March 7, 1944. B. CLAYTON 2,343,829

PROCESS FOR MAKING SOAP AND PRODUCT THEREOF

Filed April 15, 1940 4 Sheets-Sheet 1

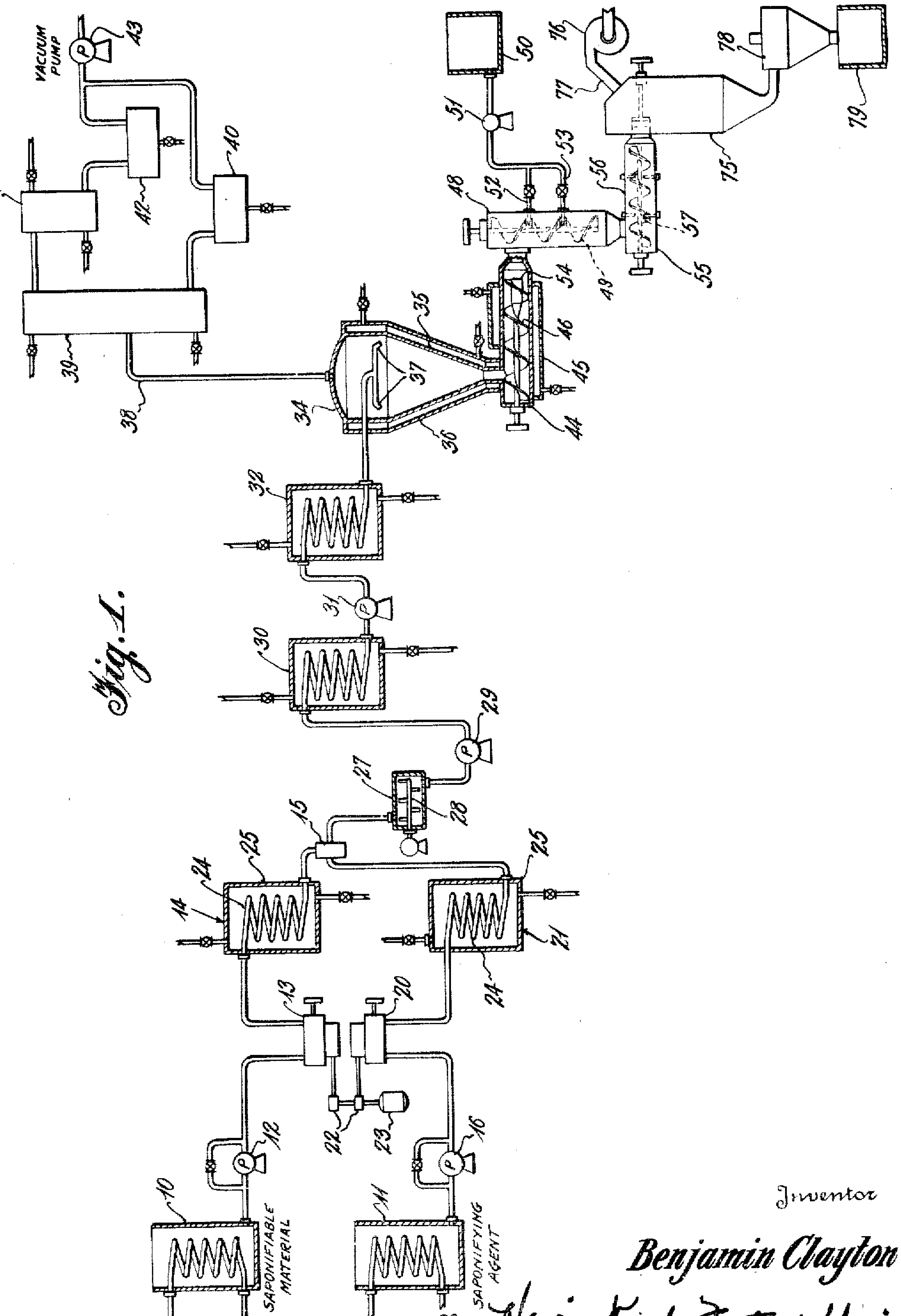

Fig. 1.

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PROCESS FOR MAKING SOAP AND PRODUCT THEREOF

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Fig. 2.

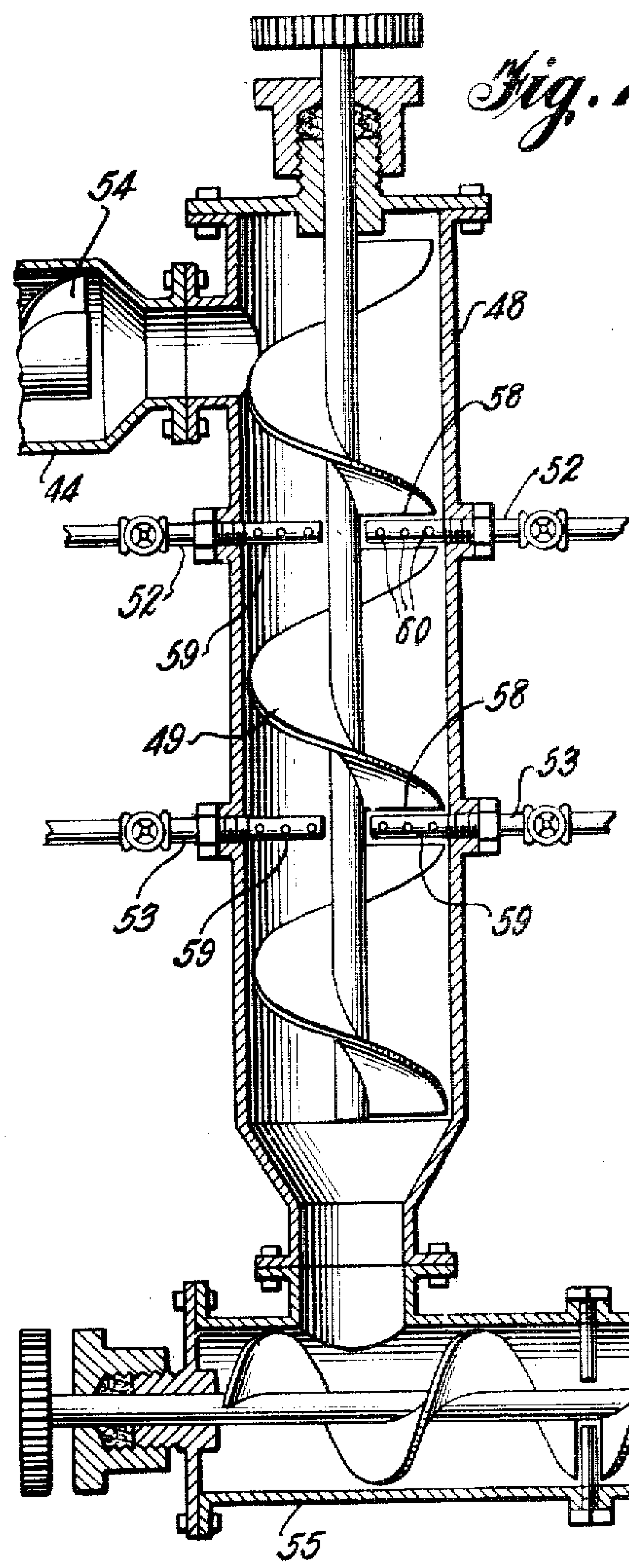
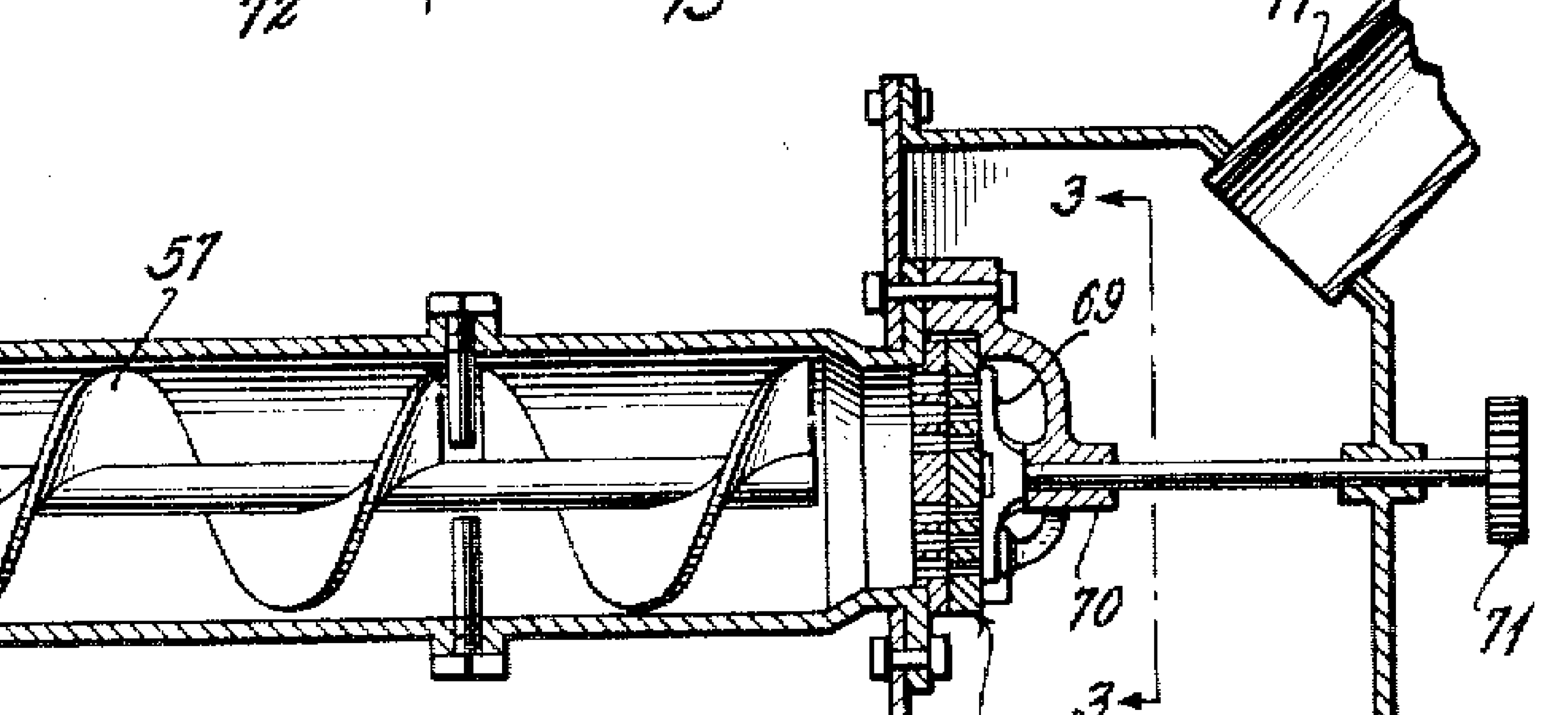



Fig. 4.

