Aug. 30, 1932. P. M. TRAVIS 1,874,388

PROCESS AND APPARATUS FOR MANUFACTURING SOAP

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Fig. 1,

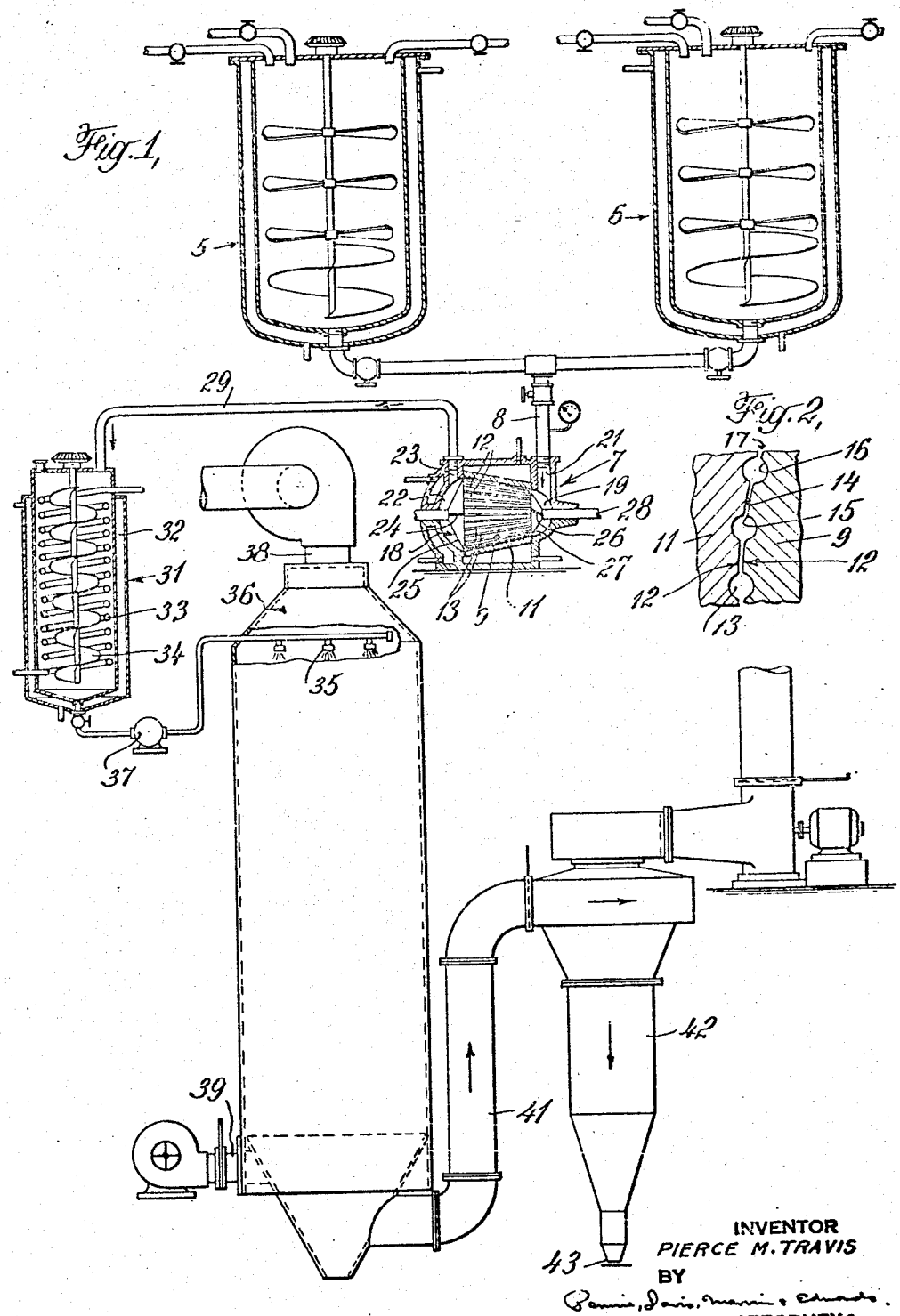


Fig. 2,

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UNITED STATES PATENT OFFICE

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PROCESS AND APPARATUS FOR MANUFACTURING SOAP

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This invention relates to the manufacture of soap, and more particularly to a process and apparatus for continuously producing a marketable solid soap product directly from its raw materials relatively instantaneously as compared with the present commercial practice.

The usual soap-making operation is generally recognized as an unduly protracted and involved procedure, and while constant efforts have been made to overcome these objectionable factors, no satisfactorily effective and commercially practical solution has been found heretofore.

