June 4, 1940. C. T. WALTER 2,202,973

SOAP PRODUCT

Filed Dec. 8, 1937 2 Sheets-Sheet 1

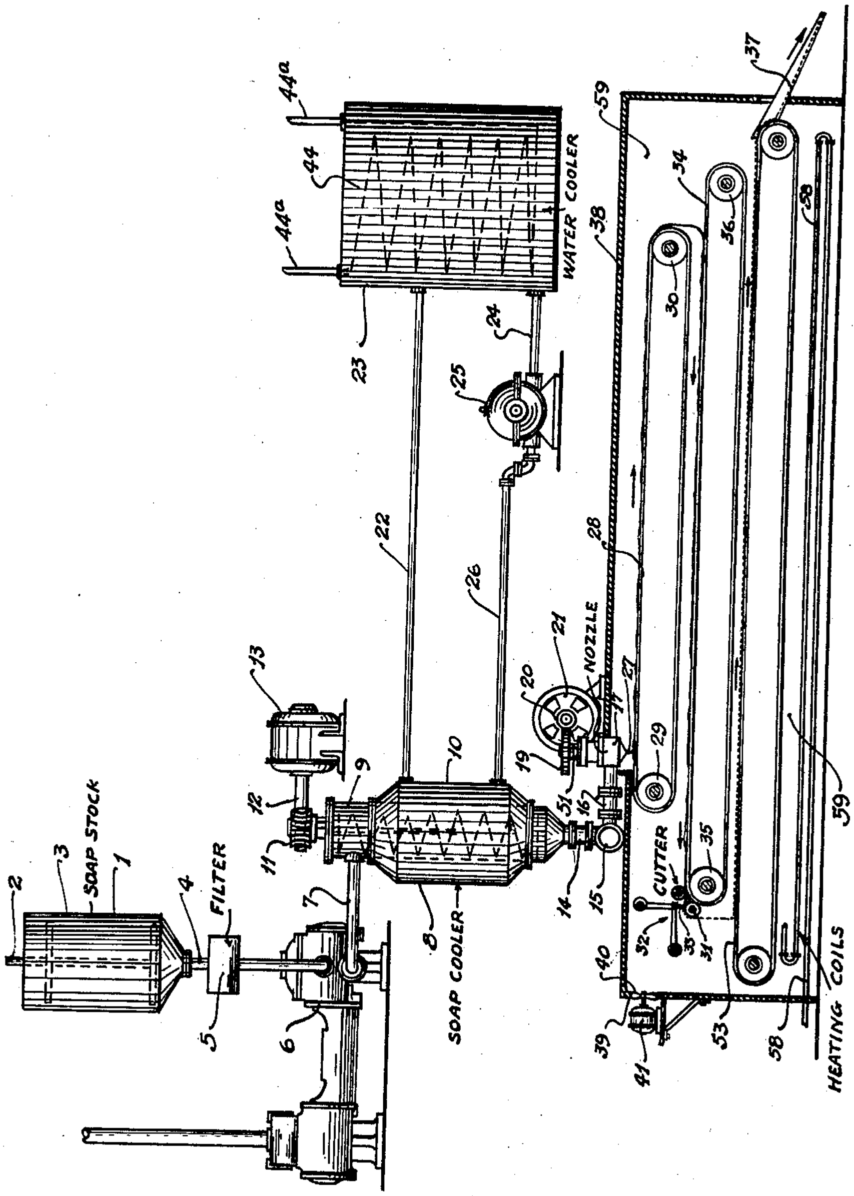

Fig. 1

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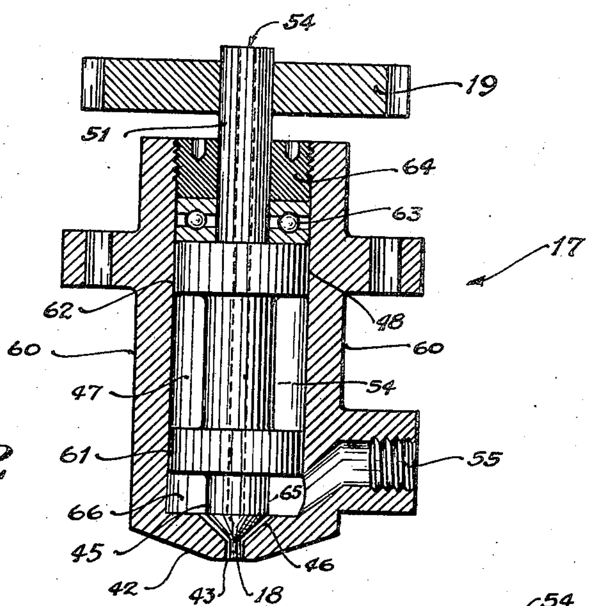

