

UNITED STATES PATENT OFFICE

2,391,236

OXIDATION OF PARAFFINIC
HYDROCARBONS

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No Drawing. Application August 25, 1943,
Serial No. 500,005

17 Claims. (Cl. 260—451)

This invention relates to an improved process of oxidizing high molecular weight hydrocarbons and to the resulting products. More particularly the invention relates to improved processes of forming fatty acids and mixed products containing fatty acids suitable for use in the preparation of soaps, detergents, wetting agents and the like, and made from high molecular weight hydrocarbons, which are liquid or solid at ordinary temperatures and pressures, and to the resultant mixed products of such processes.

It is an object of the invention to provide improved processes of treating high molecular weight hydrocarbons, particularly paraffinic hydrocarbons and to provide improved fatty acid containing mixtures and purified fatty acids of such processes. Other and further objects are those inherent in the processes and products hereinafter illustrated, described and claimed.

In carrying out the invention there is utilized a starting material of high molecular weight hydrocarbon, preferably a paraffinic hydrocarbon which is liquid or solid at ordinary temperatures and pressures. As examples of these compounds, there may be mentioned fuel oils, lubricating oils, the paraffins, crude mineral wax, crude mineral oil and fractions thereof. In order to effect the formation of fatty acids or fatty acid-containing mixtures, the starting material is treated at slightly elevated temperatures, even in an open kettle if desired, with an oxidizing gas which may be air, air enriched with oxygen, pure oxygen or oxygen diluted with inert gas. The oxygen containing gas has in it a minor percentage of moisture, preferably 1-3% water vapor, based on the weight of the gas used, and then the gas-water vapor mixture is brought into the reacting relationship by dispersing the gas-water vapor mixture in the high molecular weight hydrocarbon, while the latter is in a liquid state, and so forming an emulsion of the reaction mass during the whole time of the process of oxidation.

In order to accomplish the oxidizing, viz. fatty acid-forming reaction, there is also utilized an oxidation catalyst, preferably a "siccative" or "dryer" such as is ordinarily used as an oxidation and polymerization catalyst in paints, varnishes, enamels and the like. For this purpose there is preferably used a metallic soap, preferably a heavy metal soap in an amount preferably ranging from 0.05% to 3.0%, based upon the amount of hydrocarbon used. As the siccative, viz. dryer, there may be used a metallic soap such as zinc, manganese, cobalt, lead or other heavy metal stearate, oleate, palmitate, linoleate, or soaps

made from other fatty acids singly or in combination, or the corresponding heavy metal soaps of the mixed fatty acids produced in accordance with the present invention. Resinic and/or naphthenic soaps of the heavy metals are also well suited as catalysers. The zinc soaps are preferred because of the somewhat antiseptic effect of zinc which may desirably be left in small percentages in the finished products or separated fatty acid mixture. This is of importance where the finished fatty acids or mixture is used for the production of ordinary household soaps used by human beings, or where the soap is used in conjunction with manufactured goods, which later are used by human beings. In addition the zinc soaps have a desirable light color and, therefore, do not produce or impart an off-color to the final product. In this connection it may be mentioned that the iron soaps, for example, produce the necessary effect in so far as the reaction of the hydrocarbon, hereinafter described, is concerned, but tend to discolor the final product.

In addition for accomplishing the reaction of the hydrocarbon, there is also used a per-salt having as the cation a metal, preferably an alkali or alkaline earth metal, or similar alkaline cation, for example potassium, sodium, lithium, ammonium or the like. The cation may also be other multi-valent metals. Among these may be mentioned calcium, barium, strontium, manganese, cobalt, iron, zinc, copper, and other two or three valent metals. Many of these are expensive, as strontium, and it is therefore preferable to use the inexpensive and available sodium per-salts. As the anion of the per-salt there may be used the per-manganates, per-borates, per-chlorates, per-chromates, per-sulphates and similar per-salt anions. Sodium or potassium per-manganates or sodium or potassium per-chlorates as well as the sodium or potassium per-borates all serve admirably in the process.