The boiling or settled soap process by which soap is generally manufactured in present day practice, is a long drawn out and comparatively costly operation involving the use of cumbersome equipment and an inordinate amount of space. In the saponification of fats by this process, a plurality of prolonged stages is required, including a substantial primary saponification, followed by salting out, washing, strengthening, fitting and settling. Thereafter, in the production of the vast majority of soaps, fillers and the like are incorporated in the hot settled soap, and the mass is run into large frames to cool. As generally conducted, a period varying from four days to a week or thereabouts is consumed in carrying out the boiling and associated stages properly, and from three to six days in the usual frame cooling.

Formerly the so-called "cold" process was more widely used for soap manufacture but that process has been more or less generally supplanted by the more effective boiling process. According to the original "cold" process, suitable quantities of strong caustic and certain fats are agitated in a crutcher for a short time, and when proper mixture has been secured and saponification has progressed to a suitable degree, the usual fillers, coloring material and the like are incorporated, and the reacting batch is run into frames and allowed to stand for several days to complete the saponification and then to cool, the heat used in the operation being mainly that developed by the reaction. The time element involved does not differ substantially from that of the objectionably protracted boiling process, for from six to ten days is ordinarily required for completion of the cold process. While from a manufacturing standpoint the process presents a less involved and more efficient type of operation than does the boiling process, certain technical deficiencies practically prohibit its use in place thereof and have caused its general abandonment in favor of the latter process. Its major disadvantage lies in the almost invariably incomplete saponification obtained as compared with the boiling process, for even with the exercise of all due care, it cannot be depended upon to produce soap of suitable and uniform quality. Soap made by the ordinary cold process is almost always characterized by the presence of excessive amounts of free alkali and/or unsaponified fat, and by its tendency to discolor and rancidify in a relatively short time.

It is the object of my invention to provide a process and apparatus by which a marketable solid soap of uniform and high quality, may be continuously produced directly from its raw materials relatively instantaneously as compared with these recognized processes, and in a manner which is simple, practical and thoroughly effective.

According to my invention, a mixture of syrupy consistency, containing the common soap-forming fats, oils or fatty acids, either individually or blended in suitable proportion, and the alkali, in which mixture is ordinarily incorporated the customary fillers such as sodium silicate, carbonate and the like, is subjected to an intense disrupting and dispersing action which increases the interfacial area and intimacy of contact to such an extent that saponification is completed practically instantaneously, with the accompanying production of an extremely homogeneous and fine mixture of the soap, fillers and other materials used, and the resulting mass is then converted preferably substantially immediately, into very small units, in which very accessible form it may be quickly dried and/or cooled and/or otherwise treated to yield a solid soap product.

The preferred manner in which my inven-

tion is carried out is described in the following specification taken in conjunction with the accompanying drawing, in which,

Fig. 1 is a diagrammatic view of an illustrative combination of apparatus for carrying out my invention;

Fig. 2 is a fragmentary cross-section on an enlarged scale of the cooperating working surfaces of the saponification-completing apparatus used therein, for applying an intense disrupting and dispersing action.

Referring to the drawing, and in particular to Fig. 1, reference numerals 5 and 6 designate jacketed crutchers or agitators of any suitable and well known type, in which the raw materials for the soap are pre-mixed and treated prior to their subjection to the intense disrupting and dispersing action, which is applied through the medium of mill 7. These crutchers are provided in appropriate number and are alternately charged and discharged so as to assure a continuous supply of properly pre-treated material to the mill. If desired a single continuous agitator into which proportionate quantities of the raw materials are simultaneously and continuously metered may be used in place of the alternating crutchers. A common conduit 8 connects the crutchers directly with the mill 7, although indirect feed through an interposed buffer or feed control tank may be used if desired.

In their passage through the mill 7 the properly mixed and pre-treated materials are subjected to an intense disrupting and dispersing action which increases the interfacial area and intimacy of contact to such an extent that saponification proceeds to completion practically instantaneously.

An extremely intense disruption and dispersion which very effectively brings about such a result is that which is obtained for example, when a mixture of syrupy consistency containing the constituent materials of the soap, attenuated to accessible thin film form, is subjected practically simultaneously to a substantial high speed film shearing, a high speed film beating, and a violent agitation or eddying to relatively continually expose new surfaces of the film for shearing and beating.