Fig. 2

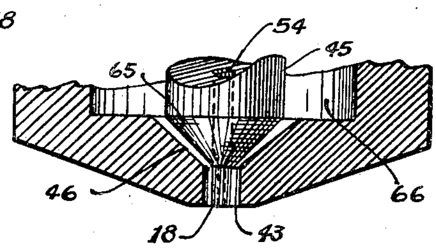

Fig. 2a

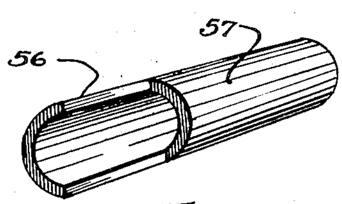

Fig. 3

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UNITED STATES PATENT OFFICE

2,202,973

SOAP PRODUCT

Charles T. Walter, Chicago, Ill., assignor to Industrial Patents Corporation, Chicago, Ill., a corporation of Delaware

Application December 8, 1937, Serial No. 178,779

9 Claims. (Cl. 87—16)

This invention relates to a new soap product.

This application is a continuation in part of my application entitled Soap product, Serial No. 92,105, filed July 23, 1936, which application Serial No. 92,105 is a continuation in part of my application entitled Soap product and method of making the same, Serial No. 703,350, filed December 21, 1933.

One of the objects of the present invention is to provide a new soap product of desirable form which is very readily soluble in water.

Other objects of the invention will be apparent from the description and claims which follow.

Referring now to the drawings:

Figure 1 is a side view partly in section of equipment which may be employed in producing the product.

Figure 2 is a side view partly in section of the type of extrusion device which may be used.

Figure 2*a* is an enlarged detail of the extrusion end of the nozzle shown in Figure 2.

Figure 3 is a perspective view partly in section of a preferred embodiment of the product of the present invention.

Referring now more particularly to Figure 1 to which, for convenience, reference legends have been applied:

1 is a tank in which hot soap stock may be placed. Tank **1** is provided with shaft **2** on which is mounted agitator blades **3**. Soap passes from tank **1** through line **4** and filter **5** and is forced by the action of pump **6** through line **7** into jacketed cooler **8** in which is mounted shaft **9** provided with agitator blades **10**.

Shaft **9** is driven through gears **11** and **12** by motor **13**. Soap stock passes from the jacketed cooler **8** through line **14**, header **15** and line **16**, through extrusion nozzle **17**. It will be noted that extrusion nozzle **17** is provided with a central pin **18** rotated by gears **19** and **20**, worm gear **20** being driven by motor **21**. Jacketed cooler **8** is cooled by water or brine circulating through line **22**, tank **23**, line **24**, pump **25** and line **26**. Any suitable refrigerating means may be used for cooling the water in tank **23** as coil **44** supplied from a compressor, not shown, through lines **44*a***.

The soap is forced through nozzle **17**, leaving nozzle **17** at point **27** in the form of a tube or ribbon and falls upon conveyor **28**. Conveyor **28** is mounted on shafts **29** and **30**. The soap is carried by the conveyor **28** in the direction of the arrows, passing over the end of the conveyor and falling upon conveyor **34** mounted upon shafts **35** and **36**, and carries the soap in the direction of the arrows, whereupon it passes over wheel **31** at which point the tubes are cut into small sections by cutter **32** provided with reciprocating blade **33**, after which the soap falls in minute sections to conveyor **53** to be carried once more the length of the drying tunnel and ejected down slide **37**.

The soap tubes, leaving the first stage of drying, passing from conveyor **28** to conveyor **34**, are sufficiently flexible to pass over the rounded end of the conveyor without damage. As many stages of drying may be provided as are necessary, depending upon the length of the tunnel, speed of operation of the conveyors and temperature of the atmosphere therein.

