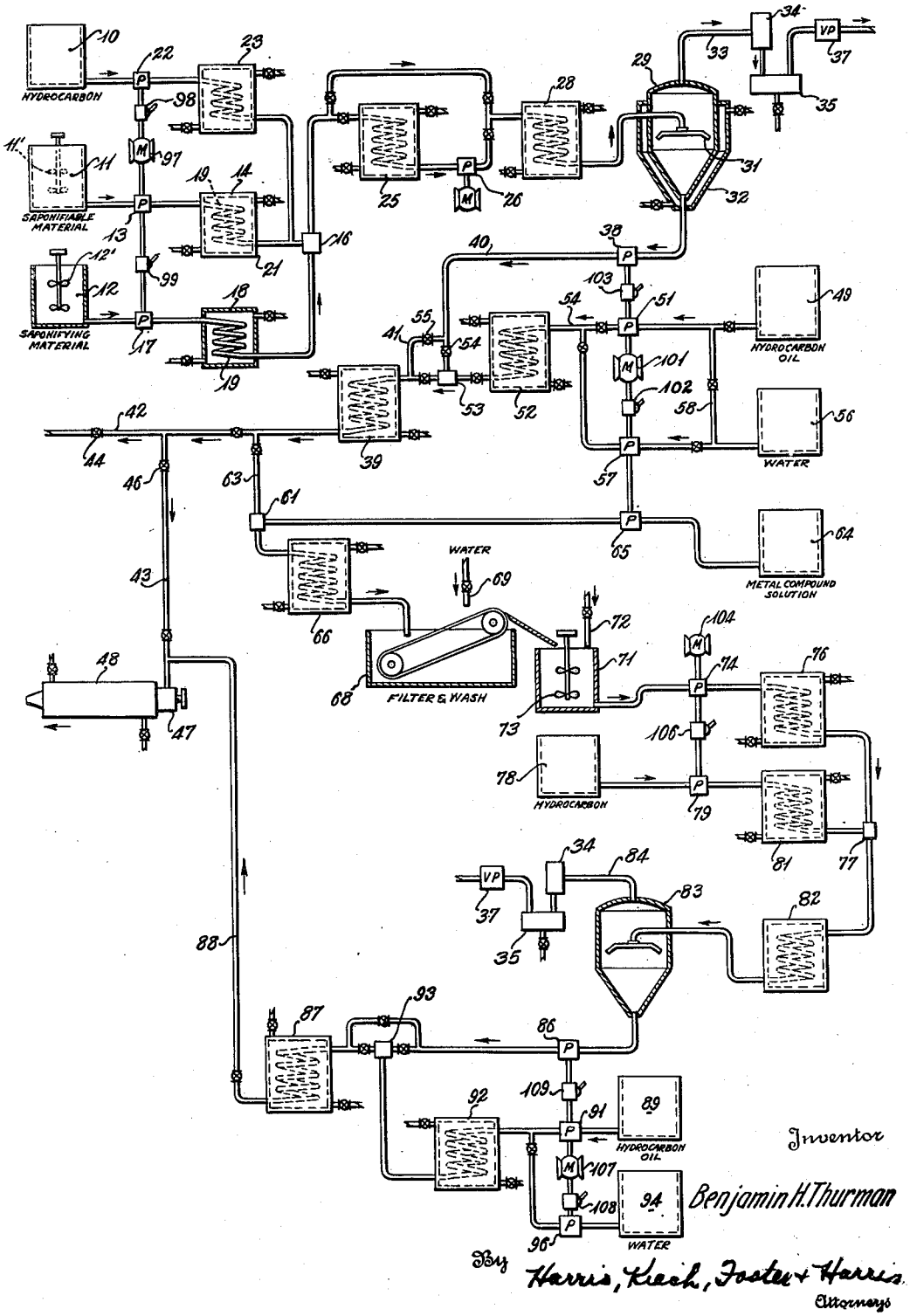
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MANUFACTURE OF GREASES

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MANUFACTURE OF GREASES

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This invention relates to the manufacture of greases and more particularly to a continuous method of incorporating mineral oil lubricants into soaps so as to produce greases having desired physical characteristics either in substantially anhydrous form or containing controlled amounts of water.