A simple mechanical means of applying such an action is provided by relatively moving cooperating working surfaces configured for example, as shown in Fig. 2. In that construction, a rotor and a stator member, designated 9 and 11 respectively, provide the relatively moving members, the cooperating surfaces of which are both formed with alternating, continuous longitudinal ridges or ribs 12 and channels 13. The ridges 12 terminate in substantially flat shearing faces 14 which form sharp edges 15 with the sides or beater faces 16 of the ridges. The channels 13 are preferably of smoothly curved cross-section to promote churning or eddying of the film being treated, for the purpose of continually exposing new surfaces thereof to the shearing and beating actions of the faces 14 and 16 respectively. A smooth curvature of the channels need not be rigidly adhered to however, although such conformation best promotes eddying. The sides 16 may for example form obtuse angles with the bottom of the channel, or be otherwise contoured to provide the desired result.

The rotor and stator surfaces are spaced with a very slight intervening clearance, to provide a narrow working gap 17 in which the materials are treated in thin film form. A clearance ranging between .002 and .010 inches is generally effective for thorough saponification, although at particularly high rotor speeds this upper limit may be somewhat exceeded.

The peripheral speed at which the rotor member is operated ordinarily, ranges from 3000 ft. to 5000 ft/min. and sometimes higher, depending upon the width of the working gap 17, the nature of the materials being treated, and the intensity of effect desired.

A practical embodiment of the cooperating working surfaces of Fig. 2 in a highly efficient form is illustrated by the mill 7 of Fig. 1. This mill comprises a jacketed stator member 11 which defines an elongated chamber 18 of frusto-conical form, communicating at its smaller end with a feed chamber 19 and inlet 21, and at its larger end with a discharge chamber 22 and outlet 23. A rotor member 9 of a frusto-conical form similar to that of the chamber 18 is mounted for rotation therein in closely adjacent, non-contacting co-axial relation with the stator 11, the ridged and channelled surfaces of the rotor and stator defining the narrow working gap 17 shown in enlarged proportion in Fig. 2.

By virtue of the conical form of the rotor and stator, the width of the gap 17 may be varied as desired by suitable longitudinal adjustment of the rotor. Furthermore, materials fed at the smaller end of the conical construction will be rapidly drawn towards the larger or discharge end, by the accelerating action of the increasing centrifugal force, the degree of acceleration depending upon the slope, and the speed of the rotor. This rapid passage finds valuable application in large scale operation and provides adequate compensation in capacity for the treatment of the materials in film form rather than as a large mass.

In the event the passage of the material through the working gap 17 is too rapid for thorough subjection to the action therein, suitable retardation may be provided whereby the time or length of passage is appropriately extended. By providing a longer gap for example, and/or by decreasing the slope of the same, suitably prolonged subjection of

the materials to the action in the gap may be obtained.

A positively acting means by which retardation of discharge may also be secured, without too greatly diminishing the power advantages resulting from the inherent centrifugal acceleration, is provided, for example, by centrifugal impeller grooves 24, or by projecting fins if desired, disposed on a detachable or integral conical projection 25 at the large end of the rotor 9. These grooves extend substantially radially of the projection in equi-distant relation, and terminate in the channels 13 on the surface of the rotor proper. By suitably increasing or decreasing the number of these grooves the retardation may be intensified or diminished as desired. Variation of the number of operating grooves or fins may be accomplished for example, by using detachable groove fillers or detachable fins. Similar grooves 26 or other impeller faces may be provided on a similar projection 27 at the smaller end of the rotor, to aid the introduction of materials into the working gap.

Rotation of the rotor and its accompanying projections is accomplished through the medium of a driving shaft 28, which may be directly connected with a suitable motor, through the medium of a flexible coupling which will permit longitudinal adjustment of the rotor, or which may be indirectly-driven by a belt connection or the like.

The outlet 23 of the mill, which may be located at the top, bottom or intermediate points in the discharge chamber 22, is connected by means of a conduit 29 with an apparatus for converting or breaking up the mass of material from the mill into very small units in which form the soap is subjected to further treatment.

An exemplary and particularly effective operation of such a nature, comprises converting the mass of material into a fine spray and treating it in that form. As an illustration thereof I have shown in the drawing the application of a spray drying apparatus of suitable and well known type.

For certain applications, the mill 7 is preferably connected with this apparatus through the intermediary of a control tank 31, provided with an external jacket 32 and an internal coil 33, for the circulation of a temperature regulating medium, and accommodating an auxiliary mixer or agitator 34. In this tank the temperature may be regulated as desired, additional materials incorporated in the soap which are not adapted for incorporation during the saponification operation, and other conditions controlled as dictated by the requirements of the subsequent operation. If desired, alternating control tanks may be used in the manner of the preliminary crutchers 5 and 6.

In other applications the mill may be connected directly with the spraying nozzles.