Roller **31** is preferably made of rubber, providing a yielding anvil for blade **33**. It will be understood, of course, that other types of cutters may be substituted for the type shown. For example, a roller may be provided with a plurality of blades contacting the rubber roller or anvil **31** over which the tubes pass after they are sufficiently dried. It will be noted that the extrusion nozzle and the conveyor are housed in housing **38** which is preferably supplied with warm air through opening **39** by the action of fan **40** operated by motor **41**. If desired, heating coils **58** may be placed in tunnel **59** within housing **38**.

The tubes may be packed into cartons or other containers immediately after cutting, or if desired, they may be subjected to a further drying operation which will have a tendency to reduce the weight shrinkage that will naturally occur in the event of a long period of holding in a dry room. Where it is desired to further dry the tubes after cutting, a convenient arrangement is provided by placing a conveyor beneath the last drying stage preceding the knife in such manner that the cut pieces will be received directly from the knife, the last mentioned conveyor being, of course, within the drying tunnel and discharging to the slide **37** or equivalent discharge means. It will be further understood, of course, that as many drying stages as desired may be installed both before and after the knife.

It will be understood, of course, that as many extrusion nozzles as desired may be mounted and supplied from the header **15**. The extrusion die disclosed in cross section in Figure 2 is one type of die which may be used in the forming of the soap, particularly of the type shown in Figure 3.

Referring now more particularly to Figure 2:

Die plate **42** is provided with an extrusion opening **43**. Pin **18** is integral with and held in place by spindle body **45** which rides on the cylindrical surface of chamber **47** of the die body

60 at bearing points 61 and 62. These bearings guide the spindle 45 and enable it to rotate, maintaining pin 18 in the center of hole 43. Shoulder 48 of spindle 45 exerts a thrust load against ball thrust bearing 63 which in turn transmits the thrust load to nut 64 which is screwed into die body 60. The clearance between spindle body conical surface 65 and surface 46 is somewhat greater than the clearance between pin 18 and the side walls of opening 43. Extension shaft 51 of spindle 45 passes through bearing 63 and nut 64 and carries gear or sprocket 19 by which the spindle 45 may be rotated. Breather tube 54 passes from pin 18 through the spindle body 45, extension shaft 51 and gear 19.

Soap stock is fed into chamber 66 through opening 55, finds its way between the surface of spindle body 45 and the surface 46 of chamber 66 and passes out opening 43. Where it is desired to prepare soap in the form shown in Figure 3, air is permitted to enter through the breather tube 54, thus preventing the walls 56 of tube 57 from collapsing.

The extrusion device shown in Figure 2 is more particularly described and claimed in my patent entitled Extrusion device, granted June 9, 1936, No. 2,043,682.

Soap stock, plastic but not liquid at the time it reaches the extrusion device, of the usual consistency of soap stock coming from chilling rolls preparatory to drying for chips or the like is satisfactory for the manufacture of the product of the present invention. Soap stock in this condition is forced through one or more extrusion dies and may then be deposited upon a conveyor in a drying tunnel such as is shown in Figure 1. If desired, the extruded soap may be dried by dropping it down a tower in which the soap is brought in contact with dry, heated air. A desirable type of drying mechanism is described and claimed in my patent entitled Drier conveyor, No. 2,043,681, granted June 9, 1936. Any other equipment or method of drying may be employed.

The method involved in the preparation of the product of the present invention is described and claimed in my patent entitled Method of making tube soap, No. 2,043,685, granted June 9, 1936, which patent issued in response to an application filed as a division of my application, Serial No. 703,350.

The extruded soap, whether in the form of a tube or otherwise, upon drying, becomes friable, in which condition it may be readily cut up into pieces of a short length. The tubular form lends itself to precise mechanical control of the important dimensions of the individual pieces of the final soap product.

The diameter of the tube and the thickness of the walls may be maintained with exact uniformity at all times and thus the rate of solubility may be controlled. Where a large volume per given unit of soap stock is desired, the thickness of the tube walls and the diameter of the tube may be adjusted to give any desired apparent specific gravity.