In carrying out the invention, the selected high molecular weight hydrocarbon is placed in a kettle and the temperature raised until the hydrocarbon, if normally solid, is melted. The kettle may be an open kettle or one equipped with a cover. A stirrer is needed to effect mixing and provision is made for a fine and thorough distribution of the oxygen-water vapor containing gas in the hydrocarbons by bubbling from the bottom of the kettle. Stirring may also be accomplished by the uprising bubbles of gas. Where a cover is used on the kettle simple inlet pipes are desirable for introducing the reaction ingredients, and a simple gas outlet line equipped

with a water cooled condenser is useful for gauging the course of the reaction. Where large batches are made, a cooling coil is desirable, since the reaction is exothermic at some stages.

The hydrocarbon is heated to a temperature range of 80–150° C., preferably 100–130° C. depending upon the nature of the hydrocarbon used. A few minutes' reaction in the range of 130–150° C. does no harm but continued operation at these temperatures causes some discoloration. Therefore, it is preferable to operate in the restricted range of 100–130° C. Some of the higher melting point waxes such as montan, may be reacted in the range of 130–150° C. Also, where color and odor are of little importance, as where the fatty acids are to be used in lubricating greases, the higher temperatures may be used to afford quick reaction. There is then prepared an emulsion of water and oleaginous material, together with an emulsifier which may be ordinary soap or soap made from the fatty acids produced by this invention. The emulsion serves to carry the per-salt ingredient and, optionally, may include also the heavy metal soap ingredient, although the latter may conveniently be dispersed directly into the hydrocarbon. This emulsion of per-salts serves not only as a very strong activator of the oxidation but keeps the whole reaction mass in emulsion, in which state the oxidation is more effective and is done in a much shorter time.

The preferred range of heavy metal soap, per-salt and emulsifying ingredients may be the following percentages, based upon the amount of hydrocarbon used:

Emulsion ingredients	Per cent	
	Oleaginous material	2–10
Water	-----	1–10
Sodium or potassium soap	-----	½–5
Per-salt dissolved in the emulsion	-----	0.05–3.0
Heavy metal soap optionally dissolved in the emulsion	-----	0.05–3.0

However, for optimum oxidizing conditions and with some raw materials, it is sometimes desirable to change the percentages of the various ingredients.

As the oleaginous material there may be used any ordinary animal or vegetable fat, such as stearin, lard, cocoa fat or oil, or a fatty acid such as saturated fatty acids of which stearic acid is exemplary, unsaturated fatty acids of which oleic is exemplary, the fatty acid end products previously produced in connection with the present invention, the products of this process which cannot be saponified, the reaction end product itself or mixed with other hydrocarbons or fatty acids. The word "fats" is understood to include animal or vegetable fats that are normally solid or liquid, and thus includes animal or vegetable fats or oils.

The emulsion is formed by thoroughly mixing the aforesaid ingredients by mechanical stirring and is then added to the heated hydrocarbon, preferably in several portions throughout the reaction period. Where the heavy metal soap is not dissolved in the emulsion, it is added directly to the melted hydrocarbon and, like the emulsion is preferably added in several portions during the course of the reaction.

The reaction period varies with the type of hydrocarbon used, the degree of fatty acid formation desired and the conditions of reaction. The period ranges from about 6 to 24 hours.

During the reaction period, the hydrocarbon is maintained at the selected temperature within

the range of 80–150° C., preferably 100–130° C., previously stated, and preferably ¼ to ½ of the emulsion (and similar fractional portions of the heavy metal soap) are added at the outset and the remainder added in one or more portions toward the end of the reaction period, so as to maintain the rate of oxidation. Where heavy metal soap and per-salts, both are ingredients of the emulsion, it is only necessary to add portions of the emulsion to the heated (liquid) high molecular weight hydrocarbon during the course of the reaction. This is the preferred method of manipulation. It is thus convenient to make up a batch of emulsion and include both the heavy metal soap and the per-salt as ingredients. Then during the reaction simply add portions of the emulsion to the reaction mass as hereinbefore stated.