From tank 31 the soap mass is delivered to spray nozzles 35 in a drying tower 36 either under pressure provided by a pump 37, or by gravity feed supplemented by atomizing gas pressure at the nozzles, depending upon the particular application involved. Hot air or other drying gas is introduced at the top of the tower through inlet pipe 38, and cooling air at the bottom of the tower through pipe 39. A discharge pipe 41 leads from the bottom of the tower to a suitable cyclone collector 42, in which the solid soap particles are separated from the effluent gases and are discharged at outlet 43 in directly marketable form.

Specific spray drying apparatus of satisfactory application in the relation herein described, are those disclosed in U. S. patent to Lamont No. 1,652,900 of December 13, 1927 and U. S. reissue patent to Holliday No. 16,749 reissued September 27th, 1927.

The general mode of operation of my process, and as applied specifically to the apparatus hereinbefore described, is as follows:

The soap stock used may be composed of the common soap-forming fats, oils or fatty acids, either individually or in suitably proportioned mixtures. This adaptability of the process to the treatment of such varied types of soap stock, permits predetermined control of the glycerine content of the soap over a range which meets all ordinary demands. A small amount of glycerine is frequently desired in soap because of its emollient and lather strengthening properties, and by using suitable proportions of fatty acids with the fats or oils when necessary, the desired content of glycerine may be readily provided.

Mixtures of fats and/or oils with free fatty acid are not adapted for treatment by the ordinary cold process because of the tendency of the free fatty acid to prematurely combine with the alkali. This results in the condition called "bunching" which is characterized by the mechanical enclosure of portions of unsaponified fat and/or oil, and alkali by the rapidly formed soap. These lumps are very difficult to disintegrate by crutching and their presence in the finished soap results in poor texture, rancidification and other undesirable features.

This "bunching" factor may be disregarded in the present operation, for any lumps which may form are readily disintegrated and completely reacted by the intense disrupting and dispersing action embodied in my process.

The use of free fatty acid in conjunction with oil or fat is of further advantage moreover, in that the saponification is made to proceed more rapidly and effectively than when the oil or fat is used exclusively. This is probably due to an accelerating action pro-

vided by the soap which is quickly formed by the free fatty acid.

Various exemplary soap stocks illustrating the wide range of mixtures which are worked very satisfactorily by my process are as follows:—

I

	Per cent
Palm kernel oil	97
Cocoanut oil fatty acid	3

II

Palm kernel oil	33⅓
Cocoanut oil fatty acid	33⅓
Red oil (commercial oleic acid)	33⅓

III

Stearic acid	55
Cocoanut oil fatty acid	40
Palm kernel oil	5

Because of the very pronounced reaction-accelerating effect of the intense disrupting and dispersing action comprised in my process, the caustic soda and/or potash or other alkali need only be supplied in substantially the theoretical quantity required for the saponification of the soap stock, as indicated for example by the saponification value of the stock or by test runs. Where material amounts of commercial silicate filler are used however, as is usually the case in the production of laundry soaps, soap powders, bead soap, and the like, which comprise the largest proportion of soap manufactured, it is advisable to use caustic in excess of the theoretical to compensate for that taken up by the silicate. Most commercial silicate is unsaturated in this respect, the commonly used "N" brand silicate, for example, and it exhibits a tendency to absorb caustic. The approximate composition of the so-called "N" brand silicate is as follows: Na_2O—8.9%; silica—29.0%; water—62%.

The excess caustic required under such circumstances however, is rather slight when the operation is properly conducted, for the caustic appears to react selectively with the soap stock and the silicate does not absorb it to capacity. This matter of caustic absorption by the silicate however, is of more advantage than disadvantage, for when material amounts of silicate are used, the inadvertent provision of alkali in moderate excess will not work commensurate injury in the final product because of the corrective action of the silicate. By the use of the less common and more expensive brands of silicate which contain their maximum amounts of caustic, this absorption phase can of course be readily eliminated, although such a procedure is unnecessary practically.

The mixed material to be introduced into the mill must be of suitable liquid consistency when supplied thereto if proper treatment is to be secured. The mechanical saponification-accelerating action in the working gap 17 is most effective, and of most efficient application from a power consumption standpoint, when the material being treated is not of unduly thick consistency, and the same is also true of the introduction of the material into and its flow through the extremely narrow working gap. A fairly thick consistency, for example, which can be worked satisfactorily under most conditions is one of the order of commercial U. S. P. glycerine.

