excess of gas will tend to produce excessive inflation and disruption of the soap particles, which result is ordinarily objectionable.

The size of the particles produced at the spray is determined largely, in the treatment of any given material, by the character of the spraying device and the conditions of its operation including the liquidity of the material sprayed. These factors can readily be determined and need not here be discussed at length. The size and mass of the particles in the ultimate product are determined principally by the particle size produced at the spray, the percentage of solids in the material sprayed, and the degree of inflation of the particle. In general, the larger the particle the greater is the tendency toward larger or principal interior voids. The particle size and mass are of particular importance to the invention, as fully discussed above.

The temperature of the atmosphere in the spray chamber affects particle structure. Relatively low temperature gas employed in conjunction with the process described herein permits of a cellular structure of microscopic dimensions extending throughout the body of the particle; higher temperatures, say upwards of 300° F., ordinarily foster the production of voids in the innermost portions of the particles, due probably to the expansive effect of rapidly generated steam within the body of the particle before the material of the particle has attained form-sustaining condition. Temperatures below the solidification temperature of soap; e. g., ordinary atmospheric air or chilled air, can be used and are of particular value in producing soap and soap powder products wherein a relatively high moisture content is ordinarily desired.

From the above specification it will be appreciated that the character of the product, notably its structural characteristics, can be controlled and varied by appropriate control and variation of process conditions. The relation of the principal process conditions and variables to the principal product characteristics have been reasonably well ascertained and have been set forth above at considerable length to facilitate proper understanding of the invention and to afford full technical information as to practice of the invention.

The invention is defined in the appended claims, and is defined in terms of the novel process features above described which are applicable generally to the production of a soap product of the general class referred to herein, and is further defined in its more specific aspect in terms of the characterizing and defining features of the new soap product herein disclosed and in terms of the particular process features which are responsible for such product.

The expression heavy soap as employed in the appended claims to designate the character of soap to be processed means a soap stock in the condition in which it normally occurs in the boiling kettles in the ordinary process of commercial manufacture or such soap having added to it appropriate amounts of additional materials such as sodium carbonate solution, sodium silicate, and generally similarly acting substances according to the recognized practice in the manufacture of "filled" soaps.

I claim:

1. The process of producing a soap product composed mainly of particles having a generally rounded outline, as distinguished from a sharp angular configuration, having an interior structure substantially enclosed by a protective but water permeable outer surface formed with myriads of minute cells distributed therein, and having the property of readily absorbing water and becoming wet throughout upon contact with water, and of dissolving readily and rapidly in water, which comprises incorporating a non-

aqueous gas into heavy soap which is in a fluent state, effecting a thorough distribution of said gas throughout the entire body of the soap, the thorough distribution of the gas being effected while the soap is maintained under pressure substantially in excess of the atmosphere with its contained gas resultingly compressed, effecting formation of particles of generally rounded outline having the aforesaid water permeable outer surface and cellular internal structure by spraying said gas-containing soap into a region of reduced pressure sufficiently low to permit susbtantial expansion of the contained gas within the respective individual soap particles, and effecting a rapid conversion of the said soap particles into form-retaining condition thereby to retain said cellular structure within the respective individual soap particles and imparting to the product the aforesaid properties of ready and rapid wetting and dissolving, said non-aqueous gas being incorporated into the fluent soap in an amount in substantial excess of the quantity of gas which the soap is capable of containing at the reduced pressure of the region into which the soap particles are sprayed.

2. The process of producing a soap product composed mainly of particles having a generally rounded outline, as distinguished from a sharp angular configuration, having an interior structure substantially enclosed by a protective but water permeable outer surface formed with myriads of minute cells distributed therein, and having the property of readily absorbing water and becoming wet throughout upon contact with water, and of dissolving readily and rapidly in water which comprises establishing a flowing stream of heavy soap, incorporating a non-aqueous gas into the soap in a quantity substantially in large excess of the quantity of gas which the soap is capable of containing at atmospheric pressure, effecting a thorough distribution of gas throughout the entire body of soap, the thorough distribution of the gas being effected while the soap is maintained under a pressure of upwards of 100 lbs. per square inch with its contained gas resultingly compressed, effecting a sub-division of said gas-containing soap into separate individual particles of generally rounded outline having the aforesaid water permeable outer surface and cellular internal structure by spraying said gas-containing soap into a region of substantially atmospheric pressure to permit substantial expansion of the contained gas within the respective individual soap particles, and effecting a rapid conversion of the said soap particles into form-retaining condition thereby to retain said cellular structure within the respective individual soap particles and imparting to the product the aforesaid properties of ready and rapid wetting and dissolving.