Greases, in general, contain a lubricant, usually a mineral lubricating oil having a viscosity approximating that desired for the particular lubrication application and at least one soap as a carrier for the oil in order to produce a relatively stiff material, which upon application to a bearing releases its oil for lubrication. The soap itself may have some lubricating properties and does to some extent modify the lubrication characteristics of the mineral oil. For certain types of lubrication, soaps similar in chemical composition to ordinary detergent soaps, that is, alkali metal salts of fatty acids, are employed. For other lubrication applications the soaps employed are of the water insoluble type such as salts of fatty acids and polyvalent metals, for example calcium, aluminum, magnesium, lead, zinc, iron, manganese, etc. Soaps containing organic acid radicals other than fatty acid radicals, for example, abietic or naphthenic acid radicals are also employed in greases usually in combination with the salts of fatty acids.

In general any substantial amount of water is deleterious in greases but it has been extremely difficult to prepare mixtures of soaps and mineral oils which are free of water. A small amount of water has, however, been found desirable in certain greases, for example, those containing calcium soaps. The amount of water in such soaps is small in amount but the percetage of water should be carefully controlled. In prior processes it has been extremely difficult to consistently prepare such greases containing the requisite amount of water. The presence of glycerine in greases has also presented a difficult problem as the majority of such greases should be substantially free of glycerine, one reason being the hygroscopic nature of glycerine. A small amount of glycerine is desirable in certain greases but it has also been difficult to prepare greases containing no glycerine or a controlled small amount of glycerine particularly if glycerides are employed in the manufacture of the soap unless the glycerides are first split and the glycerine removed from the resultant fatty acids before forming the soap.

The manufacture of greases involving the operations of mixing the soap and the oil and reducing the water content thereof has usually required high temperature treatments for extended periods of time. Such high temperature treatments degrade the fatty material including the soaps and also tend to crack the mineral oil employed in the soaps producing deleterious compounds in the resulting product. Both of these phenomena are time and temperature reactions.

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In accordance with the present invention soaps are rapidly produced and mixed with mineral oil while anhydrous or substantially anhydrous. High temperatures are employed but the materials are rapidly brought to the high temperatures and then quickly cooled so that the time of high temperature treatment is not sufficient to cause any substantial thermal decomposition. Any glycerine or higher fatty alcohol resulting from the production of soap from glycerides or other fatty materials containing alcohols can be rapidly and substantially completely removed or removed to a controlled desired extent and water may be rapidly added to the mixture under carefully controlled conditions, if it is desired in the resulting grease.

It is, therefore, an object of the present invention to provide an improved process of producing grease free of water or alcohols such as glycerine or having any desired definite small content of such materials.

Another object of the invention is to provide a process of rapidly producing soap in anhydrous molten form and mixing a mineral oil lubricant therewith.

A further object of the invention is to provide an improved process of making greases in which a lubricant oil is mixed with molten anhydrous soap and rapidly cooled.

A still further object of the invention is to provide an improved process of making greases directly from glycerides, or other similar esters of higher fatty acids or other soap forming acids without a prior splitting step, to produce a grease containing mineral oil in which the resulting product is substantial y free of water or alcohols or contains definite small amounts thereof.

Other objects and advantages of the process will appear in the following description of preferred embodiments of the invention shown in the attached sheet of drawing illustrating an apparatus suitable for carrying out the present invention.

When the lubricating oil employed in the grease is of sufficiently high boiling point that it does not vaporize appreciably at the melting point of the soap employed when said soap is anhydrous, it may be added to the saponifiable or saponify-