The general range of suitable consistencies for the mixed mass is best designated as syrupy. The thickest workable consistency in this range, is determined by its amenability to effective treatment and handling by the mechanical action involved in the particular operation. The thinnest consistency utilizable is limited only by possible retarding effect upon saponification e. g. in the reduction of the consistency by the use of water in amounts which cause undue dilution of the caustic.

Proper consistency, as well as mixture of the ingredients, temperature regulation etc., is obtained by suitable treatment in the preliminary crutching operation which precedes the subjection of the syrup-like mass to the action in the mill. In addition to affording control of the factors noted, this preliminary crutching treatment serves other valuable purposes. The initial phases of saponification usually proceed quite readily because of the chemical affinity of the soap-forming materials, and it is mainly with the final phases and the substantial completion of the saponification that the greatest difficulty is encountered. For this reason it is desirable and economically expedient to cause the reaction to proceed to a suitable extent without applying any considerable amount of external energy, and then to utilize the intense accelerating action in the mill for the completion of the remaining stages. In accordance with this economically and technically advantageous procedure, saponification is preferably carried to a satisfactory degree, depending upon the speed of reaction of the materials used, in the preliminary crutching operation, with the advantages attendant thereupon of low power consumption, utilization of the heat of reaction to elevate the batch temperature, pre-regulation of consistency, etc.

The extent and manner of bringing about saponification in the crutching operation, will vary mainly according to the materials used. With materials which react very readily and rapidly, substantial saponification will be more or less coincident with the crutching to secure intimate mixture, and may tend to cause excessive swelling and foaming unless low temperatures are used. Under these circumstances the initial batch temperature should ordinarily be as low as is commensurate with eliminating undue swelling and

foaming and securing proper consistency in the final clutched mass. With materials which react less readily or relatively slowly, the preliminary crutching should be used principally to bring about saponification to such extent as is practical, in which operation the incidental mixing will necessarily be very thorough, and in such cases the most advantageous temperatures are generally above those ordinarily dictated by the limitations of the original "cold" process. The possibility of "bunching" in the crutcher at high temperatures because of too rapid reaction, with resulting mechanical enclosure of unreacted material by the rapidly formed soap, presents no particular difficulty in the present operation, for as noted hereinbefore in relation to the use of free fatty acid-fat mixtures, it is easily remedied by the subsequent intense disrupting and dispersing action in the mill.

The variations in temperatures, liquid content, period of crutching and similar operating conditions which are necessary to bring different soap stocks and compositions to a proper state of consistency, reaction and the like, for suitable and most economical treatment in the mill, are not great and can be readily recognized or determined by one skilled in the art. In the matter of consistency for example, the visual observation of the mass in the crutcher usually affords a fair criterion after slight experience with the operation of the particular mill.

Satisfactory initial temperatures for the melted soap stock range in most intances between 120° and 180° F., and for the caustic, between room temperature and 200° F., although these limitations may be exceeded as the circumstances may dictate and as will be apparent to one skilled in the art. The temperatures of the silicate, soda ash and similar solutions are likewise pre-regulated as determined by the particular operating conditions and the ultimate batch temperature desired. These solutions serve very effectively as temperature controlling media, to correct excessive or deficient temperatures in the soap stock-caustic mixture. Their most general use in this respect is in the reduction of the excessive temperatures which frequently result from rapid reaction of the soap stock and caustic, often accompanied by excessive swelling and foaming, and in such application, the silicate and soda-ash solutions generally can be used at substantially room temperature of a few degrees above or below the same. By their addition at such temperatures, the temperature of the batch can be reduced economically to a proper point for subjection to the saponification-accelerating action in the mill.

The caustic solution used should be fairly strong although the effective concentration range varies somewhat for different soap stocks. In general, the effective concentration of caustic solution ranges between 25% and 40% solid sodium hydrate. When the preliminary crutching is carried on at particularly high temperatures with the development of appreciable amounts of steam, the strength of the caustic solution provided need not be as high as when lower temperatures are used.

With the caustic solution and the soap stock at proper temperatures, the caustic is introduced into the crutcher and the liquid or liquefied soap stock rapidly run in thereafter. The addition of the soap stock is accompanied by rapid crutching, and the resulting mass is thoroughly and continuously crutched for several minutes to provide a reasonably homogeneous mixture of the consistency of thick syrup, and to accomplish a suitable saponification prior to introduction of the other materials. The fillers, such as sodium silicate and carbonate, trisodium phosphate, clay etc., are then mixed into the batch before it has thickened to a degree which would interfere with crutching and subsequent introduction into the mill. Upon the addition of sodium silicate, the use of which is generally desirable, the mixture becomes smoother and of thinner consistency.