The apparent specific gravity or bulk of the ultimate product and the solution time may be varied by varying the thickness of the tube walls, the diameter of the tube, and the length of the individual tubes. The longer the individual tube, the greater the bulk; the shorter the individual tube, the shorter the solution time. A satisfactory device for cutting extruded tubes into individual lengths is described and claimed in my patent entitled Soap cutter, No. 2,043,684, granted June 9, 1936.

Soap stock of the formulae usually used for the manufacture of soap chips, laundry flakes and the like, is suitable for the manufacture of the product of the present invention. For example: A finished soap product having the following analysis is suitable for manufacture under the conditions mentioned:

EXAMPLE I

	Per cent
Dry soap	76½
Silicate (dry basis)	11
Soda ash	2½
Moisture	10

Another example of a finished soap product suitable for manufacturing by this process shows the following analysis:

EXAMPLE II

	Per cent
Dry soap	60
Silicate (dry basis)	20
Soda ash (dry)	2
Moisture	18

It will be noted that these two formulae differ widely in the quantity of dry soap they contain, the quantity of filler and the amount of moisture. These two examples are cited to show the wide flexibility of the process, for I find that either of these formulae may be handled with equal facility. As is usual in soap formulae, the term "silicate" in the foregoing examples indicates sodium silicate.

The preferred method of manufacture is to start with a hot liquid soap having a temperature of approximately 180° F. At this temperature, the soap stock is a liquid and flows readily through pipes by gravity or under the influence of pump pressure.

This liquid soap stock is picked up by a suitable pump and caused to flow under pressure through a suitable filter device for removing small particles of dirt or fibers which frequently find their way into the soap mixture.

From the filtering device the soap stock is passed into a suitable heat exchanger which removes the sensible heat and latent heat of fusion and brings about a congealing action. The temperature of the soap leaving the cooler may be any convenient desired degree. For example: A temperature of 70° F. is satisfactory.

In this connection, I have found that plastic soap at a temperature of as high as 90° F. can be successfully extruded into reasonably strong self-supporting tubes. At lower temperatures the tube becomes stronger and will stand more handling without breaking or collapsing.

As the soap leaves the heat exchanger, it is in a stiff plastic condition. It will flow through pipes and other conduits under the influence of a sufficiently great pressure. It can even be forced through a fine mesh filter screen in this condition, and I find it expedient to subject the material to a secondary filtering operation at this stage in order to insure that no solid particles of substantial size remain in the mass as it flows to the extrusion device.

From the heat exchanger the plastic soap is forced through pipelines to a multiple number of extrusion nozzles attached to the manifold.

An alternate method which may be used to prepare soap in tubular form is to first chill the soap stock having the desired formula by either passing it over a chilling roll as in the manner for manufacturing soap chips or casting it in blocks as in the manner for manufacturing laundry soap and the like in bar form. This chilled soap is not permitted to dry and in such a condition is plastic and may be made to readily flow under pressure.

This chilled plastic soap may be placed in a cylinder in which operates a plunger and when sufficient pressure is exerted on the plunger, the soap will flow through the system which should consist of a filtering device and the extrusion nozzles.

It will be noted that this method differs from the preferred method described above only in that in this latter method the chilling of the liquid soap to a stiff plastic condition takes place outside of the pressure system.

In the preferred system the soap is more readily handled by the pump and the system lends itself more readily to continuous operation.

The amount of drying or solidifying effect which must take place to bring the tubes into the proper state for cutting depends upon the nature of the soap stock from which the tubes are made.

In general, soap stocks which contain a large percentage of filler such as Example II given above, dry or solidify to a suitable degree for cutting in an appreciably shorter time under the same drying conditions than do formulae containing less filler as illustrated in Example I. I have found that there is an optimum condition reached during the drying process in which the soap must be cut into pieces in order to get the best results.

If an attempt is made to cut the soap tubes before they have solidified sufficiently, the pressure of the cutting knife will cause the tubes to flatten appreciably at the point of cutting. This results in small tubular elements with partially closed ends.

On the other hand, if tubular soap is cut beyond a certain stage of dryness, it is found that a considerable percentage of the tubular elements break into small splinters. I have found that this range of dryness in which cutting may take place satisfactorily is reasonably broad and may readily be obtained with ordinary commercial drying apparatus.