ing materials or both before or during the formation of the soap so that it is merely necessary to cool the resulting mixture in order to produce the grease. Irrespective of whether the lubricating oil is added before or after formation of the soap it is desirable to have a relatively volatile hydrocarbon such as kerosene or light furnace oil present during the production of the anhydrous soap. This light hydrocarbon may be admixed with the saponifying and saponifiable material during the production of the anhydrous soap and may be added either by itself or in admixture with the heavier hydrocarbon desired in the grease. Thus the apparatus for carrying out the invention may include a source of hydrocarbon shown as a tank 10, a source of saponifiable material shown as a tank 11 preferably provided with an agitator 11', and a source of saponifying material shown as a tank 12 also preferably provided with an agitator 12'. Saponifiable material may be withdrawn from tank 11 by a pump 13 and forced through a heat exchanger 14 to a mixer 16. Saponifying material may be withdrawn from the tank 12 by means of the pump 17 and forced through the heat exchanger 18 to the mixer 16. The heat exchangers 14 and 18 may be of any suitable type providing rapid flow of the materials being heated, and preferably comprise a pipe coil 19, through which the material being heated flows, positioned in a container 21 through which any desired heating medium such as heated mineral oil is circulated. The saponifiable material and saponifying material may be heated to relatively high temperatures in the heat exchangers 14 and 18, respectively, for example to temperatures between 250° and 400° F. Because of the corrosive nature of certain of the saponifying materials, temperatures in the lower portion of this range may be employed therefor. The mixer 16 may be of any type of flow mixer suitable for producing an intimate mixture of the saponifiable material and saponifying material. It is preferably of the type shown in the patent to Thurman No. 2,142,062 granted December 27, 1938, but may be any suitable mechanical mixer having power driven elements.

The hydrocarbon may be withdrawn from the tank 10 by means of a pump 22 and forced through a heat exchanger 23, which may be of the same type as the heat exchangers 14 and 18. The hydrocarbon which may be either a light hydrocarbon or the desired lubricating oil or a mixture of both may be added in flow to either the saponifiable or saponifying material but is preferably added to the stream of saponifiable material entering the mixer 16 as shown on the drawing. The light hydrocarbon acts as a diluent to produce a more flowable mixture in the mixer 16 and the resulting mixture may be passed through another heat exchanger 25 which may be of the same type as the heat exchanger 14. The temperature in the heat exchanger 25 is preferably raised to or maintained at a temperature at which saponification of the saponifiable material is substantially completely effected in a short period of time. The temperature should, however, be below that at which material thermal degradation of unsaponified saponifiable material takes place. Such temperatures will usually range between 300° and 450° F. In most instances the saponification will be substantially completed in the heat exchanger 25, but it is preferred to employ another pump 26 which delivers the material from the heat exchanger 25

to another heat exchanger 28 so that the mixing action of the pump can be employed for insuring that substantially complete saponification is effected prior to introduction of the material to the heat exchanger 28. In the heat exchanger 28 the temperature of the materials is raised to or maintained at a temperature above the melting point of anhydrous soap when the soap is also substantially free of the light hydrocarbon added from the tank 10. These temperatures will usually range between 350° and 550° F. but may be as high as 700° F. The soap is much more stable against thermal decomposition than the saponifiable material ordinarily employed and by substantially completing the saponification reaction in the heat exchanger 25 no degradation of the soap takes place during the time at which it is subjected to high temperatures. The mixture from the heat exchanger 28, which may include soap, hydrocarbon, water and glycerine or other alcohols, is delivered into a vapor separating chamber 29 through nozzles 31 which are preferably positioned so as to direct the mixture against the walls of the vapor separating chamber 29. The pressure on the heat exchangers 14, 18, 23 and 25 is preferably maintained sufficiently high that no substantial vapor formation takes place therein. However, the pressure in the heat exchanger 28 may be sufficiently low that substantial vapor formation does take place therein so as to enable a relatively large amount of heat to be stored in the mixture delivered to the vapor separating chamber 29.