Throughout the reaction period air, pure oxygen, or a mixture of gases containing oxygen is bubbled into the heated high molecular weight hydrocarbon. It is important that the gas comprising oxygen be humidified so that it contains, for example 1–3% moisture (based upon the weight of the gas). The oxygen is utilized in the reaction, and the supply is adjusted so that an excess is available and passes off at the surface of the liquid. The gas comprising oxygen should be finely dispersed in the hydrocarbon, and it is therefore desirable to introduce it by means of small nozzles, porous diaphragms or the like.

The completion of the reaction may be judged by periodically sampling and determining the saponification number of the reaction mass. Thus, in a typical run with air, after 6 hours the saponification number of paraffin, treated as previously described, was 110 and after 12 hours the saponification number was 175. When oxygen is used the reaction time is very much shortened. When the oxidation is continued a little longer, a saponification number of 200 or more is very easily obtained.

I prefer to stop the reaction where the saponification number is from 200–220, or thereabouts, for with most starting materials, such a saponification number is easily reached without inducing side reactions which would impart color or odor to the product.

At the end of the reaction period, the reaction mass contains a major percentage of fatty acids and a minor percentage of unsaponifiable material or partially saponifiable. Thus in a typical run, after 12 hours of reaction, the reaction mass contains more than 80% of saponifiable matter, indicating that in excess of 80% of the mass was of the fatty acid type.

In a preferred method of separation the fatty acids may be recovered in a manner much easier and cheaper to carry out than the conventional method of saponifying the mixture with caustic alkalis, extraction of the unsaponifiable with solvents and finally acidifying the soaps formed by the saponification to recover the fatty acids. My preferred method of separating the fatty acids from the unsaponifiable matter is carried out as follows: The temperature of the reaction mass is lowered to a temperature between the congealing point of the fatty acids and the congealing point of the residual unsaponifiable material. This temperature will depend upon the properties of the hydrocarbons used as raw materials in the oxidation process. For example when separating the fatty acids from the unsaponifiable material in an oxidation of a paraffin of 52–55° C. melting point, it was found that the congealing point of

the fatty acids was in the neighborhood of 28° C. and the congealing point of the unsaponifiable fraction was somewhat above 45° C., so a temperature of 35° was found satisfactory for the thermal separation. The mass is held at such a desired temperature for several hours. The components of the mass then distribute themselves into three layers. On the top floats a solid layer of the unsaponifiable materials. In the center is a liquid layer of the fatty acids. On the bottom is a layer of the catalyst or metallic soap in the form of finely divided solid particles. These layers may be separately withdrawn from the vessel by appropriate means. The fatty acid layer is found to be practically pure fatty acids requiring no further purification before technological utilization. The layer of unsaponifiable matter contains a small amount of mechanically held fatty acids which may be recovered by further treatment, though if the unsaponifiable matter is to be returned in a subsequent batch or cycle to the oxidation process for further oxidation, it is unnecessary to remove these acids.

The separated fatty acids are white in color when in the solid state. When they are in a liquid state, they have a very light straw color. These fatty acids when produced from paraffin have the color, consistency, melting point, odor and saponification number range of the mixed acids produced from coconut oil. Like coconut oil fatty acids they may be saponified at low temperatures (viz. "cold saponification") by relatively weak alkalies such as soda ash, an important characteristic, which differentiates the fatty acids of the present invention from all prior synthetic fatty acids made from higher aliphatic hydrocarbons. In one important property these fatty acids made by my process are superior to the natural fatty acids from coconut oil, this property being that of delayed rancidity. The soaps made from the acids manufactured by my process do not become discolored with age as soon as do soaps from natural fats. Soap made from these acids does not discolor after more than six months' exposure to the air, whereas a control sample of commercial soap of high quality made from natural fats was badly discolored within one month. It is believed that this stability of the fatty acids and their resulting soaps is due to the formation of antioxidants during the oxidation process. The resultant products are therefore useful for many purposes, such as the refining of other fats.