The product of the present invention has many advantages over other soap products. In recent years it has been proposed to prepare soap in the form of small, hollow spheres or beads, this being done by the separate drying method. One method in vogue for forming bead soap is to separate the stock in a rather liquid condition in the form of small soap bubbles in drying towers, the product being cooled in the form of dried, hollow beads by any appropriate dust collecting apparatus.

The spheres or beads formed in this manner are irregular in shape and size and have a decided tendency to powder. This tendency to powder results in the accumulation of fines in packages of the material. Furthermore, this type of product tends to lump when poured in water and the fines which rise in the form of dust when a quantity is poured from the package into water are often decidedly offensive to the nostrils.

Soaps prepared in tubular form in accordance with the present invention, depending upon dimensions, show varying weight volume relationship as indicated in the following tables:

Table I

Outside diameter	Wall thickness	Approximate length of individual pieces	Pounds per cubic foot
Inches	*Inches*	*Inches*	
.09	.0055	1/4	13.1
.09	.0055	5/8	11.2
.09	.0045	1/4	12.5
.09	.0045	5/8	10.6
.09	.0035	1/4	10.6
.09	.0035	5/8	8.7
.07	.0055	1/4	14.4
.07	.0055	5/8	13.1
.07	.0035	1/4	11.9
.07	.0035	5/8	9.4

Table II

Inside diameter	Wall thickness	Approximate length of individual pieces	Apparent specific gravity (calculated to 10% moisture basis)
Inches	*Inches*	*Inches*	
.086	.0030	1/4	0.102
.086	.0090	1/4	0.204
.086	.0140	1/4	0.245
.086	.0030	3/8	0.108
.086	.0050	3/8	0.122
.086	.0070	3/8	0.172
.086	.0090	3/8	0.193
.086	.0120	3/8	0.223
.086	.0140	3/8	0.233
.086	.0030	1/2	0.086
.086	.0090	1/2	0.190
.086	.0140	1/2	0.231
.086	.0030	5/8	0.084
.086	.0090	5/8	0.164
.086	.0140	5/8	0.197

Table II shows the effect of varying wall thickness and piece length with the inside diameter remaining constant. The moisture and apparent specific gravity were determined for each sample. The data given in Table II with respect to apparent specific gravity was derived by calculating each sample to a 10% moisture basis.

The apparent specific gravity of the product of the present invention is of the order of such soap products as flakes, granules, and spray dried soap. Flakes and granules of large distribution normally range in apparent specific gravity between 0.22 and 0.27. Spray dried soap products generally on the market range in apparent specific gravity between 0.15 and 0.33, the latter product being considered more desirable by the trade.

The solubility rate of soap flakes, granules, and spray dried soaps on the market has been found to range between 20 seconds and 97 seconds. The spray dried products normally range between 24 seconds and 77 seconds.

The product of the present invention may be prepared having solubility rates throughout the entire range indicated for flakes, granules, or spray dried products.

The tube soap which is the preferred embodiment of the present invention is mechanically strong, does not powder easily, does not have a tendency to produce fines, does not lump in water, and may be easily prepared of such a wall thickness and diameter that it will dissolve more quickly than the bead type soap.

The most satisfactory wall thickness and tube diameter depends to some extent upon the type of soap stock employed, it being possible to secure extremely thin walls which are mechanically strong with high grade soap stocks.

A preferred commercial form of the tube soap of the present application is a plurality of individual pieces having an outside diameter of from .07 to .09 inch and a wall thickness of from .0035 to .0055 inch. An example of preferred measurements is a diameter of .08 inch and a wall thickness of .0045 inch. It will be seen that the tubes have extremely thin walls and have a diameter great in size relative to the thin walls. The tubes may be from one-fourth inch to three-fourths inch in length.

The present invention is concerned with thin walled tubes. The term "thin walled" as used in this specification and in the claims which follow, must be understood as being limited to tubes having an inside diameter of the order of .0315 inch to .375 inch and a wall thickness of the order of below .09 inch.

Since these small tubes are open at both ends, water enters the inside of the tube by capillary action and the walls of the tube dissolve simultaneously from both the outside and the inside surfaces.