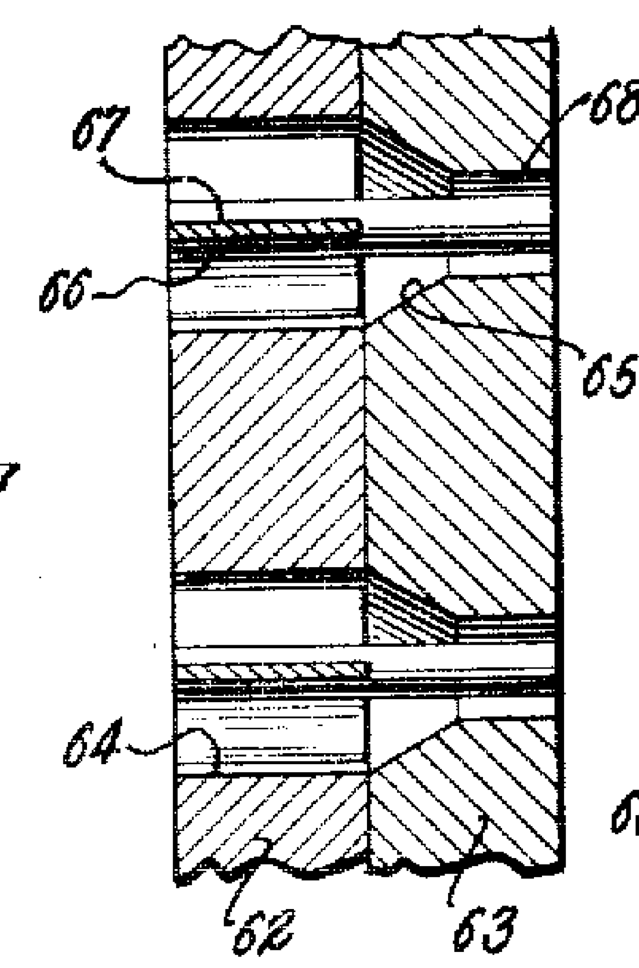


Fig. 5.

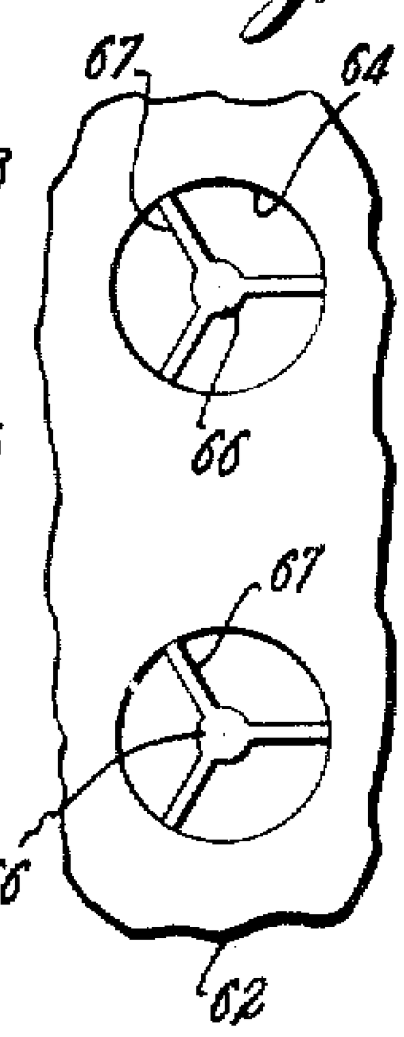


Fig. 6.

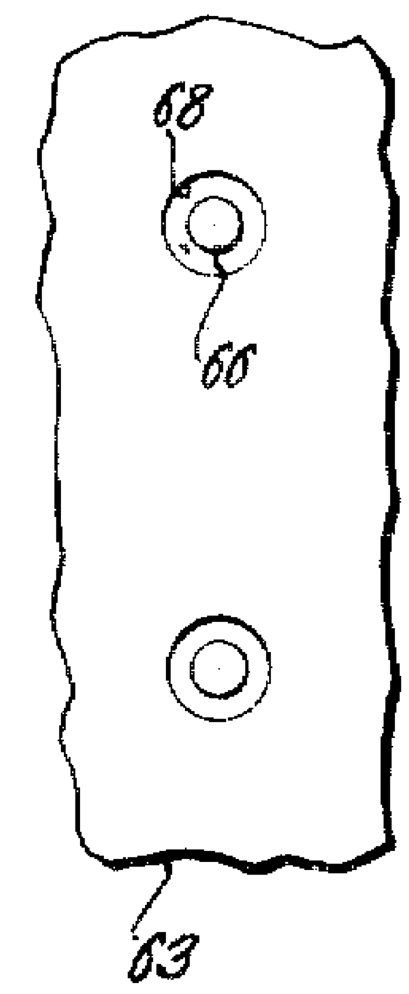


Fig. 7.

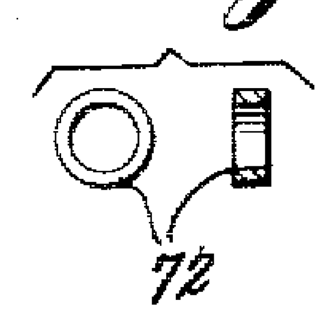
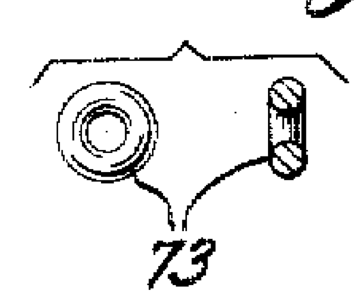


Fig. 8.



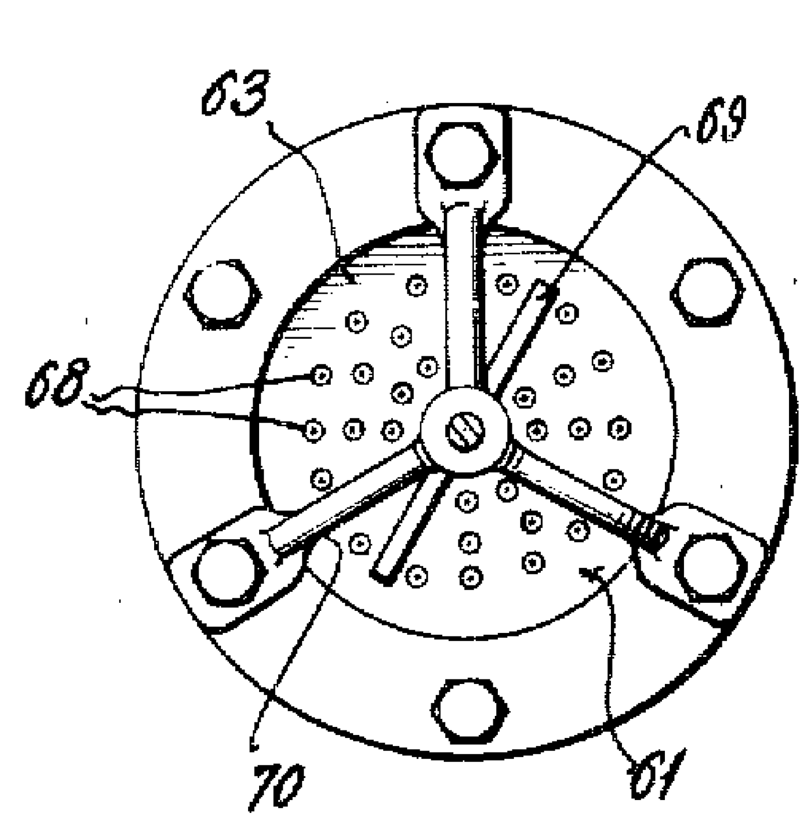


Fig. 3.