The vapor separating chamber 29 is preferably provided with a heating jacket 32 to prevent any substantial drop in temperature therein due to vaporization of liquids therein. The vapor separating chamber 29 may be provided with a vapor withdrawal conduit 33 leading to a condenser 34 for liquefying vaporized materials such as water, glycerine and light hydrocarbon, the condenser 34 being provided with a receiver 35 connected to a vacuum pump 37. The vacuum system, including the condenser 34, receiver 35 and vacuum pump 37, may be employed to provide a reduced pressure in the vapor separating chamber 29 and to also recover valuable by-products such as glycerine as well as the light hydrocarbon in liquid form. Substantially anhydrous molten soap collects in the bottom portion of the vapor separating chamber 29 and this soap may contain any desired proportion of glycerine or higher fatty alcohol depending upon the temperature and pressure in the vapor separating chamber 29. This molten soap may be withdrawn from the vapor separating chamber by means of a pump 38. If the mineral oil desired in the final lubricant is already present in the anhydrous soap it is merely necessary to cool the mixture, for example, by passing the same through a heat exchanger 39 in order to produce the final product. Thus the mixture from the pump 38 may be passed through pipes 40 and 41 directly to the heat exchanger 39. The mixture can be cooled in the heat exchanger 39 by indirect heat exchange with any suitable cooling medium, such as water, to a temperature below that at which the soap or mineral oil would be damaged by contact with the air. This cooled mixture may be discharged from the process through a pipe 42.

In many cases it is desirable to stir or agitate the grease during at least the final stages of cooling in order to develop desired physical characteristics of the grease in which case the uncooled or partially cooled mixture may be delivered

through the pipe 43, by closing the valve 44 in the pipe 42 and opening the valve 46 in the pipe 43, to a screw conveyor 47 provided with a cooling jacket 48. This conveyor may be of the general type disclosed in Thurman Patent No. 2,190,615 granted February 13, 1940.

If the hydrocarbon oil desired in the final product has not been added prior to the production of the molten anhydrous soap it may be added to a stream of the anhydrous soap by withdrawing hydrocarbon oil from a tank 49 by means of a pump 51 and delivering the same through a heat exchanger 52 to the mixer 53 to which the stream of anhydrous soap in the pipe 40 may be delivered by opening the valve 54 therein and closing the valve 55 in the pipe 41. This mixer may be similar to the mixer 16. The hydrocarbon oil from the tank 49 is preferably heated in the heat exchanger 52 to a temperature approaching that of the molten anhydrous soap in the pipe 40 to provide for quick and thorough mixing of the two ingredients by reason of their low viscosity at high temperatures. The resulting mixture may then be cooled in the heat exchanger 39 or the screw conveyor 47, or both, as previously described.

If it is desired to produce a product having a small amount of water therein, this water may be added to the mixture of soap and hydrocarbon oil in the mixer 53 and is preferably heated to a temperature approaching that of the molten anhydrous soap in order to insure thorough admixture therewith. The water may conveniently be added to the stream of hydrocarbon oil from the tank 49, for example, at the point 54 so as to flow through the heat exchanger 52 and in case no hydrocarbon oil is added from the tank 49 the water alone may flow through the heat exchanger 52. The water may be withdrawn from any suitable source such as a tank 56 and delivered into the stream of oil or forced through the heat exchanger 52 by a pump 57.

The above described process may be employed wherever the nature of the saponifiable and saponifying material is such that they will directly react at the high temperatures employed in the process to form soap, but in other cases where it is desired to produce such soaps as aluminum, magnesium or iron soap directly from glycerides or similar esters, it is more effective to first prepare a water soluble soap such as an alkali metal soap and obtain the final insoluble soap by double decomposition of the soluble soap and a soluble compound of the desired metal. In such cases the lubricant will in general not be added to the process until the final soap has been formed. Nevertheless the apparatus thus far described can be employed for rapidly producing the water soluble soap in anhydrous molten form and the light hydrocarbon supplied from the tank 10 can be employed in such process. Instead of adding hydrocarbon oil from the tank 49 to the soap in the mixer 53 the pump 51 may be connected to the source of water 56 through the pipe 58 and employed for supplying relatively large quantities of water to the mixer 53. This water is for the purpose of cooling and dissolving the molten anhydrous soap in the pipe 40 and need not be heated to any substantial extent in passage through the heat exchanger 52. The relatively large volume of water cools and dissolves the soap in the pipe 40 to produce a soap solution which may be further cooled in the heat exchanger 39. Instead of discharging this soap solution from the process it may be delivered to a

mixer 61 through the pipe 63 and a water soluble solution of a compound of the metal desired in the resultant insoluble soap also withdrawn from a source 64 by a pump 65 and delivered to the mixer 61. The resulting mixture may be passed through a heat exchanger 66 to adjust the temperature to a desired filtering or separating temperature and also provide time for completion of the double decomposition reaction. This double decomposition reaction will go to substantial completion if the metal of the metal compound supplied from the tank 64 produces a substantially insoluble soap and will liberate a water soluble compound of the alkali metal.