After a suitable period of rapid and thorough crutching to intimately and homogeneously incorporate the silicate, soda-ash, and/or other fillers in the batch, the hot syrupy mass is then discharged into the conduit 8 and thence into the mill 7, through inlet 21. It is desirable that these feed lines should be kept well filled throughout the operation in order to exclude air.

The temperature of the mass at the mill inlet should be preferably below the normal boiling point of water, e. g. 140°—200° F., in order that large amounts of steam will not be formed in the mill as a result of the heat developed therein, although the formation of some steam is frequently advantageous in promoting saponification and dispersion. This temperature can be readily obtained by proper conduct of the crutching operation, and if not, suitable correction can be secured by the use of a jacketed feed control tank as noted hereinbefore. The temperature rise occasioned in the mill by the saponification of the materials and the frictional resistance to passage, is not very marked when thorough pre-crutching has been used, and reasonable control of the mill temperature may be obtained by circulating a heating or cooling medium through the stator jackets.

With the rotor operating at a high peripheral speed, e. g. at 5000 ft./min. the hot syrupy mass will be rapidly drawn into the narrow conical working gap, and in accessible thin film form will be there subjected to a violent disrupting and dispersing action. As may best be understood by an inspection

of Fig. 2, the shearing faces 14 of opposite ridges 12 on the rotor and stator, moving relatively to each other at such very high speed, will exert an intense and substantial hydraulic shearing action upon the film of liquid material therebetween, setting up powerful disrupting and dispersing forces in the film; the sides 16 and the sharp edges 15 of the ridges will provide practically simultaneously with the hydraulic shearing, a beating action of pronounced disruptive and dispersive intensity; and the channels 13 will serve to promote the violent agitation or eddying in the liquid film for the relatively continual exposure of new surfaces thereof to the accompanying actions.

As a result of the action so constituted, and such other forces as may be inherent therein in addition to those noted, the particles of material in the working gap will be practically instantaneously disrupted to a quasi-collodial size and thoroughly and uniformly dispersed in such form, with a resultant enormous increase in the inter-facial area and intimacy of contact of the soap stock, caustic, and other materials. With such reaction accelerating conditions prevailing, the unreacted soap stock will completely react with the caustic, and in some instances with some of the carbonate also, practically instantaneously. The resulting mass, will, moreover, contain the soap, silicate and carbonate and/or other materials in a state of extremely fine and homogeneous mixture unattainable by any mixing action heretofore used.

The particularly effective nature of such intense disruption and dispersion of the materials is clearly demonstrated when it is considered, that while completion of the final stages of saponification is ordinarily very difficult to accomplish except by prolonged treatment, the acceleration of the reaction obtained as noted, is so marked, that saponification is carried to completion within the few seconds time which is required for passage through the working gap.

This specific manner of obtaining the saponification is the subject of my co-pending application Serial No. 307,322.

The hot mass discharged from the mill is then passed through pipe 29 either directly to the spray nozzles, or into the jacketed control tank 31, depending upon the requirements of the subsequent operation. In the tank 31 the temperature may be elevated or decreased, additional ingredients admixed, and other conditions regulated as is desired or necessary, with the temperature, consistency, liquid content, and other conditions of the mass regulated as the nature of the subsequent operation dictates, it is then delivered under suitable pressure by the pump 37, for example, to the spray nozzles 35 in the drying tower 36, where it is dispersed into a fine spray which passes downwardly through the tower in contact with the hot drying gas introduced through pipe 38. In its passage through the tower the sprayed material is dried thoroughly, or to the extent desired, and after the temperature of the suspension has been suitably lowered by contact with the cooling gas introduced at the bottom of the tower through pipe 39, the suspended solid particles are carried through discharge pipe 41 into the cyclone collector 42, in which they are separated from the effluent gases and are discharged through outlet 43.

Where a thoroughly dried product is desired, the temperature of the gaseous suspension should be maintained above the dew-point until the moisture-laden gas has been separated in the collector. After separation, further cooling of the solid particles may then be accomplished if desired, by the use of a second stream of cooling gas in conjunction with a second cyclone collector or in any other suitable manner.

The following exemplary operation for preparing directly a marketable finely divided soap from a specific soap stock will illustrate one application of the general method of procedure described hereinbefore.