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PROCESS FOR MAKING SOAP AND PRODUCT THEREOF

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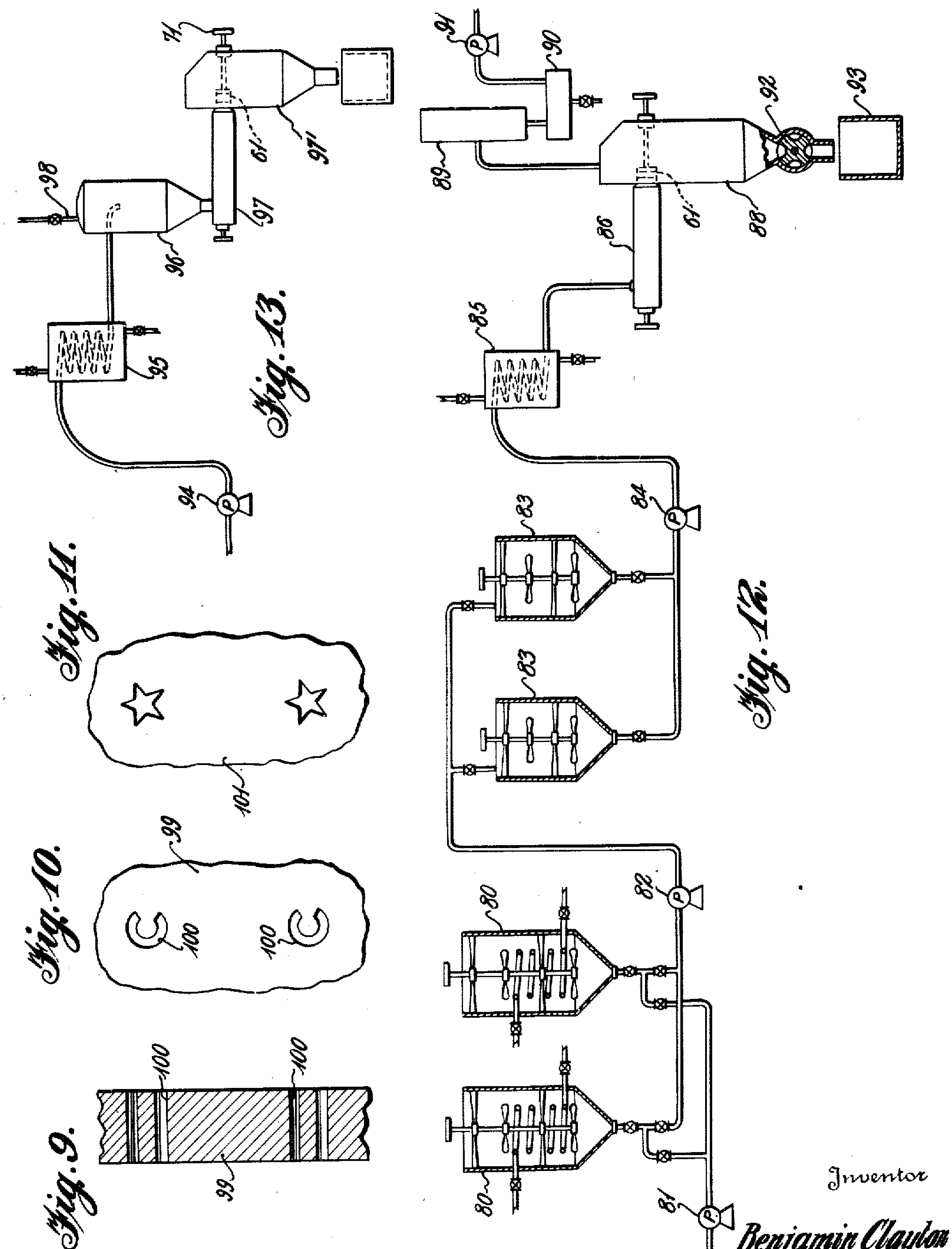

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PROCESS FOR MAKING SOAP AND PRODUCT THEREOF

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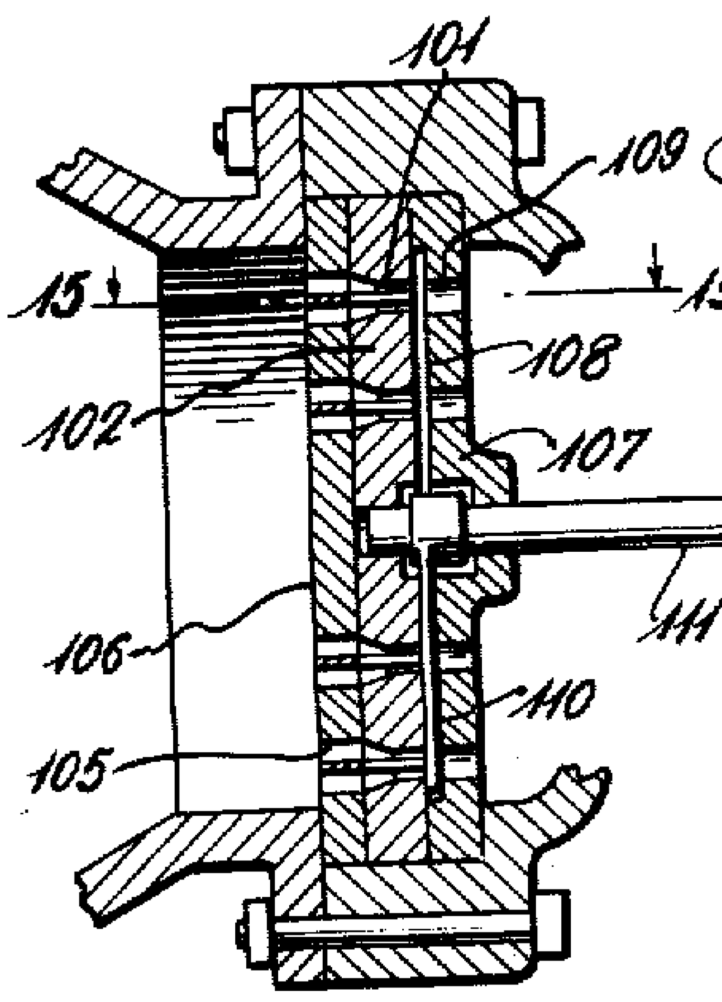


Fig. 14.

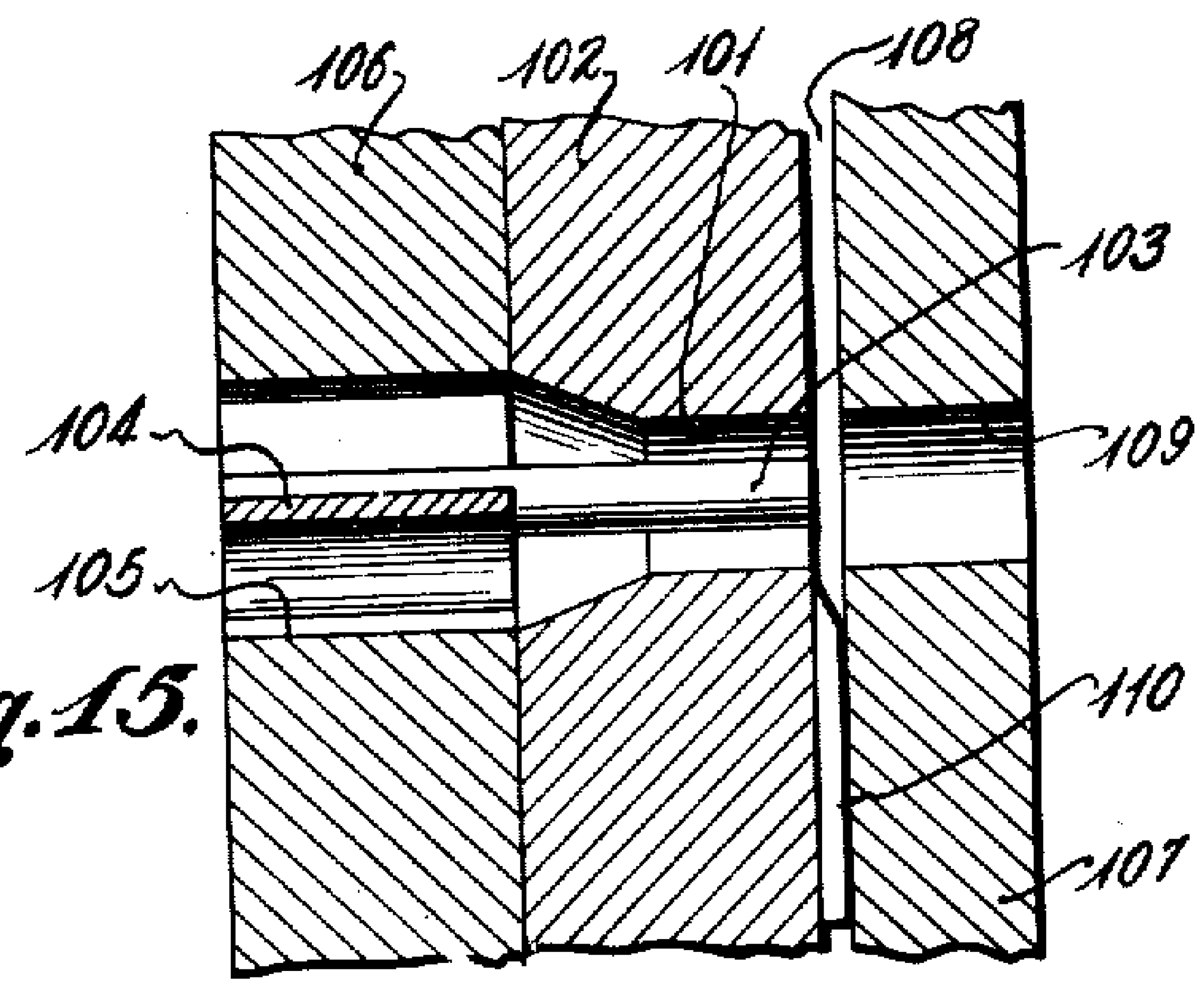


Fig. 15.