The material thus liberated in solution is in most cases, desirably removed from the insoluble soap. One way of accomplishing this is to deliver the suspension of insoluble soap to a continuous filter 68 to which wash water is applied through a pipe 69 to wash the filtered insoluble soap. The washed insoluble soap may be delivered to an agitator 71 to which water is added through a pipe 72 to form a flowable suspension of insoluble soap. The agitator 71 may be provided with agitating blades, shown diagrammatically at 73, rotated from any suitable source of power. The suspension of insoluble soap in water may be withdrawn from the agitator 71 by means of a pump 74 and forced through a heat exchanger 76 to a mixer 77. If the mineral oil desired in the lubricant has a relatively high boiling point it may be added to the soap suspension prior to removal of water, thus the oil can be withdrawn from the source 78 by means of a pump 79 and passed through a heat exchanger 81 to the mixer 77. If desired a light hydrocarbon can be added, either alone or in combination with the lubricating oil, to assist in removal of water from the soap.

In order to secure a thorough admixture between the hydrocarbon and the metallic soap, the mixture leaving the mixer 77 is preferably passed through another heat exchanger 82 to raise the temperature of the mixture above the melting point of the soap when anhydrous. This heated mixture may be delivered to a vapor separating chamber 83 which may be of the same type as the vapor separating chamber 29 and be provided with a condenser 34, receiver 35 and vacuum pump 37. Water along with any light hydrocarbon present may be removed from vapor separating chamber 83 through the pipe 84 and recovered from the condenser 34. The molten anhydrous soap collected in the bottom of the vapor separating chamber 83 may be withdrawn therefrom by a pump 86 and if it already contains the requisite amount of mineral oil may be delivered directly to the heat exchanger 87 wherein the same is cooled to a temperature at which neither the soap nor the mineral oil is damaged by contact with the atmosphere, and discharged from the process through pipes 88, 43 and 42. If agitation during cooling or partial cooling is necessary to provide a desired physical structure in the grease, the uncooled or partially cooled mixture from the heat exchanger 87 may be passed through the screw conveyor 47 as previously described.

If the hydrocarbon oil desired in the final grease product has a boiling point below the temperature of the anhydrous soap, the hydrocarbon oil may be added to the molten anhydrous soap withdrawn from the vapor separating chamber 83. Thus the hydrocarbon oil may be withdrawn from a source 89 by means of a pump 91 and de-

livered through a heat exchanger 92 to a mixer 93 to which the molten anhydrous soap may also be delivered so that the soap and oil are mixed in flow and under pressure. The hydrocarbon may be heated in the heat exchanger 92 to a temperature approaching that of the molten anhydrous soap so that a thorough mixture is produced in the mixer 93 due to the relatively low viscosity of the molten anhydrous soap and heated hydrocarbon oil. If a small amount of water is desired in the finished grease, this water may be added thereto before the grease is cooled in the heat exchanger 87 or conveyor 48. Thus water may be withdrawn from the source 94 by means of a pump 96 and passed through the heat exchanger 92. As this water is ordinarily small in amount it may be delivered directly into the stream of hydrocarbon oil entering the heat exchanger 92 or in case no hydrocarbon oil is added from the source 89 the water only may be passed through the heat exchanger 92.