The advantage of this tube type of soap over soap flakes, for example, is similar in many respects to the advantages over bead soap, there being the additional advantage that in the case of soap flakes the flakes tend to pack and stick together, thus cutting down dissolving surface area whereas there is no such tendency in the case of tube soap.

It is apparent from the foregoing discussion that the tubular soap product of the present invention is distinctively different from heretofore known forms of soap. The component particles are of a size readily perceptible to the naked eye but are so small that the product is inherently and necessarily a bulk soap product of such character that the component particles are used in mass rather than as separate entities and are individually hollow, thin-walled soap tubes, so that the product is free from substantial amounts of fine dust-like matter and presents to the eye the characteristic and distinguishing appearance of a large number of independently visible, individually distinct little soap tubes as distinguished particularly from a powder and from spray dried soap, in which product the component particles are capable of ready, independent, relative movement without clinging together, which promotes separation of the particles upon introduction of the product into water. These component particles are capable of maintaining their independent identity during dissolving without tending to form into a lump, and are also substantially immediately accessible to the solvent action of the water on both the outer and inner surfaces of the tubes, whereby rapid and complete solubility is assured and positive resistance to lumping and balling of the product not heretofore attained in soap products is attained.

It is clear that the individual tubes of soap, although relatively small as pieces of soap, are large considering the amount of soap contained in each individual particle and, consequently, the available surface presented to the solvent action of the water is large relative to the amount of soap contained in the particle, by reason of which the soap product is soluble with particular readiness, speed, and completeness, and is characterized by a total absence of any tendency to form lumps, balls, or spots of soap undissolved in washing, the particles being capable of attaining practically immediate contact with water upon being dropped upon the surface.

Various means may be employed to cut the extruded tubes into sections of the desired length. In the operation of the equipment shown in Figure 1, conveyor **28** may be operated rapidly enough so that the tubes are moist when they pass over the wheel **31**, under the cutter **32**. Blades **33** of cutter **32** may be adjusted to merely nick the tubes so that when the tubes are dry after leaving conveyor **53**, they may be readily broken up into the sections indicated by the nicks. It is preferable, however, to completely sever the sections, the conveyor **28** being of sufficient length and driven at a proper speed so that the tubes are at a proper state of dryness when they pass the cutter **32** to be entirely cut up in sections of the desired length. It is unsatisfactory to attempt to cut the tubes immediately after coming from the extrusion nozzle, since the tubes are in such plastic condition at that time that there is a likelihood of collapse.

If it is attempted to cut the tubes after they become perfectly dry, it is difficult to secure clean cuts without shattering the tube walls to some extent. It has been found necessary in practice in order to produce a continuous tube of soap to rotate the pin **18** while soap is being extruded and permit air to enter through the breather tube **54** to prevent collapse of the tube.

A new type of ribbon soap may be formed from tubes as is more particularly described and claimed in my copending application entitled Ribbon soap, Serial No. 178,780, filed December 8, 1937, which application is a continuation in part of aforesaid application Serial No. 92,105.

I have found that the tube soap may be given a glossy finish by heating the nozzle of the extrusion plate to a temperature of from 160° to 180° F. The action of the heated nozzle would seem to produce a skin effect on the extruded soap, a very thin film of soap being heated and probably melted. The depth of this heating effect is not sufficient to materially affect the strength of the extruded tube. After being in contact with the cool air for a few seconds after leaving the extrusion die, the more or less molten outside film or skin solidifies into a smooth, glossy surface, which is thereafter retained indefinitely.

The nozzle of the extrusion die may be heated by means of a hot water jacket around its lower end, which provides enough heat to the apparatus to compensate for the heat removed by the stream of soap flowing through it, thus maintaining a constant temperature.

If a glossy finish is not desired, the suede finish common in soap products may be secured by extruding the soap with the extrusion nozzle at atmospheric temperatures. Soap containing filler, heat treated as has just been described, gives every appearance of a milled soap not containing filler.

In the formation of the tube soap, it is necessary to permit air to enter the tube as it is being formed to prevent partial collapse of the delicate tube. At high extrusion velocities it is necessary to force air into the tube through the breather tube under pressure.

In comparatively large scale operations, I have successfully started with soap in a hot liquid state, the soap being drawn from a small jacketed agitator by a suitable pump. The pump forces the hot soap stock through a cooling device in which it is reduced to a stiff, plastic mass suitable for forming into thin-walled, self-supporting tubes.