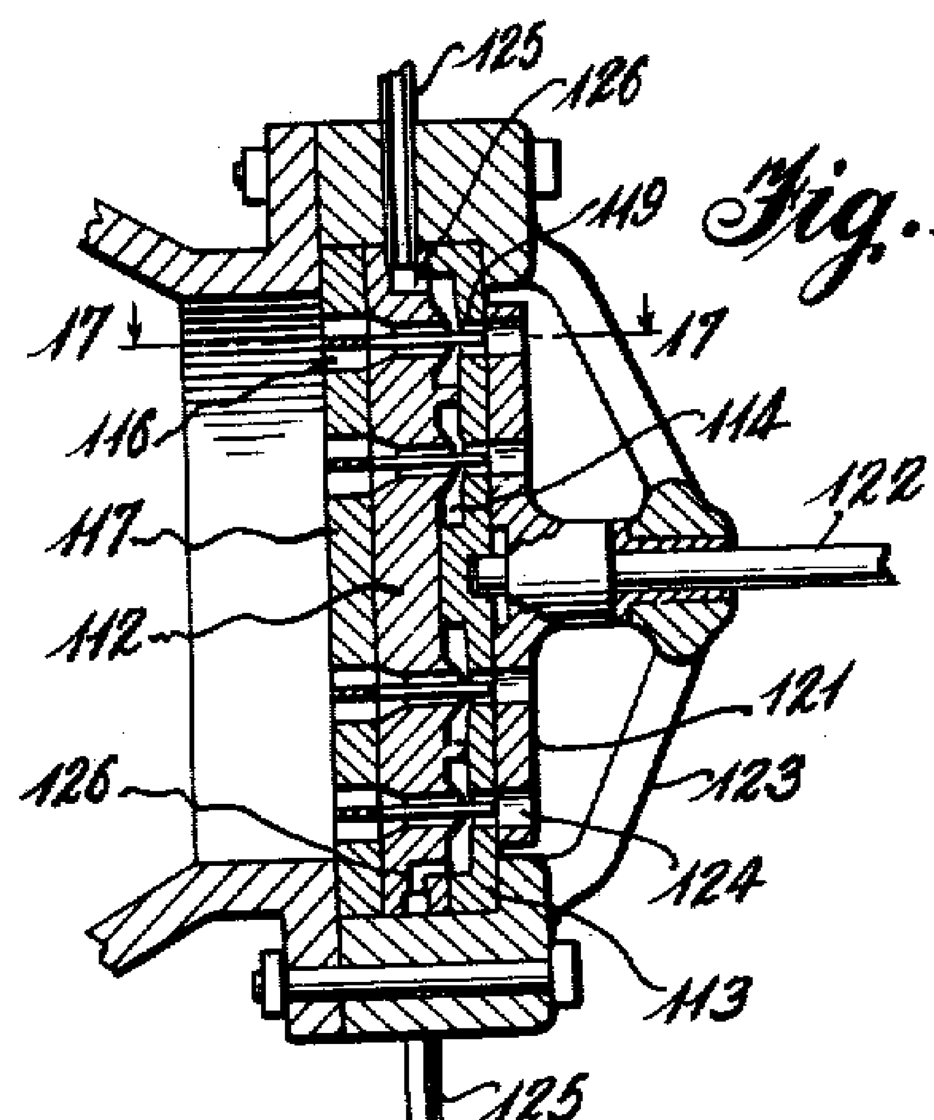


Fig. 16.

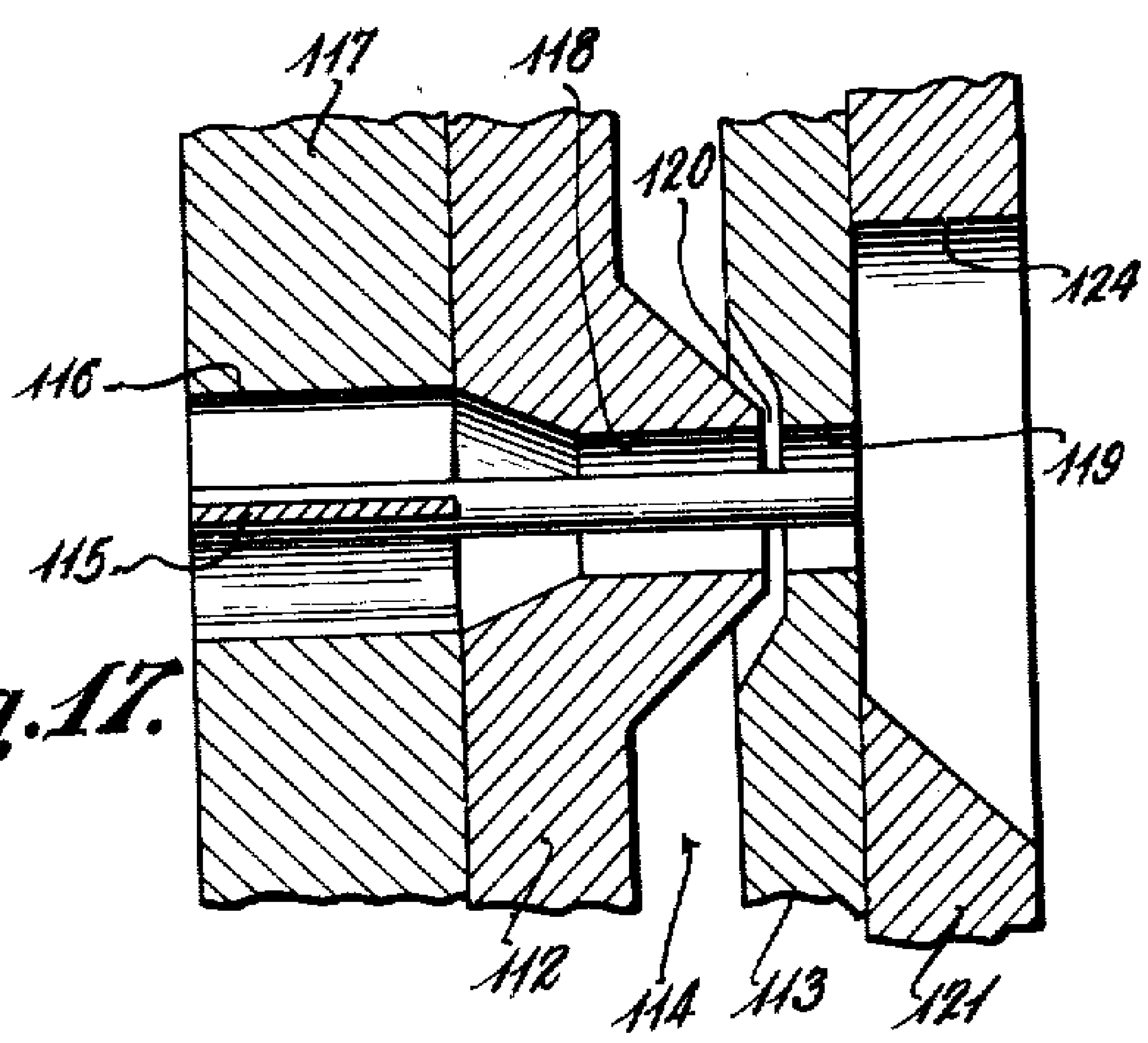


Fig. 17.

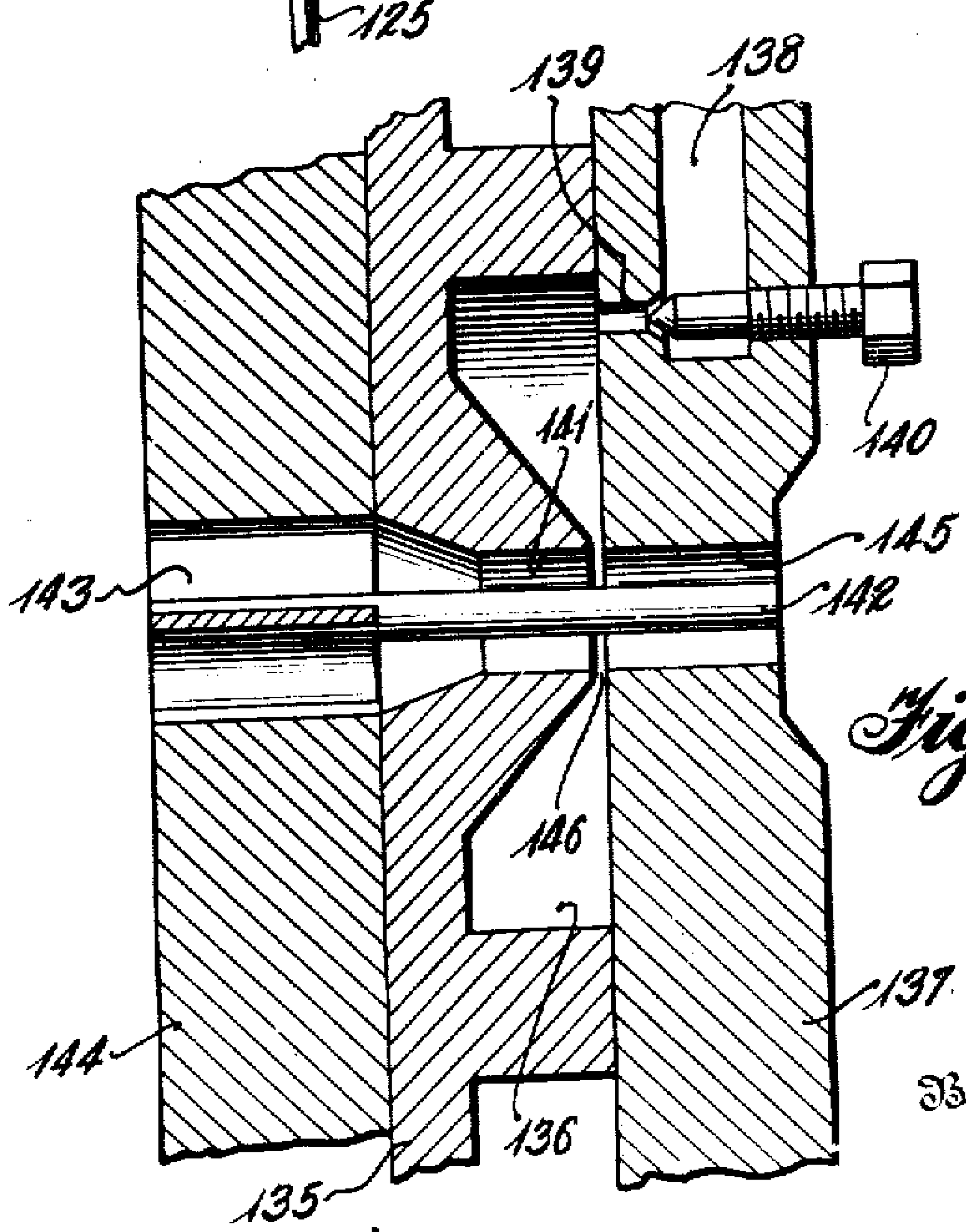


Fig. 20.