Thus, by means of my process hydrocarbons may be converted into two classes of materials, each having greater value than the raw material, these being the fatty acids and unsaponifiable material. The fatty acids are suitable for the manufacture of soaps for cleansing, metallic soaps, lubricating soaps, detergents, wetting agents, emulsifiers and other such uses. The unsaponifiable matter may be used as raw material for further oxidation; it may be a filler in soaps or other detergents, it may be used as an antioxidant, and it has high adsorptive powers which renders it useful as an additive in paint, varnish and enamel formulas. Thus, without separating the fatty acids and unsaponifiable matter, one may make a soap, in which case the unsaponifiable matter serves as a useful filler in the resultant soap.

The reaction may be carried out in a glass, enamel, or enamel or glass-lined apparatus, but preferably is carried out in aluminum, stainless steel or other metals which do not discolor the

fatty acids, kettles. The kettle should be provided with jackets for heating and cooling, an air inlet nozzle or diaphragm at or near the bottom, a stirrer and a cover having inlet pipes for introducing the raw materials and an outlet for drawing off water vapor, volatiles produced during the reaction and excess air. The volatiles include relatively small amounts of the lighter fractions, including acids, ketones and aldehydes which, being fairly volatile, are scrubbed out of the reaction by the excess air used. These by-products may be recovered by a simple condenser.

Aluminum, when present in the kettle, stirrer or the like seems to catalyze the reaction, for when using aluminum apparatus the same degree of reaction (as indicated by the saponification number) is achieved in about 50% of the time required as when the same materials are processed under identical conditions in glassware vessels. Aluminum kettles are therefore preferred, especially for commercial operations.

Working with pure oxygen shortens the reaction time, but requires extra precautions and careful use of the cooling jackets on the kettles during the exothermic phase of the reaction, which usually occurs early in the process. On large scale operations the oxidation proceeds faster, and cooling is therefore especially required in larger apparatus.

It is very easy to obtain a saponification number of 200-220 and 80-85% fatty acids in a day's run of 6-12 hours under optimum conditions. When using normally solid hydrocarbons, the resulting final product and fatty acids are white, and have the consistency, color, odor, and ease of saponification of coconut oil fatty acids. No dark colored or objectionable smelling side-reaction products are produced. Furthermore, due to the mild and efficient oxidation, the resultant fatty acids seem not to be bound to the unsaponifiable fractions since they separate easily upon standing at appropriate temperatures, as previously stated. Furthermore, the fatty acids may be saponified at a low temperature (cold saponification), at a temperature which is under the melting point of the unsaponifiable fractions. As a result, even the unsaponifiable fractions are white in color and have no smell whatever. Consequently, it is entirely feasible to allow the relatively small unsaponifiable fractions to remain in the resultant soap.

Having thus described in general the features of the invention, reference is made to the examples given hereinafter which illustrate specific and desirable modes of proceeding and the resultant products. These examples should not however be considered as limiting the invention.

Example 1

Paraffin (500 grams) having a melting point of 52-55° C. was placed in a glass reaction vessel and heated at atmospheric pressure to 110° C. The reaction vessel was equipped with an air inlet tube at or near the bottom for blowing air into it in finely dispersed bubbles. The reaction vessel was also equipped with a cover having a mechanical stirring device of glass thereon and also an inlet pipe for the introduction of emulsion, as hereinafter described. The cover was also equipped with an outlet pipe having a simple water-cooled condenser therein for the collection of vapors given off in the process. An emulsion was prepared by mixing together 25 grams of fatty acids from beef tallow, 0.5 gram of potassium stearate, 0.25 gram potassium per-manga-

nate and 50 grams of hot water. The separately prepared emulsion mixture was stirred thoroughly so as to provide a homogenous mixture of the named ingredients.