A strong caustic solution is prepared by dissolving 12 lbs. of caustic soda (98% pure sodium hydrate) in 35 lbs. of water at room temperature, whereupon a rise in temperature to approximately 190° F. occurs due to the heat evolved on solution. This hot solution is introduced into one of the crutchers 5, 6 and into it is poured, with continual crutching, a soap stock blend consisting of 63.75 lbs. palm kernel oil and 2 lbs. cocoanut oil fatty acid, at a temperature of 140° F. A rapid reaction takes place in the mixture with the evolution of an appreciable amount of heat, and after three or four minutes crutching a batch of thick syrupy consistency is obtained with a temperature between 160°-175° F. At this point 60 lbs. of "N" brand sodium silicate at a temperature of 82° F. is crutched into the batch, and directly thereafter 17 lbs. of sodium carbonate solution (23% soda-ash) at a temperature of 88° F.

Upon the addition of the silicate the batch becomes smoother and of thinner consistency, and after a few minutes thorough crutching to secure intimate incorporation of the silicate and soda-ash, with a resulting temperature e. g. of 160° F., the hot syrupy mass is passed through conduit 8 into the mill 7, which has been suitably preheated by circulating steam through the stator jackets. In its rapid passage through the mill the mass is subjected to the intense saponification-completing reaction described hereinbefore, and its temperature is elevated in passage to 170° F.

In the production, for example, of the product described in the Lamont patent hereinbefore referred to, this hot mass from the

mill is then passed through the control tank 31, and its temperature is quickly raised to 220° F. in passage. From the tank 31, the heated mass is delivered by the pump 37 to the spray nozzles 35 at a high pressure, and is sprayed into strongly preheated drying gas (500° F.) and otherwise treated in accordance with the teachings of the patent noted to obtain the desired product.

The particular saponification steps and apparatus described hereinbefore, are peculiarly and very advantageously adapted for use in conjunction with the spray processing disclosed in the Lamont patent. The conditions of consistency and moisture content (usually in the neighborhood of 40% and ranging between 30% and 45%) which generally prevail in the saponification phase are such, that the resulting filled soap mass is obtained in such suitable condition for the preparation of the Lamont product that no further adjustment of these conditions is necessary. The temperature at which the filled soap mass is best adapted for the spray processing (of the order of 220° F.), may be closely approximated in the mass discharged from the mill, so that any temperature-regulation required thereafter would be inconsiderable. The saponification operation may be carried out very effectively at temperatures just slightly below the boiling point of water, and with the pressure in the mill but slightly above atmospheric, the boiling point can easily be elevated to 220° F. or above. Under such conditions the control tank 31 may be dispensed with.

Moreover, the finely divided product obtained by the specific combination in my basic process of the Lamont spray drying process, exhibits markedly improved qualities, over that obtained by like spray drying of a similarly constituted material containing soap prepared by the boiling process, and over finely divided soap products prepared by other known methods. A finely divided, spray dried soap product made by such specific combination, as described hereinbefore, is for example, almost instantaneously soluble with no sedimentation of silicate or other materials, it rapidly yields a closely knit and firm lather, contains practically no free alkali or unsaponified soap-forming stock, is of uniform and attractive appearance, and possesses very rapid and effective detergent properties. The solubility, sedimentation and saponification characteristics of a typical product for example, were as follows:

Five grams of the soap dissolved completely in 100 cc. of water at 50° C. in slightly less than 30 seconds, with no stirring or agitation.

Alkali determinations showed a content of .02% free alkali (NaOH).

No unsaponified soap-forming stock was present.

While I have noted the eminent applicability of my basic process in specific combination with the spray processing of the Lamont patent, for the production of a hollow particle of the structure described in that patent, it is likewise applicable with markedly improved results in the production of granular, shredded, powdered and other types of finely divided soaps wherein spraying, exuding, or other means of converting the soap mass into very small units for treatment may be used.

In addition to the pronounced reduction in operating time, the marked improvement in the product, and other novel features which result from this combination, of an intense disrupting and dispersing action for completing saponification, with a subsequent conversion of the resulting saponified mass into the accessible form of very small units for rapid drying and/or cooling or other treatment, this combination of steps in my process, with the conversion to small units in substantially immediate sequence to the intense disrupting and dispersing action, is of practically essential importance for the invariable production of improved filled soaps.

In the production of filled soaps, which usually contain sodium silicate and carbonate, intimate incorporation of the filler in the soap is essential, for with poor incorporation the soap will effloresce and soda-crack on aging. The ordinary crutching operation which is used for this purpose, is at best not particularly effective, and thorough and uniform distribution of the filler throughout the soap is not obtainable without inordinately prolonging crutching, if then.