3. The process of producing a soap product composed mainly of particles having a generally rounded outline, as distinguished from a sharp angular configuration, having an interior structure substantially enclosed by a protective but water permeable outer surface formed with myriads of minute cells distributed therein, and having the property of readily absorbing water and becoming wet throughout upon contact with water, and of dissolving readily and rapidly in water, which comprises incorporating a non-aqueous gas into heavy soap which is in a fluent state, effecting a thorough distribution of said gas throughout the entire body of soap, the thorough distribution of the gas being effected while the soap is maintained under pressure in excess of 100 lbs. per square inch with its contained gas resultingly compressed, effecting formation of particles of generally rounded outline having the aforesaid water permeable outer surface and cellular internal structure by spraying said gas-containing soap into a region of reduced pressure sufficiently low to permit substantial expansion of the contained gas within the respective individual soap particles, and effecting a rapid conversion of the said soap particles into form-retaining condition thereby to retain said cellular structure within the respective individual soap particles and imparting to the product the aforesaid properties of ready and rapid wetting and dissolving, said non-aqueous gas being incorporated into the fluent soap in an amount in substantial excess of the quantity of gas which the soap is capable of containing at the reduced pressure of the region into which the soap particles are sprayed.

4. The process of producing a soap product composed mainly of particles having a generally rounded outline, as distinguished from a sharp angular configuration, having an interior structure substantially enclosed by a protective but water permeable outer surface formed with myriads of minute cells distributed therein, and having the property of readily absorbing water and becoming wet throughout upon contact with water, and of dissolving readily and rapidly in water, which comprises incorporating a non-aqueous gas into heavy soap which is in a fluent state, effecting a thorough distribution of said gas throughout the entire body of soap, the thorough distribution of the gas being effected while the soap is maintained under pressure substantially in excess of the atmosphere with its contained gas resultingly compressed, effecting formation of particles of generally rounded outline having the aforesaid water permeable outer surface and cellular internal structure by spraying said gas-containing soap into a region of reduced pressure sufficiently low to permit substantial expansion of the contained gas within

the respective individual soap particles, the area of the region of reduced pressure being defined by a treating chamber of an area sufficient to permit the individual sprayed particles to attain substantially form-retaining condition prior to an impingement thereof upon its walls, and effecting further independent drying of said respective sprayed particles while they contain substantial amount of gas which has been distributed within the soap thereby to retain said cellular structure within the respective individual soap particles and imparting to the product the aforesaid properties of ready and rapid wetting and dissolving, said non-aqueous gas being incorporated into the fluent soap in an amount in substantial excess of the quantity of gas which the soap is capable of containing at the produced pressure of the region into which the soap particles are sprayed.

5. The process of producing a soap product composed mainly of particles having a generally rounded outline, as distinguished from a sharp angular configuration, having an interior structure substantially enclosed by a protective but water permeable outer surface formed with myriads of minute cells distributed therein, and having the property of readily absorbing water and becoming wet throughout upon contact with water, and of dissolving readily and rapidly in water, which comprises incorporating non-aqueous gas into heavy soap which is in a fluent state, effecting a thorough distribution of said gas throughout the entire body of the soap, the thorough distribution of the gas being effected while the soap is maintained under pressure in excess of 100 lbs. per square inch with its contained gas resultingly compressed, effecting formation of particles of generally rounded outline having the aforesaid water permeable outer surface of cellular internal structure by spraying said gas-containing soap coincident with the reduction of pressure thereon to permit substantial expansion of the contained gas within the respective individual soap particles, and effecting a rapid conversion of the said soap particles into form-retaining condition thereby to retain said cellular structure within the respective individual soap particles and imparting to the product the aforesaid properties of ready and rapid wetting and dissolving, said non-aqueous gas being incorporated into the fluent soap in an amount in substantial excess of the quantity of gas which the soap is capable of containing at the reduced pressure to which it is subjected coincident with the spraying thereof.