To the heated paraffin there was then added 2.5 grams of zinc stearate, while stirring so as thoroughly to disperse the zinc stearate throughout the melted and heated paraffin, and then approximately $\frac{1}{2}$ of the emulsion was added and stirred into the paraffin-zinc stearate mixture. During the entire course of the reaction air containing 1-3% moisture was continually blown through the reaction mass, the excess air being permitted to pass off through the vapor pipe and condenser. During the reaction a condensate was continuously collected in the condenser and the rate of the reaction may be judged by the rate at which such condensate is collected.

After 12 hours the reaction began to slow down, as indicated by a decrease in the rate at which condensate collected in the condenser, and in order to maintain the rate of reaction 2.5 grams more of zinc stearate and the remainder of the emulsion were added. Throughout the entire reaction the temperature was maintained at or near 125° C. and air containing 1-3% moisture was continuously bubbled through the heated reaction mass.

After 12 hours of reaction, the saponification number of the entire mass was 180 and after 15 hours the saponification number of the mass was 218. After 15 hours the reaction was stopped. The entire mass was white and free from objectionable odor, it was very easy to saponify, even cold saponification can be done, and the whole product reminds in color, odor, consistency like the fatty acids of the coconut group.

The reaction mass contains a large percentage of the fatty acids of the hydrocarbon material together with a minor percentage of unsaponifiable products. The fatty acids may be separated from the unsaponifiable material and from the residue of the metallic soap and emulsion ingredients by permitting the temperature of the mass to fall below the temperature at which the unsaponifiable materials solidify, in this instance somewhat below 42° C. Thus the temperature was maintained at 35° C. for 16 hours and three layers formed in the reaction vessel. The upper solidified layer contained the unsaponifiable matter. A middle layer of still melted material contained the fatty acids. A small bottom layer of metallic soap and emulsion residue formed at the bottom of the kettle. The bottom layer and the top layer of unreacted or partially unreacted starting material were drawn off and the fatty acids recovered. After correction for the fatty acids added by way of the emulsion, there was obtained 410 grams of fatty acids, viz. 82% of the paraffin starting material. The layers may easily be separated by centrifuging, if desired.

The top layer drawn off from the reaction kettle is not capable of saponification and appears to be a mixture of unoxidized or partially oxidized paraffins. They are useful as such or may, if desired, be re-worked as starting material in subsequent batches. The unsaponifiable portion is also white and has no odor.

Example 2

Paraffin (600 parts) having a melting point of 52-55° C. was reacted in a glass kettle with an aluminum stirrer as in Example 1 except that the emulsion was prepared from soap made from the fatty acids separated in Example 1, rather

than from fatty acids of beef tallow. The reacting conditions, proportions of ingredients, times of reaction and ingredients were otherwise as in Example 1.

After 12 hours of reaction the saponification number of the entire mass was 146; in 17 hours the saponification number was 196; and in 19 hours the saponification number was 218.

The reaction was stopped at 19 hours and the entire mass, which was white and free from objectionable odor, was treated as in Example 1 to separate the fatty acid layer from the unsaponifiable fraction layer and the layer of metallic soap constituting the residue of the emulsion used. The yields and quality of product were as set forth in Example 1.

Example 3

Paraffin (500 parts) having a melting point of 52-55° C. was treated as in Example 2, the reaction materials, proportions of ingredients, temperatures and conditions being as in Example 2, with the single exception that oxygen gas in place of air was bubbled through the reaction mass. The oxygen contained 1-3% moisture, as in Example 2. The reaction proceeded at a faster rate with the result that after 8 hours the saponification number of the mass was 175, and after 12 hours the saponification number of the mass was 208. After 12 hours the reaction was stopped and the reaction mass, which had a quality as in Example 2, was worked up as in Example 2, in order to separate the thus produced fatty acids, unsaponifiable matter and metallic soap residue from the emulsion used as one of the reactants.