For the purpose of accurate proportioning the pumps 22, 13 and 17 are shown as being driven by a single motor 97, which may be of the variable speed type. A variable speed device 98 may be employed between the motor 97 and the pump 22, and a second variable speed device 99 is shown between the pump 13 and the pump 17. The pumps 13, 17, 22, motor 97 and variable speed devices 98 and 99 thus comprise a proportioning device, but other suitable proportioning devices such as one similar to that shown in the patent to Thurman No. 2,142,062 granted December 27, 1938, may be employed. Similarly the pumps 38, 51, 57 and 65 are shown as being driven by a motor 101 with a variable speed device 102 between the motor and the pumps 57 and 65, and a variable speed device 103 between the pumps 38 and 51. Similarly, the pumps 74 and 79 are shown as being driven by a motor 104 with a variable speed device 106 between the pumps 74 and 79, and the pumps 86, 91 and 96 are shown as being driven by a motor 107 with a variable speed device 108 between the motor and the pump 96, and a variable speed speed device 109 between the pumps 86 and 91. It is apparent that any of these proportioning devices may be of any suitable type, such as that shown in the Thurman patent last referred to. It is also apparent that the apparatus beginning with the pumps 74 and 79 and extending through the heat exchanger 87 is essentially similar to the apparatus beginning with the pumps 13 and 22 and extending through the heat exchanger 39. Thus by producing insoluble soap in the apparatus starting at the beginning of the process and ending after the filter operation carried on in the filter 68 and storing this insoluble soap, the same can be later run through the same apparatus omitting the double decomposition and filtering and then cooled to convert the same into grease, containing mineral oil, thus enabling the duplicate apparatus shown in the drawing to be eliminated.

In the present invention the saponifiable material is usually a glyceride of a fatty acid, the most usual glycerides being lard oil and tallow. Glycerides can be directly saponified with caustic soda or potash or even alkaline compounds of sodium or potassium such as sodium or potassium carbonate under the high temperature conditions employed in the present process. If the carbonates are employed carbon dioxide is liberated and can be removed from the system through the vapor separating chamber 29. The glycerides

may likewise be saponified with alkaline earth metal hydroxide such as calcium hydroxide in which case a slurry, maintained substantially uniform by the agitator 12' in the tank 12, instead of a solution of calcium hydroxide may be employed because of the low solubility of the saponifying agent. In a similar manner lead oxide can be employed to directly saponify glycerides. Rosin which contains abietic acid as well as naphthenic acid may be admixed with a saponifiable material in any proportion desired for certain types of greases and saponified as above described. Also such materials as wool fat or spermaceti or vegetable or animal waxes which are essentially esters of fatty acids with higher fatty alcohols may be employed as part of the saponifiable materials as such materials are readily saponified under the temperature conditions possible under the present process. It is preferred to employ glycerides or other esters of fatty or similar acids as they are in general less expensive than fatty acids and also valuable by-products such as glycerine or higher fatty alcohols can be recovered in relatively pure form from the vapor separating chamber and associated apparatus. However for making the soap particularly with the less active saponifying agents such as aluminum hydroxide or magnesium hydroxide, the saponifiable material may be fatty acids with which these agents will readily react to form soap and liberate water which can be removed from the resulting soap along with any water employed to make up the solution of saponifying agent in the vapor separating chamber. It is preferred to employ saponifying agents in concentrated aqueous solutions or slurries, that is in concentrations substantially greater than 30% to reduce the amount of water which must be removed in the vapor separating chamber. Thus concentrations between 50% and 85% have been found suitable. With such high concentrations, particularly when reacting upon fatty acids, it is of particular importance to employ a relatively high temperature of preheat, that is, temperatures approaching 450° F. prior to mixing the saponifying and saponifiable material in order to prevent the formation of viscous soap which is difficult to pump through the system. A light hydrocarbon such as kerosene or light furnace oil can advantageously be employed as a diluent to also assist in reducing the viscosity of the soap. Such light hydrocarbon also assists in separating vapors or glycerine, water and higher fatty alcohols from the soap in the vapor separating chamber 29. Thus amounts of light hydrocarbon ranging from 2% of the total mixture up to 50% or more can be employed in the process.