Fig. 18.

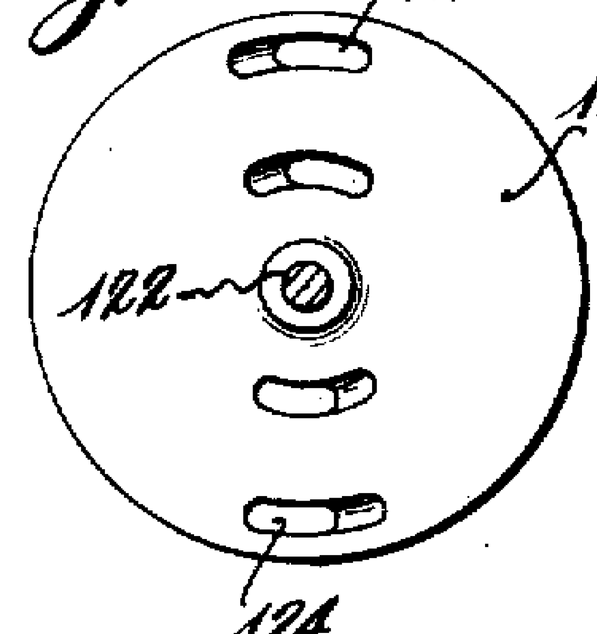
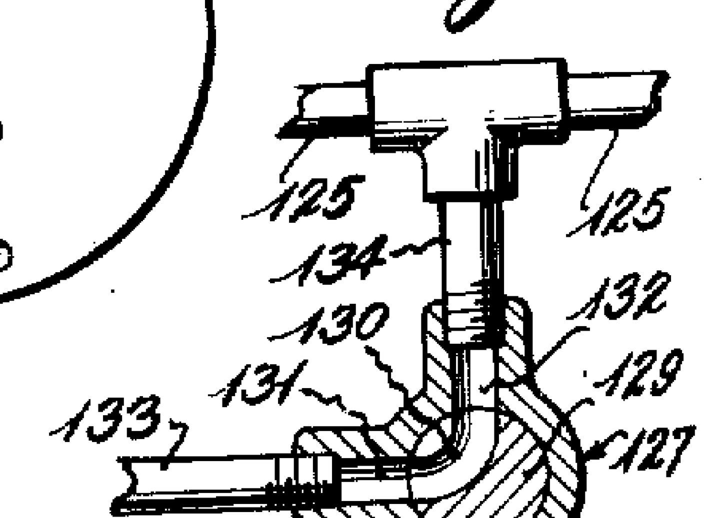


Fig. 19.



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Patented Mar. 7, 1944 2,343,829

UNITED STATES PATENT OFFICE

2,343,829

PROCESS FOR MAKING SOAP AND PRODUCT THEREOF

Benjamin Clayton, Houston, Tex., assignor, by mesne assignments, to Refining, Unincorporated, a Texas partnership

Application April 15, 1940, Serial No. 329,803

14 Claims. (Cl. 252—368)

This invention relates to a process and apparatus for making soap and product thereof, and more particularly to a process for converting soap into particles of predetermined shape having characteristics rendering them particularly suitable for packaging and for detergent purposes.

The present invention is particularly applicable to the conversion of highly heated anhydrous soap into hydrated particles of soap of definite size and shape. Anhydrous soap, when cooled from a molten condition during continuous movement of the soap, is a friable or powdered material. In accordance with the present invention, the anhydrous soap is hydrated and formed into discrete particles of substantial size as a part of the process of production. The resulting product is free flowing when packaged and substantially dustless. It dissolves or disperses rapidly in water and can be given the properties of floating for a considerable period of time upon the surface of water without agglomerating into difficultly dispersable lumps. Although the present invention is particularly applicable to the conversion of anhydrous soap into a commercial product, it can also be employed to convert kettle made soap into a similar product.

An object of the present invention is to provide an improved process of converting soap into particles of controlled shape and size to form an improved soap product.

Another object of the invention is to provide a process of converting hydrated anhydrous soap directly into discrete hydrated particles of substantial size.

Another object of the invention is to provide a process of converting highly heated anhydrous soap into hydrated particles of controlled size and shape.

Another object of the invention is to provide a process of converting soap into expanded or porous particles of a desired shape and size.

Another object of the invention is to provide an improved soap product in which the soap is present as particles of controlled size and shape.

Another object of the invention is to provide a soap product in which the soap is present as porous particles of predetermined size and shape.

A further object of the invention is to provide an apparatus for forming soap into small particles of definite size and shape.

A still further object of the invention is to provide an apparatus for converting soap into porous particles of controlled size and shape.

Other objects and advantages of the invention will appear in the following description of preferred embodiments thereof made with reference to the attached drawings, of which:

Figure 1 is a schematic diagram of an apparatus in accordance with the present invention;

Figure 2 is a sectional view upon an enlarged scale of a portion of the apparatus of Figure 1;

Figure 3 is a fragmentary sectional view taken on the lines 3—3 of Figure 2;

Figure 4 is a fragmentary section upon a still further enlarged scale of an extrusion die in accordance with the present invention;

Figure 5 is a view showing one elevation of the die of Figure 4;

Figure 6 is a fragmentary view showing another elevation of the die of Fig. 4;

Figure 7 illustrates one form of soap produced by the apparatus of Figures 1 to 6;

Figure 8 illustrates another form of soap produced by the apparatus of Figures 1 to 6;

Figure 9 is a view similar to Figure 4 showing a modified form of die;

Figure 10 is a fragmentary elevation of the die of Figure 9;

Figure 11 is a view similar to Figure 10 showing a still further modified form of die;

Figure 12 is a view similar to Figure 1 illustrating a modified apparatus; and

Figure 13 is a view similar to Figure 1 illustrating a portion of a further modified apparatus.

Figure 14 is a sectional view of another modified form of extrusion die;

Figure 15 is a fragmentary section taken on the line 15—15 of Figure 14 upon an enlarged scale;

Figure 16 is a view similar to Figure 14 showing a further modified form of die;

Figure 17 is a view similar to Figure 15 taken on the line 17—17 of Figure 16;

Figure 18 is an elevation of the rotary element of Figures 16 and 17;

Figure 19 is a sectional view of a rotary valve which may be employed with the structure of Figures 16 to 18; and

Figure 20 is a fragmentary section on an enlarged scale of a still further modified form of die.

Referring more particularly to Figure 1, the apparatus disclosed in this figure is adapted to the continuous production of preformed hydrated soap particles continuously from saponifiable and saponifying materials. Provision is made for removing glycerine or other vaporizable materials from the soap at high temperatures to produce substantially anhydrous molten soap which is directly and continuously converted into the hydrated soap particles referred to. The apparatus of Figure 1 may include a tank 10 as a source of supply for saponifiable materials which are ordinarily glycerides of fatty acids, although fatty acids alone or other saponifiable material such as higher fatty alcohol esters of fatty acids, for example sperm oil, may be employed, as well as mixtures of these materials or mixtures with other saponifiable materials such as rosin or abietic acids. The apparatus may also include a tank 11 for a saponifying agent which is ordinarily an aqueous solution of caustic soda, although other caustic alkalies or alkali metal salts of weak acids or various mixtures of alkalies may be used. The saponifiable material may be withdrawn from the tank 10 by means of a pump 12 and forced through a proportioning cylinder 13 and then through a heating device 14 to a flow mixer 15. The saponifying agent may be withdrawn from the tank 11 by means of a pump 16 and forced through a proportioning cylinder 20 and then through a heating device 21 to the mixer 15. The proportioning cylinders 13 and 20 deliver properly proportioned streams of saponifiable and saponifying materials to the mixer 15 and may be of the D-valve or "dummy pump" type having valves controlled from eccentrics 22 on a common shaft driven by a motor 23. The details of such a proportioning system, as well as a suitable flow mixer, are disclosed in the patent to Benjamin H. Thurman No. 2,142,062, granted December 27, 1938. The proportioning system illustrated is particularly effective for soap production, but any suitable type of proportioning system may be substituted therefor. The heating devices 14 and 21 preferably include a coil 24 through which the material to be heated is passed, the coils being positioned in a casing 25 through which any suitable heating material such as heated mineral oil may be passed.

It is many times desirable to additionally mix the materials prior to further heating, and a supplemental mixer which may include a casing 27 in which a rapidly rotating agitator 28 is positioned may be employed. The resulting mixture may be forced by a pump 29 through a heating device 30 which may be similar to the heating device 14 and then preferably forced by another pump 31 through another similar heating device 32. The heating devices 14 and 21 are employed to separately heat the saponifiable material and saponifying agent prior to mixing to a temperature sufficiently high that a liquid soap mixture is produced when these materials are mixed. The heating devices 30 and 32 are employed to progressively heat the mixture to a temperature considerably above the melting point of the soap when anhydrous.