Moreover, even after apparently satisfactory incorporation, separation of the filler frequently occurs, with resulting detriment to the marketable quality and appearance of the soap. This separation usually takes place after the filled soap mass has been run into the frames, although it not infrequently occurs in the operations prior to framing, and the resulting solid soap cannot be economically or practically treated to correct the difficulty. The causes of such separation are rather obscure, and it has been variously ascribed to poor incorporation of the filler, crutching too hot or too cold, delayed framing, and other factors. The exact reason for the separation however, is usually difficult of explanation, for even with extremely careful repetition of a successful set of conditions, separation will frequently occur for no apparent reason at all. Inasmuch as filled soaps constitute the major proportion of present-day soap production, these difficulties are of considerable importance.

In my process however, the intense disrupting and dispersing action incorporates the filler in the soap in a state of extremely fine division and uniform distribution impos-

sible of attainment by any degree of ordinary crutching, with the incidental combination in a single step of the separate saponifying and filling steps required in the boiled soap process, and the carrying over of such an enhanced degree of incorporation to the finished product is invariably assured by the conjoint use of the substantially immediately subsequent step of my process. By substantially immediately converting the homogeneous mass into very small units and rapidly drying it for example, while in such form, the detrimental filler separation characteristic of prior methods of production, is effectively eliminated and the extremely fine and thorough dispersion of my prior step which provides a remarkably homogeneous and improved product, is obtained in every instance.

Furthermore, the advantages of improved and uniform quality with extremely fine and homogeneous distribution of fillers and the like, obtainable by my process, are not confined to the production of soap in the form of small units, but may likewise be extended to the production of high grade cake soap if desired. By suitable treatment of the small units into which the saponified mass in my process is promptly converted, e. g. by suitable regulation of the temperature and volume of the drying gas in the spray drying operation to retain a suitable amount of moisture in the sprayed particles, the units may readily be pressed together to form cakes. For this purpose use can be made, for example, of any of the well known squeezing or plodding machines, wherein soap chips are squeezed together and issue in the form of a bar which is subsequently cut into cakes for stamping and wrapping.

By the process and apparatus herein described, a practical manufacturing operation is provided which eliminates the objectionally protracter, involved and comparatively expensive phases of the usual soap making practice, adequate correction of which has long been sought.

Of major importance is the great reduction in operating time accomplished thereby. In this novel operation the time consumed in the manufacture of the product in directly marketable form from its raw materials is but a matter of minutes as compared with the many days required in present soap practice.

Further supplementing its elimination of the inordinate time consumption required in the recognized boiling and cold processes, as well as its avoidance of their involved aspects, this novel operation supplies various other deficiencies of those processes, some of which have been noted hereinbefore, while providing added advantages.

The operation is simple in nature, involves but slight running expense, and provides a practically 100% yield. It can be carried on continuously, under direct control, and the output can be promptly adjusted as production requirements may dictate. No particularly cumbersome plant equipment is required, and the space consumed thereby is relatively slight as compared with that necessary for the boiling and framing operations.

Because of the adaptability of the operation to the saponification of mixtures of fatty acids, with fats or oils, as well as of the pure fats or oils, it permits a wide range of preregulation of the glycerine content of the product, and where complete glycerine recovery is desired, its very effective treatment of pure fatty acids, adapts it for use conjointly with the Twitchell or a similar process for obtaining free fatty acid and glycerine from the fats or oils.

In addition to this high degree of manufacturing efficiency which the operation presents, the soap obtained thereby is of uniform and greatly improved quality as compared with that obtained by prior methods. Unsaponified soap stock and/or free alkali are absent therein, and the soap exhibits markedly enhanced solubility, detergent properties and other desirable characteristics.

While I have described herein an illustrative manner of carrying out my invention and certain applications thereof, my invention is not limited thereto or otherwise than as defined in the following claim.

I claim:—

The process of manufacturing filled cake soap which comprises subjecting a mass of syrupy consistency containing the soap stock, saponifying alkali and filler to an intense disrupting and dispersing action whereby a completely saponified mass containing the materials in a fine state of division and uniform dispersion is obtained, then spraying said mass while the materials are substantially in said state, drying to a suitable degree, and then compacting the droplets constituting the spray to form cakes whereby a homogeneously and finely filled cake soap is obtained.

In testimony whereof I affix my signature.

PIERCE M. TRAVIS.

CERTIFICATE OF CORRECTION.

Patent No. 1,874,388. August 30, 1932.

PIERCE M. TRAVIS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 8, line 43, for "protracter" read protracted; same page, lines 108 to 110, the claim, strike out the words "to a suitable degree, and then compacting the droplets constituting the spray" and insert instead the droplets constituting the spray to a suitable degree and then compacting said units; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22nd day of November, A. D. 1932.

M. J. Moore,
(Seal) Acting Commissioner of Patents.