If the lubricating oil to be employed in the grease has a boiling point considerably above that of any vaporizable material to be removed, and also approaching or above that of the temperature of the molten anhydrous soap produced, it may be added to the saponifiable or saponifying material prior to admixture of these two materials so that it is present in the anhydrous soap collected at the bottom of the vapor separating chamber 29. This may be done either by mixing the lubricating oil with the saponifiable material in the tank 11 with the saponifying material in the tank 12, using the agitators 11' and 12', respectively, for maintaining a substantially uniform mixture, or in accordance with the preferred procedure, proportioning the lubricating oil into a stream of either the saponifiable mate-

rial or saponifying material or a combined stream of both. Any light hydrocarbon employed in the process may be similarly introduced and, if the various materials do not form a thick or unpumpable mixture at the relatively low temperature (usually below the boiling point of water) in the supply tanks, all of the materials entering the process may be agitated together in a single supply tank such as the tank 11. In such case it is preferably to flow the mixture through the mixer 16 after passage through a heat exchanger such as the heat exchanger 14. If, however, the hydrocarbon oil desired in the final product has a lower boiling point, it can be added to a stream of the anhydrous molten soap from the vapor separating chamber 29 at a temperature at least as great as the melting temperature of the resulting mixture and preferably at a temperature above the melting point of the anhydrous soap so that a thorough admixture with the soap is produced. This addition is made under pressure and out of contact with the atmosphere. If a substantial amount of agitation during cooling is required to produce grease of the desired physical characteristics, the resulting mixture may be cooled in the screw conveyor 47, but otherwise may be cooled to relatively low temperature at which it will not be damaged by contact with the atmosphere, for example, 200° F., in the heat exchanger 39 and discharge directly to the atmosphere through the pipe 42.

In order to employ glycerides or similar esters in the making of insoluble soaps from the lesser reactive saponifying agents, for example hydroxides of aluminum, magnesium, zinc, manganese, etc., it is desirable to first saponify the glycerides with a highly reactive saponifying agent such as caustic soda or potash or alkaline compounds thereof and then convert soluble soap thus formed into insoluble soap. In certain cases this type of operation is desirable even when calcium or lead soaps are desired in the end product. This can be done by admixing a stream of the anhydrous soap from the vapor separating chamber 29 with a stream of water in sufficient amount to dissolve a substantial portion of the soap. Thus, amounts of water ranging from an equal weight of the soap up to several times the weight of the soap may be employed and such water can be brought into direct contact with the molten soap while maintaining the two materials in stream flow under pressure. If necessary the soap solution may be further cooled and then brought into contact with a soluble compound metal of the desired insoluble soap. For example, sulfates of aluminum, magnesium and zinc or the acetate of lead are suitable for making insoluble soaps of the respective metals mentioned. For making calcium soap calcium chloride may be employed. The precipitated insoluble soap of a polyvalent metal can be separated from the resultant aqueous solution of alkali metal compound formed during the double decomposition reaction by any suitable means such as settling or filtering and washing, a continuous filtering being shown on the drawing, and the resulting insoluble soap can then be suspended in water in the agitator 71 and delivered to a vapor separating chamber 83.

In order to substantially eliminate water from the insoluble soap and also to effect a thorough admixture with the lubricating oil it is preferable to maintain the temperature in the vapor separating chamber 83 above the melting point of the anhydrous soap so as to produce a flowable material which can be removed from the vapor separating chamber and thoroughly admixed with a lubricating oil. If the lubricating oil employed has a boiling point above the melting temperature of the anhydrous soap it may be admixed with the soap either by admixture with the slurry of soap in the tank 71 or in stream flow in the mixer 77 prior to removal of water therefrom and melting of the soap. This is the preferred operation but if the desired lubricating oil has a boiling point below the melting point of the anhydrous soap, the oil may be added to a stream of the molten anhydrous soap withdrawn from the vapor separating chamber 83 and cooled either in a cool coil or in the conveyor 47.

With certain types of greases, particularly greases containing calcium soap, a small amount of water is sometimes desirable in the final product. This water may be added to the mixture of soap and lubricating oil while the same is still at a high temperature so as to secure a thorough incorporation of the water into the soap. Water can thus be added to either the soap mixture formed by direct saponification of the saponifiable material or to the mixture including soap formed by double decomposition of a soluble soap.