The resulting heated soap mixture containing glycerine or other volatile material as well as substantial amounts of water may be continuously delivered into a vapor separating chamber 34 provided with inclined walls 35 surrounded by a heating jacket 36 through which any suitable heating medium may be circulated. As shown diagrammatically, the soap mixture is preferably discharged by means of nozzles 37 against the heated walls of the vapor separating chamber so as to flow downwardly in a thin film thereon. The walls of the vapor separating chamber are preferably maintained at a temperature above the melting point of the soap when anhydrous in order to maintain the same liquid.

A relatively high vacuum, for example, 29 to 30 inches of mercury, is preferably maintained in the vacuum chamber 34. In order to maintain such vacuum, vapors are withdrawn from the vapor separating chamber 34 through a conduit 38 and are preferably delivered to a fractionating column 39 provided with a receiver 40 for condensed materials having a lower boiling point than water, for example glycerine. Vapors withdrawn from the upper end of the fractionating column 39 are condensed in condenser 41 and delivered to a receiver 42 and both receivers 40 and 42 may be connected to a vacuum pump 43. By the condensing system shown, water may be separated from glycerine and collected in the receiver 42 while substantially dry glycerine is collected in the receiver 40.

The molten anhydrous soap deposited in the vapor separating chamber 34 is allowed to flow into a conveyor housing 44 provided with a cooling jacket 45 through which any desired cooling medium such as water may be circulated. The conveyor housing 44 may contain a screw conveyor 46 for advancing the soap during cooling to a seond conveyor housing 48 provided with a similar conveyor screw 49. The soap is ordinarily cooled in the conveyor housing 44 sufficiently to be delivered into the conveyor housing 48 in a relatively stiff plastic condition. The conveyor housing 44 should be of sufficient length for this purpose, or more than one cooling conveyor can be employed in series. In order to hydrate the soap, water or water containing desirable modifying agents may be withdrawn from a source of supply shown as a tank 50 by means of a pump 51 and injected in controlled amounts through one or more conduits 52 and 53 into the conveyor housing 48. At the high temperatures prevailing in the conveyor housing, the water readily hydrates the soap to form a homogeneous solution containing a minor proportion of water. Since the temperature in the conveyor housing 48 is ordinarily substantially above the boiling point of water, considerable pressure may be built up therein. As indicated diagrammatically the shaft of the conveyor 46 may have an enlarged end 54 providing a restricted passage for the plastic soap in order to seal the pressure in the conveyor housing 48 from the vacuum in the vapor separating chamber 34.

The hydrated soap or soap solution is delivered from the conveyor housing 48 into a plodder and extruding mechanism 55 which may take the form of a screw conveyor having a housing 56 provided with a screw 57. The details of the soap hydrating and plodding mechanism are more clearly shown in Figure 2, and as illustrated therein the conveyor screw 49 may have slots 58 formed in the flights thereof to receive inwardly extending hollow members 59 provided with ports 60 communicating with the hollow interior of the members 59. The conduits 52 and 53 may be connected with the inwardly extending members 59 in order to inject small streams of water into the mass of soap in the conveyor housing 48. The members 59 also function as devices for preventing rotation of the soap with the conveyor screw 49 and thus insure advance of the soap through the conveyor. The soap is somewhat further cooled by the introduction of water and is discharged as a plastic mass into the conveyor housing 55 in which it is advanced by the conveyor screw 57 toward and through an extrusion die 61, the details of which are more clearly shown in Figures 4 to 6 inclusive.

A preferred form of die includes a pair of plates 62 and 63 provided with a plurality of registering apertures 64 and 65, respectively. Pins 66 may be supported by spider members 67 in the apertures 64 of the plate 62 and extend through a restricted portion 66 of the apertures 65 in the plate 63 so as to provide for extruding the soap as a thin-walled tube. As shown in Figures 2 and 3, a rotating knife 69 may be journaled in a spider member 70. The spider member 70 may be secured to the conveyor housing 55 and also serve to clamp the extrusion die 61 against the discharge end of the housing 55. The knife 69 may be rotated from any suitable source of power through a pulley or gear 71 and serves to slice short lengths of soap tubing immediately upon extrusion of the soap through the die 61.

If the extruded soap is of sufficiently low temperature, small ringlets 72 of soap of the form shown in Figure 7 are produced, whereas soap containing excess water and a relatively high temperature will puff or expand into porous particles 73 of approximately the shape shown in Figure 8 and can be best described as being of the shape of small doughnuts. The latter form of soap is preferred, as it is lighter in density and more readily floats upon the surface of water. In both cases it is preferred to form ringlets having an axial length substantially less than the diameter. Preferably the particles of soap 72 and 73 shown in Figures 7 and 8 are relatively small, for example, having a diameter ranging between 3/32 and ¼ inch, and an axial length ranging from 1/32 to ⅛ inch.

The soap particles formed by the extrusion and cutting operations may drop downwardly in a chamber 75. In order to assist in removing the soap from the knife 69 or to further dry the soap, it is many times desirable to direct a blast of air from a blower 76 shown in Figure 1 through a conduit 77 against the face of the die 61. Depending upon the type of particle desired and the temperature of the soap being extruded, the blast may comprise heated or cooled air. When producing particles in the larger size range mentioned, the particles are ordinarily easily separable from the air, but in case smaller size particles are produced, a separator of the cyclone type indicated at 78 may be employed to separate the soap particles from the air and discharge the same into the container 79.

In carrying out the process of Figure 1, the temperature of heating of the saponifiable material will ordinarily be in the neighborhood of 300° F., but may range from 250 to 350° F. The saponifying agent is also desirably heated to a temperature within this range so that relatively concentrated aqueous solutions of saponifying agent may be employed and still produce a liquid soap mixture. The discharge temperature from heating device 30 will ordinarily be between 350 and 450° F., whereas the discharge temperature from the heating device 32 will ordinarily range between 500 and 650° F. The pressure in the heating devices 14, 21 and 30 is usually maintained sufficiently high to prevent vapor formation, whereas a lower pressure with resultant formation of substantial quantities of vapor in the heating device 32 is desirable in order to impart sufficient heat to the mixture to cause the glycerine to be substantially immediately liberated in vapor form when the mixture is discharged into the vapor separating chamber 34. The mixture should be substantially completely saponified prior to being subjected to the high temperatures of the heating device 32 in order to prevent thermal decomposition of fatty material. In order to assist in liberation of glycerine, the amount of saponifying alkali mixed with the saponifiable material may be such as to produce a soap mixture in the vapor separation chamber which is slightly acid, i. e. has an acidity equivalent to a few hundredths of 1% of NaOH. The liquid anhydrous soap delivered into the conveyor housing 44 will ordinarily have a temperature between 500 and 650° F. The conveyor housing 44 should be of sufficient length or a plurality of conveyors employed to cool the soap to plastic form at a temperature ranging from 280 to 375° F. Water injected into the conveyor housing 48 lowers this temperature to some extent, but the hydrated soap is preferably delivered into the conveyor housing 55 at a temperature between 260 and 350° F. The amount of water added to the soap in the conveyor housing 48 will depend upon the nature of the soap and the amount of water to be removed during extrusion. Thus, amounts of water ranging from 10 to 30% of the soap may be injected. If a neutral soap is desired and the soap entering the conveyor housing is slightly acid as indicated above, the water for hydrating the soap may have dissolved therein enough alkali to produce such neutral soap. If a filled soap is desired, fillers such as sodium silicate or sodium carbonate may be added with the water, for example by injecting relatively concentrated solutions of these materials instead of pure or slightly alkaline water. In general, the greater the amount of filler, the greater the amount of water which can be tolerated in the finished soap.

Extrusion of the soap containing a substantial amount of water and at a temperature in excess of approximately 250° F. will usually cause puffing of the ringlets to produce a particle substantially like that shown in Figure 8. The degree of puffing will depend upon the temperature as well as the amount of water in the soap. Too great a puffing action is undesirable, as the particle becomes fragile. A rounded particle with a porous surface is preferred. However, by incorporating a lesser amount of water and extruding at a lower temperature, particles having increased mechanical strength and sharp-cut corners such as shown in Figure 7 can be produced.

Although the production of soap particles of the present invention directly from anhydrous soap produced continuously from the raw materials is the most economical and the nature of the particle can be more closely controlled, it is possible to produce such particles from kettle-made soap. For example, as shown in Figure 12, soap may be produced by known processes in kettles 80 which are intended to represent the conventional soap kettles of the prior art. Such kettle-made soap containing glycerine or other volatile materials, as well as water, may be agitated in the kettles to maintain a uniform mixture and a stream of such soap mixture pumped through the heating devices 30 and 32 of Figure 1 to recover glycerine by vaporization and produce anhydrous soap which is treated as above described. The kettle-made soap may alternatively be washed free from glycerine and other impurities in the kettles in the conventional manner, for example, by employing salt solutions as well as water to produce the conventional neat soap. The impurities can be discharged from the soap kettles by means of a pump 81 and after the impurities have thus been removed the neat soap can be delivered by a pump 82 to crutchers 83 wherein soap fillers such as sodium silicate or sodium carbonate are added. Two soap kettles and two crutchers 83 have been illustrated in order that neat soap may be in the process of preparation in one kettle 80 while neat soap is being withdrawn from the other kettle 80 and also that one batch of soap may be mixed with filler in a crutcher 83 while the filled soap is being withdrawn from the other crutcher. Neat soap ordinarily contains approximately 30% water and is sufficiently fluid to be pumped at temperatures approaching the boiling point of water. Such neat soap contains too much water for satisfactory extrusion in accordance with the present process. However, by adding a dry filler in the crutcher 83, the nature of the soap is altered so that more water can be tolerated and still form a solid soap upon cooling. By maintaining the temperature of the filled soap in the crutcher 83 relatively high, the resulting soap may be maintained in flowable condition so that it can be pumped from the crutcher by the pump 84. If necessary with a particular soap mixture, the crutchers may be closed and operated under pressure in order to enable a sufficiently high pressure to be maintained to produce a pumpable soap mixture. It is ordinarily desirable to pump the soap solution through a heating device 85 in order to raise the temperature thereof to between approximately 250 and 350° F. and then discharge the heated soap into an extruding conveyor 86 which may be similar to the conveyor 57 and be provided with an extrusion die 87 similar to the die 61 of Figures 2 to 6. Sufficient water can be flashed from the soap upon extrusion to form a solid particle similar to that shown in Figure 7. To assist in removing water, a vacuum may be maintained in the extrusion chamber 88 by withdrawing water vapors and condensing the same in a condenser 89 to which a vacuum pump 91 is connected. A vacuum seal, for example, a star valve 92, may be provided to discharge the soap particles from the extrusion chamber 88 into the receiver 93. Since the vacuum in the extrusion chamber 88 need not be extremely high, a star valve is sufficient to function as a vacuum seal even though such a star valve introduces substantial amounts of air into the vacuum chamber.