The cooling device is preferably equipped with a mixing or stirring device to bring about uniform cooling and mixing of the material as it passes through the cooler. From the cooler, the plastic soap is delivered to a manifold and thence to a multiple number of extrusion dies.

The plastic soap emerges from the dies in the form of a continuous length of thin-walled tubes which are received upon a drying conveyor. After the tubes are partially dried, they are passed through a cutting device consisting of a plain roller having a smooth machined surface adapted to engage with a second roller carrying a series of knife edges. From this cutting device the soap tubes are discharged in the form of tubular elements, which upon completion of drying are ready for packaging.

A preferred form of arrangement of the extrusion dies and drier conveyor is shown in my Patent No. 2,043,681, entitled Drier conveyor, granted June 9, 1936. A preferred form of extrusion device is shown in my patent entitled Extrusion device, granted June 9, 1936, No. 2,043,682.

I have found that the peculiarities of soap stock are such as to prevent the formation of a continuous length of perfect tube by simple extrusion through an orifice.

I am assuming here, of course, the formation of relatively small thin-walled soap tubes. I have found that it is necessary to continuously rotate the central pin in order to form a continuous length of soap tube. In the type of extrusion device disclosed in Figure 2 of the drawings, the pin is preferably rotated at about 100 R. P. M., although good results have been obtained with rotative speeds as low as 10 R. P. M.

I claim:

1. A new soap product consisting of individual tubular sections approximately .07 to .09 inch in diameter, having soap walls approximately .0035 inch to .0055 inch in thickness.

2. A tubular soap product approximately .08 inch in diameter and having soap walls approximately .0045 inch in thickness.

3. A tubular soap product not greater than .09 inch in outside diameter and having soap walls not greater than .0055 inch in thickness.

4. A new soap product consisting of individual tubular sections approximately .07 inch to .09 inch in diameter, having soap walls approximately .0035 inch to .0055 inch in thickness, having a smooth glossy surface.

5. A tubular soap product approximately .08 inch in diameter and having soap walls approximately .0045 inch in thickness having a smooth glossy surface.

6. A tubular soap product not greater than .09 inch in outside diameter and having soap walls not greater than .0055 inch in thickness having a smooth glossy surface.

7. A tubular soap product not greater than .375 inch in inside diameter and having soap walls not greater than .09 inch in thickness.

8. A tubular soap product in which the component particles are of size readily perceptible to the naked eye but are so small that the product is inherently and necessarily a bulk soap product of such character that the component particles are used in mass rather than as separate entities, and are individually hollow, thin-walled soap tubes so that the product is free from substantial amounts of fine dust-like matter and presents to the eye the characteristic and distinguishing appearance of a large number of independently visible, individually distinct little soap tubes as distinguished particularly from a powder and from spray dried soap, in which product the component particles are capable of ready, independent, relative movement without clinging together which promotes ready separation of the particles upon introduction of the product into water and which component particles are capable of maintaining their independent identity during dissolving without tending to form into a lump, and are also substantially immediately accessible to the solvent action of the water on both the outer and inner surfaces of the tubes, whereby rapid and complete solubility is assured, and positive resistance to lumping and balling of the product not heretofore attained in soap products is effected.

9. A tubular soap product in which the component particles are individual soap tubes sufficiently large to readily appear to the eye as independent, individually distinct particles of uniform shape, and sufficiently small to constitute necessarily a bulk soap product of such character that the component particles are used in mass rather than as separate entities, and consist of a thin-walled tube of dry soap material open at the ends, in which product the individual soap tubes composing the mass comprise appreciable amounts of soap so that the respective particles are individually distinct bodies capable of ready, independent, relative movement and ready separation upon introduction into water, are capable of attaining practically immediate contact with water upon being dropped upon the surface thereof, and of maintaining their independent identity without sticking together to form masses of undissolved soap, and are large considering the amount of soap contained therein to thereby present an available surface which is large relative to the amount of soap in the particle, whereby the soap product is free from any substantial characterizing amount of powder or dust-like matter, is soluble with particular readiness, speed, and completeness, and is characterized by a total absence of any tendency to form lumps, balls or spots of undissolved soap in washing.

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