The amount of lubricating oil added in either case will vary greatly with the nature of the saponifiable material, the type of soap, the metal of the soap produced in the process, the nature of the lubricating oil employed, and the desired properties of the final grease. Thus amounts of lubricating oil ranging from 50% to 98% of the final product are employed in greases. The process of the present invention is extremely flexible so that greases of nearly any desired composition can be directly prepared in a rapid continuous process. If it is desired to leave all or a small amount of glycerine or higher fatty alcohol in the soap, the pressure in the vapor separating chamber 29 may be maintained sufficiently high that all of the glycerine or similar material is not evaporated from the soap. Very precise regulation of the amount of glycerine or similar material left in the soap can be obtained by controllably varying the pressure in the vapor separating chamber. On the other hand all of the glycerine or similar volatile material may be removed from the soap and desired quantities proportioned into the stream of molten anhydrous soap or combined stream of molten anhydrous soap and lubricating oil. They may, for example, be added in conjunction with any water desired in the grease, or if no water is desired in the final product, such materials may be introduced into said stream in the absence of water.

The materials collected in the receiver 35 connected to the condenser 34 for the vapor separating chamber 29 will depend upon the nature of the saponifiable material and whether a light hydrocarbon is employed during the saponification process. If glycerides are employed, this material will include an aqueous solution of glycerine and the light hydrocarbon which material will stratify into two layers, the upper being the light hydrocarbon which may be withdrawn separately from the condenser and reused in the process. If desired, water and glycerine may be fractionally condensed, for example, by employing a fractionation column in order to produce substantially water free glycerine.

The mixing of the lubricating oil with the soap while in molten anhydrous form or the presence

of the lubricating oil in the soap when it is brought to molten anhydrous form enables an extremely uniform composition to be prepared. Since the process can be carried on with extreme rapidity, such that the soap or lubricating oil, or both, is not subjected to high temperatures for any substantial length of time, the high temperatures can be employed without danger to the fatty material, soap or lubricating oil. Substantially any desired physical characteristic of the final product can be developed by the method of cooling employed. For greases of buttery composition the mixture can be rapidly cooled in a cooling coil while for fibrous greases the mixture can be cooled during agitation thereof, for example, in the conveyor 47. It will be seen that I have provided a rapid continuous process of producing greases containing lubricating oils and soaps of various kinds which process is extremely flexible and capable of being employed in the manufacture of nearly any type of grease.

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 grease containing a lubricating oil and a soap, which comprises, heating a stream of a suspension in water of an insoluble polyvalent metal soap to a temperature above the melting point of said soap, rapidly passing said stream through a vapor separating chamber and therein removing said water by vaporization while maintaining a temperature above said melting point to produce a stream of molten substantially anhydrous soap, mixing a lubricating oil with said molten anhydrous soap in a closed mixing zone to prevent loss of oil by vaporization and rapidly cooling a stream of the resulting mixture while out of contact with the atmosphere to a temperature below that at which said soap and oil will be damaged by contact with the atmosphere.

2. The process of making grease containing a lubricating oil and a soap, which comprises, heating a stream of a suspension in water of an insoluble polyvalent metal soap to a temperature above the melting point of said soap, rapidly passing said stream through a vapor separating chamber and therein removing said water by vaporization while maintaining a temperature above said melting point to produce molten substantially anhydrous soap, mixing a lubricating oil and a small amount of water with said molten anhydrous soap in a closed mixing zone to prevent loss of oil and water by vaporization and rapidly cooling a stream of the resulting mixture while out of contact with the atmosphere to produce said grease.

3. The process of making grease containing a lubricating oil and soap, which comprises, heating a stream of a suspension in water of an insoluble polyvalent metal soap to a temperature above the melting point of said soap, rapidly passing said stream through a vapor separating chamber and therein removing said water by vaporization while maintaining a temperature above said melting point to produce a stream of molten substantially anhydrous soap, mixing a lubricating oil with said molten anhydrous soap in a closed mixing zone, partially cooling the resulting mixture in the absence of mechanical agitation and thereafter rapidly cooling the partially cooled mixture while mechanically agitating the same, the steps of said process being carried out while said resulting mixture is out of contact with the atmosphere.

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