Since the amount of water present in the kettle may limit the type of particle which may be prepared, it is usually desirable to remove a controlled portion of the water prior to extrusion. As shown in Figure 13, either the neat soap directly from the kettle or a filled soap containing sufficient water to be easily flowable may be pumped by means of a pump 94 through a heating device 95 and delivered into a vapor separating chamber 96. By spraying the soap at a temperature above the boiling point of water, for example, at a temperature between 250 and 350° F., sufficient water may be evaporated from the soap to provide the desired amount of water in the soap for extrusion from an extrusion conveyor 97 similar to the extrusion conveyor 57 of Figure 2 into an extrusion chamber 97'. Water vapor separated from the soap may be discharged to the atmosphere through a pipe 98 and the amount of water retained in the soap may be controlled by the temperature of the soap introduced into the vapor separating chamber 96 as well as by throttling the pipe 98 in order to maintain a predetermined pressure in the vapor separating chamber 96. Thus, soap of any desired temperature and water content may be delivered into the extrusion device 97 and extruded through an extrusion die 61. It is apparent that the extrusion chambers 75 of Figure 1, 88 of Figure 12, and 97' of Figure 13 may be operated at atmospheric pressure or under either superatmospheric or subatmospheric pressure, or with a blast of air, depending upon the characteristics, temperature, and water content of the soap being extruded; or that the soap may be extruded into the open atmosphere.

If the soap ringlets or pellets are extruded into a space having a pressure substantially below the pressure in the extrusion conveyor or other extrusion device, while the soap is at a relatively high temperature and contains water which tends to vaporize at the lower temperature, the soap pellets may tend to expand unevenly as the portion thereof which is extruded first is subjected to the lower pressure while the portion last extruded is still attached to the soap within the extrusion die. This tendency to distort may be largely prevented by extruding the particles into a chamber maintained at a relatively high pressure, preferably a pressure commensurate with the pressure to which the soap is subjected just prior to being forced through the extrusion die. Thus, the extrusion chamber 88 of Figure 12 may be maintained under pressure by introducing a compressed gas, for example, air or an inert gas such as carbon dioxide or a vapor under pressure such as steam. By employing such gases or vapors or mixtures thereof, any desired pressure or temperature, as well as any desired moisture content can be imparted to the atmosphere in the extrusion chamber 88. By regulating the temperature, pressure and moisture content in the extrusion chamber, expansion or drying of the soap prior to cutting into pellets or ringlets can be substantially completely prevented or can be controlled to give any desired degree of expansion. Unexpanded or partly unexpanded particles can be discharged by the star valve 92 into a lower pressure space and caused to expand with liberation of moisture.

Instead of forming soap ringlets as disclosed in Figures 7 and 8, other forms of soap pellets may be formed. For example, as shown in Figures 9 and 10, an extrusion die 99 may have apertures 100 of semi-cylindrical shape. Other forms of pellet, such as star-shaped pellets, for example, a pellet formed by a die 101 shown in Figure 11, may also be produced. Flake-like pellets may also be produced by cutting a substantially round or other shaped rod into thin slices. A rotating knife such as shown in Figures 2 and 3 may be employed to cut the extruded threads into short lengths. Such pellets may be extruded at low temperatures and comprise short lengths of solid thread of soap with sharp-cut edges or may be expanded or puffed to have a porous surface and rounded corners. The present invention may also be employed to produce flake soap. For example, the various pellets described above may be passed between rolls to flatten the same into flakes of substantially uniform size. If desired, such rolls may be heated to prevent sticking of the flakes thereto, or the flakes may be scraped from the rolls. The rolls may also have finely corrugated surfaces or surfaces provided with small projections to shape or perforate the surfaces of the flakes.

Instead of maintaining an atmosphere under pressure in the extrusion chamber, the die itself may be constructed to prevent or retard expansion until after the ringlet or pellet has been severed from the soap being extruded. For example, in Figure 14 a die is shown in which the pellet is prevented from expanding radially and to at least some extent longitudinally by being severed from the soap prior to being discharged from the die. In Figure 14 the soap is extruded through the apertures 101 in a die plate 102, in which aperture may be positioned a pin 103 supported by a spider 104 in an aperture 105 in a plate 106. A plate 107 having its central portion spaced at 108 from the die plate 102 may be provided with apertures 109 aligned with and of substantially the same diameter as apertures 101. A rotating knife having thin blades 110 may be positioned in the space 108 and carried by a shaft 111 journaled in the plates 102 and 107. As the soap is extruded in tubular form through the aperture 101 into aperture 109, the knife 110 divides the tube of soap into ringlets which are progressively forced through and out of apertures 109. If the soap is of a correct temperature and moisture content, the ringlets in aperture 109 adhere to each other only superficially and readily break into separate ringlets. The bounding walls of the aperture 109 prevent outward radial expansion, and to a large extent prevent distortion of the ringlets due to expansion.

In the die structure of Figures 16 to 18, inclusive, instead of employing a knife to sever the tube of soap into ringlets a gas or vapor under pressure may be employed for this purpose. As shown upon a large scale in Figure 17, the die plate 112 may be spaced from a plate 113 to provide a conduit 114 for gas or vapor under pressure. The pin 115 supported in a spider 116 in a plate 117 may extend entirely through aligned apertures 118 and 119 in the plates 112 and 113, respectively. The plates 112 and 113 may be formed as shown in Figure 17 to provide a restricted angular aperture 120 between the conduit 114 and the aligned apertures 118 and 119. When the discharge end of the aperture 119 is opened and a ringlet of soap has been formed in the aperture 119, gas or vapor under pressure in the conduit 114 will sever a ringlet from the tube of soap and discharge the same from the aperture 119. The discharge end of the aperture 119 may be closed and opened intermittently by means of a rotating member 121 bearing against the face of the plate 113 and carried by a shaft 122 journaled in the spider 123. As shown most clearly in Figures 17 and 18, the rotating member 121 may be provided with elongated apertures 124 which are radially aligned with the apertures 119. When a solid portion of the rotating member 121 covers the aperture 119, the tube of soap is forced against the rotary member 121 to form a ringlet of soap, which is severed from the soap tube and discharged from the aperture 119 whenever an aperture 124 in the rotary member 121 registers with the aperture 119.

Compressed air, compressed inert gases or steam may be introduced into the conduit 114 through pipes 125 communicating through ducts 126 in the plate 112 with the conduit or space 114 between the plates 112 and 113. As the mechanical pressure upon the soap adjacent the annular aperture 120 may be considerably greater than the fluid pressure in the pump 114 when the aperture 119 is closed, soap may tend to be extruded into the annular aperture 120. Upon release of the pellet or ring of soap maintained under pressure in the aperture 119, any soap backing up into annular aperture 120 will be added to and discharged with the soap pellet. The pellet formed in the aperture 119 is maintained under a substantial pressure until released by the rapidly rotating member 121 and then almost instantaneously severed and ejected so that it may expand when subjected to the lower pressure in the extrusion chamber substantially uniformly in all directions.

It is apparent that fluid pressure may be supplied to the conduit 114 intermittently or in pulsations so that the rotary member 121 may be eliminated. For example, a rotary valve 127 such as shown in Figure 19 and provided with a casing 128 and a rotor 129 provided with a duct 130 intermittently communicating with a duct 131 and a duct 132 in the casing 128 may be employed. A pipe 133 attached to a source of fluid pressure (not shown) may supply fluid under pressure to the duct 131. A pipe 134 may communicate with the duct 132 and branch into the pipes 124 and 125 of Figure 16. When the valve 127 is closed, soap is extruded through the aperture 118 of Figure 17 into the aperture 119, and when the valve 127 is opened to supply fluid pressure to the conduit 114 between the plates 112 and 113, the portion of the tube in the aperture 119 is severed and ejected from the aperture 119. This allows the pressure in the conduit 114 to drop to a low value and the valve 127 is then closed. Soap is again extruded into the aperture 119 and the action just described repeated. The aperture 119 and pin 115 cooperate to prevent radial expansion of the soap tube in aperture 119 during extrusion, leaving the pellet free to expand in all directions after ejection from the aperture 119. By adjusting the speed of rotation of valve 129 relative to the rate of extrusion of soap through the apertures 118 and 119, any desired length of soap ringlet may be produced independently of the axial length of aperture 119.