6. The process of producing a soap product composed mainly of particles having a generally rounded outline, as distinguished from a sharp angular configuration, having an interior structure substantially enclosed by a protective but water permeable outer surface formed with myriads of minute cells distributed therein, and having the property of readily absorbing water and becoming wet throughout upon contact with water, and of dissolving readily and rapidly in water, which comprises establishing a flowing stream of soap having solid content of of at least about 60%, incorporating a non-aqueous gas into said soap, effecting a thorough distribution of said gas throughout the entire body of soap, the thorough distribution of the gas being effected while the soap is maintained under pressure substantially in excess of the atmosphere with its contained gas resultingly compressed, effecting formation of particles of generally rounded outline having the aforesaid water permeable outer surface and cellular internal structure by spraying said gas-containing soap into a region of reduced pressure sufficiently low to permit expansion of the contained gas within the respective individual soap particles, and effecting a rapid conversion of the said soap particles into form-retaining condition, thereby to retain said cellular structure within the respective individual soap particles and imparting to the product the aforesaid properties of ready and rapid wetting and dissolving said non-aqueous gas being incorporated into the fluent soap in an amount in substantial excess of the quantity of gas which the soap is capable of containing at the reduced pressure of the region into which the soap particles are sprayed.

7. The process of producing a soap product composed mainly of particles having a generally rounded outline, as distinguished from a sharp angular configuration, having an interior structure substantially enclosed by a protective but water permeable outer surface formed with myriads of minute cells distributed therein, and having the property of readily absorbing water and becoming wet throughout upon contact with water, and of dissolving readily and rapidly in water, which comprises establishing a flowing stream of soap having a solid content of at least about 60%, incorporating a non-aqueous gas into said soap, agitating the soap in the flowing stream in the presence of the gas for effecting a thorough distribution of said gas throughout the entire body of soap, the thorough distribution of the gas being effected while the soap is maintained under pressure substantially in excess of the atmosphere with its contained gas resultingly compressed, effecting formation of particles of generally rounded outline having the aforesaid water permeable outer surface and cellular internal structure by spraying said gas-containing soap into a region of reduced pressure sufficiently low to permit expan-

sion of the contained gas within the respective individual soap particles, and effecting a rapid conversion of the said soap particles into form-retaining condition by bringing a current of relatively low temperature air into contact with said particles, the temperature of said air being sufficiently low so that the maximum temperature attained by the sprayed particles before solidification thereof does not exceed the atmospheric boiling point of water, thereby to retain said cellular structure within the respective individual soap particles and imparting to the product the aforesaid properties of ready and rapid wetting and dissolving, said non-aqueous gas being incorporated into the fluent soap in an amount in substantial excess of the quantity of gas which the soap is capable of containing at the reduced pressure of the region into which the soap particles are sprayed.

8. The process of producing a soap product composed mainly of particles having a generally rounded outline, as distinguished from a sharp angular configuration, having an interior structure substantially enclosed by a protective but water permeable outer surface formed with myriads of minute cells distributed therein, and having the property of readily absorbing water and becoming wet throughout upon contact with water, and of dissolving readily and rapidly in water which comprises establishing a flowing stream of heavy soap, incorporating a non-aqueous gas into the soap, effecting a thorough distribution of said gas throughout the entire body of soap, the thorough distribution of the gas being effected while the soap is maintained under pressure in excess of 100 lbs. per square inch for a period of at least three minutes, effecting formation of particles of generally rounded outline having the aforesaid water permeable outer surface and cellular internal structure by spraying said gas-containing soap into a region of reduced pressure sufficiently low to permit substantial expansion of the contained gas within the respective individual soap particles, and effecting a rapid conversion of the said soap particles into form-retaining condition thereby to retain said cellular structure within the respective individual soap particles and imparting to the product the aforesaid properties of ready and rapid wetting and dissolving, said non-aqueous gas being incorporated into the fluent soap in an amount in substantial excess of the quantity of gas which the soap is capable of containing at the reduced pressure of the region into which the soap particles are sprayed.

In testimony whereof I affix my signature.

DALLAS R. LAMONT.