As shown in Figure 20, a rotary valve is unnecessary to produce pressure pulsations for severing and discharging pellets or ringlets of soap, as a die mechanism having no moving parts can be employed for this purpose. A die plate 135 is formed to provide a pressure chamber 136 between the die plate 135 and a cover plate 137. A duct 138 communicating with a source of fluid pressure (not shown) may be connected through a restricted port 139 with the pressure chamber 136. If desired, an adjusting screw 140 may be provided to vary the effective size of the port 139. Soap extruded through the aperture 141 in the die plate 135 and surrounding the pin 142 supported in a spider 143 in a plate 144 is caused to flow into the aperture 145 through which the pin 142 extends. A restricted annular aperture 146 communicates with the aligned apertures 141 and 145 and the pressure chamber 136. If the annular aperture 146 has a somewhat greater cross sectional area than the restricted port 139, the pressure in chamber 136 will be relatively low when no soap is present in the aperture 145. Upon extrusion of soap from aperture 141 into aperture 145, the annular aperture 146 is closed and pressure builds up in pressure chamber 136. When this pressure becomes sufficient to sever the tube of soap and eject the pellet in the aperture 145 therefrom, a ring of soap is severed and the volume of the pressure chamber 136 is sufficient to maintain the fluid pressure until the ringlet is completely ejected from the aperture 145. The pressure in chamber 136 thereupon falls to substantially the pressure in the extrusion chamber and soap is again extruded into aperture 145 until the pressure in chamber 136 again builds up sufficient to sever and eject the pellet. By correlating the degree of fluid pressure supplied through the duct 138, the rate of soap extrusion, and the size of the port 139 with that of the annular aperture 146, soap ringlets or pellets of any desired axial length can be produced automatically and at a rapid rate. The pellet is prevented from having radial expansion either inwardly or outwardly until either severed or ejected, so that it may expand substantially uniformly when ejected into the lower pressure of the extrusion chamber. The length of the pellet is independent of the axial length of the aperture 145.

In all of the forms of dies shown in Figures 14 to 20, the soap tube is severed into pellets before substantial expansion or drying of the soap tube occurs. While the ringlet form of soap is preferred, it is apparent that any of the dies of these figures may be employed to produce a solid thread of soap, and thus solid pellets, by eliminating the pins shown in the various figures. The diameter of the extrusion orifices when the pin is eliminated will usually be smaller and the extrusion orifice may have various shapes, as discussed with reference to the dies of Figures 4 to 6, 10 and 11, and the pellets may be formed into flakes with rolls or other mechanism as above described.

I have found it desirable to add to the soap to be formed into particles a small amount of phosphatidic material. Such phosphatidic material may be added, for example, in dispersion in water in the conveyor housing 48 along with the water or filler solutions from the tank 50. In the case of kettle made neat soap, such phosphatidic material may be added immediately before withdrawing the neat soap from the kettle, or, in Figure 12, in the crutchers 83. The phosphatidic material causes the soap to be much more rapidly dispersable in water and also improves the emulsive action of the soap and its detergent properties. Furthermore, the phosphatidic material imparts increased mechanical strength to the soap particles and provides for greater expansion or puffing of the particles without rupture of the surface thereof. Such phosphatidic material may comprise vegetable phosphatides, preferably those free of fatty acid radicals of greater unsaturation than linoleic acid, such as corn or cottonseed phosphatides. Various other phosphatidic materials such as the alkali metal phosphate compositions of phosphatides disclosed in the copending application of Benjamin H. Thurman, Serial No. 311,705, filed December 29, 1939, now Patent No. 2,271,409, granted January 27, 1942, or the compositions of alkali metal salts of hydroxy acids with phosphatides disclosed in the application of Benjamin H. Thurman, Serial No. 311,707, filed December 29, 1939, now Patent No. 2,271,410 granted January 27, 1942, may also be employed. Small amounts, for example, .1 to 2% of the various phosphatidic materials, are effective. All these materials are intended to be included within the term "phosphatidic material" as used herein.

It will thus be seen that I have provided a process and apparatus for converting soap into discrete particles of controlled size and shape, which particles are substantially free of dust and may be made porous. All of the particles discussed above have large surfaces compared with their mass and are readily dispersed or dissolved in water. The ringlets of Figures 7 and 8 have the advantage that air is initially trapped in the aperture extending therethrough so as to cause the particles to spread out and float upon the surface of the water. The particles, however, rapidly become wet and the large surface compared to their volume causes them to rapidly go into solution. This is particularly true of the puffed particles of Figure 8, and also such particles float for a considerably longer time than the more solid particles of Figure 7.

While I have disclosed the preferred embodiments of my invention, it is understood that the details thereof may be varied within the scope of the following claims.

I claim:

1. The process of making soap pellets, which comprises, extruding under pressure a small element of plastic soap containing water and heated to a temperature sufficient to cause vaporization of water and formation of porous soap when said pressure is released, and cutting said element of porous soap into short lengths immediately upon extrusion.

2. The process of making soap pellets, which comprises, extruding under pressure a small tube of soap containing water, said soap being heated to a temperature sufficient to cause liberation of sufficient water upon release of said pressure to cause said soap to expand and become porous when extruded, and cutting said tube into short lengths immediately upon extrusion to form expanded and porous ringlets of soap.

3. The process of making soap, which comprises, mixing a heated stream of a saponifiable material containing glycerides with a heated stream of saponifying material, the amount of saponifying material being slightly less than that required to completely saponify said saponifiable material, reacting a flowing stream of the resulting mixture under elevated temperatures to form a soap mixture which is slightly acidic, continuously distilling glycerine and other volatile materials from the slightly acidic soap mixture in a vapor separating zone at a temperature above the melting point of said soap when anhydrous to deposit substantially anhydrous molten soap in said vapor separating zone, removing a stream of said molten soap from the vapor separating zone, partially cooling said molten soap, and hydrating the same with water containing sufficient alkali to produce at least a neutral soap.

4. The process of making soap, which comprises, reacting a saponifiable material with a saponifying material in an amount slightly less than that necessary to completely saponify said saponifiable material, separating vaporizable materials from the resulting soap as vapor in a vapor separation zone at a temperature above the melting point of the soap when anhydrous to produce substantially anhydrous molten soap which is slightly acidic, and cooling and hydrating said soap with water containing sufficient alkali to produce at least a neutral soap.

5. The process of making soap, which comprises, reacting a saponifiable material with a saponifying material in an amount slightly less than that necessary to completely saponify said vaporizable material, separating vaporizable materials from the resulting soap as vapor in a vapor separation zone at a temperature above the melting point of the soap when anhydrous to produce substantially anhydrous molten soap which is slightly acidic, cooling and hydrating said soap with water containing sufficient alkali to produce at least a neutral soap, and extruding a small element of the hydrated soap and cutting the same into short lengths to form soap particles of controlled size and shape.

6. The process of making soap pellets, which comprises extruding under pressure a small tube

of soap containing a vaporizable material, said soap being at a temperature sufficient to vaporize vaporizable material near the surface of said soap upon lowering of said pressure to make at least the surface of said soap porous, and cutting said tube into short lengths immediately upon extrusion to form ringlets of soap having a porous surface.

7. The process of making soap pellets, which comprises, extruding a small element of plastic soap through an aperture and applying pulsating gas pressure to said element adjacent said aperture to cut said element into short lengths immediately upon its emergence from said aperture.

8. The process of making soap pellets, which comprises, extruding under pressure a small element of plastic soap containing water and heated to a temperature sufficient to cause vaporization of water and formation of porous soap when said pressure is released, and applying a pulsating gas pressure to said element of porous soap adjacent said aperture to cut the same into short lengths immediately upon extrusion.

9. The process of making soap pellets, which comprises, extruding a small tube of soap through an aperture having a central member applying a pulsating gas pressure to said tube adjacent said aperture to cut said tube into short lengths immediately upon extrusion from said aperture, and supporting said lengths on said central member during cutting by said pulsating fluid pressure.

10. The process of making a soap product made up of small elements of porous soap having porous surfaces, which comprises, extruding under pressure small elements of plastic soap containing water, said soap being at a temperature sufficient to vaporize water from said elements upon lowering of said pressure to expand a substantial portion of said elements and make the surfaces thereof porous, and lowering the pressure upon the extruded elements sufficient to produce expanded elements having porous surfaces.

11. The process of making a soap product made up of small elements of porous soap having porous surfaces, which comprises, delivering a heated stream of soap containing water and other vaporizable materials into a vapor separating chamber, separating said vaporizable materials in vapor form from said soap at a temperature above the melting point of said soap when anhydrous to deposit anhydrous molten soap in said chamber, continuously removing a stream of said soap from said chamber, partially cooling the same, hydrating said partially cooled soap under pressure to produce a plastic soap containing water, extruding under pressure small elements of said plastic soap containing water, said soap being at a temperature sufficient to vaporize water from said elements upon lowering of said pressure to expand said elements and make the surfaces thereof porous and lowering the pressure upon the extruded elements sufficient to produce elements having a porous structure and having porous surfaces.

12. As a product of manufacture, a soap product comprising small elements of soap having a rounded surface which is porous and having at least a substantial portion of the element adjacent said surface puffed to produce a porous structure, said soap being produced by extruding under pressure a plastic soap containing a vaporizable material and lowering the pressure upon the extruded soap to vaporize a sufficient amount of said vaporizable material to produce said porous structure.

13. As a product of manufacture, a soap product comprising small elements of soap having a rounded surface which is porous and having at least a substantial portion of the element adjacent said surface puffed to produce a porous structure, said soap being produced by extruding under pressure a plastic soap containing water and lowering the pressure upon the extruded soap to vaporize a sufficient amount of said water to produce said porous structure.

14. As a product of manufacture, a soap product comprising small elements of soap having a rounded surface which is porous and having at least a substantial portion of the element adjacent said surface puffed to produce a porous structure, said soap being produced by extruding under pressure a plastic soap containing water and a small amount of phosphatidic material and lowering the pressure upon the extruded soap to vaporize a sufficient amount of said water to produce said porous structure.

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