Example 4

Paraffin (500 parts) having a melting point of 52-55° C. were reacted, as stated in Example 2, all reaction material, proportions, temperatures and conditions being the same as Example 2, with the exception that 2.50 grams of sodium per-borate was used instead of 0.25 part of potassium per-manganate, as set forth in Example 2. The reaction proceeded at approximately the same speed as in Example 2, and after 12 hours the saponification number of the reaction mass was 128, and after 22 hours the saponification number of the mass was 195. The quality of the reaction mass at the end of the reaction (22 hours) was approximately the same as in Example 2. The fatty acids, thus produced, were separated from the unsaponifiable and metallic soap and emulsion residue fractions as set forth in Example 2.

Example 5

A refined mineral oil (500 parts) obtained from a paraffin base crude oil, and having a boiling point range beginning at 175° C. was treated as in Example 2. After 12 hours the saponification number of the reaction mass was 200. The reaction mass at the end of the reaction period had not darkened, and it had approximately the same color as the oil used as a starting material. The fatty acids were recovered as previously described, and the percentage yield was the same as in Example 1.

Example 6

600 grams paraffin of the melting point 52-55° C. is melted in a kettle equipped with an inlet at the bottom, an outlet for the vapors leading to a water cooled condenser to collect all the volatile products and a good mechanical stirrer.

The temperature is raised to about 125° C. and 6 grams of the catalyst, in this case zinc stearate, is added and mixed by stirring.

Apart from this an emulsion is prepared from: 15 grams beef tallow fatty acids and 15 grams fatty acids recovered from this process, from a previous run, 1 gram of soap made from a reaction product from a previous run, is added and 0.25 gram potassium permanganate dissolved in 50 cc. hot water. All these ingredients are thoroughly mixed until a good emulsion is formed.

Half of this emulsion is now stirred in the paraffin-catalyst mixture and the temperature is held at about 125° C. In the beginning the air is blown through slowly until the foam which is formed in the reaction mass is dispersed. The air supply is then adjusted so as to provide an excess of air which passes off the surface of the reaction mass. The oxidation starts after a short time. When the temperature rises because of the exothermic reaction, the heat is interrupted for a while. When the oxidation process begins to slow down, the rate at which condensation products are given off decreases and this time another part of the emulsion is stirred into the reaction mass, about ¼, and toward the end the last ¼ of the emulsion is added.

The saponification number after 6 hours of oxidation is 110 and after 12 hours 180, and after 16 hours 218.

Example 7

600 grams of clear yellow mineral oil having mostly hydrocarbons of the aliphatic series and a specific gravity of 0.86, which has been freed completely from hydrocarbons which tend to form gummy or asphaltic compounds during the oxidation, is treated as in Example 6. The reaction is very strong, heat has to be interrupted, and cooling used for a while.

After 12 hours the saponification number is 200. This oxidation can easily be carried out until a saponification number of 300 is obtained.

The fatty acids retained the color of the mineral oil used as starting material, when not over oxidized (saponification number about 200) and give good lathering soaps. They can further be used for many other industrial purposes.

Example 8

600 grams paraffin having a melting point of 25-55° C. is melted and heated to about 125° C., and 6 grams manganese palmitate are mixed into the melted paraffin.

An emulsion is made from 30 grams of the reaction product from an earlier run, 15 grams of stearic acid and 0.5 gram of sodium soap made from the fatty acids of a previous run. This mixture is melted and a solution of 3 grams sodium per-borate in 50 cc. hot water is stirred into the fatty acid-soap mixture until a good emulsion is formed. Half of this emulsion is now added to the melted paraffin-catalyst mixture, and the same procedure followed as in Example 6. After 6 hours of oxidation the saponification number is 108 and after 12 hours of oxidation the saponification number is 174. This product is quite white and possesses great stability and emulsifying qualities.

Example 9

600 grams paraffin having a melting point of 52-55° C. is melted and heated to about 100° C. and 1½ grams of zinc stearate and 1½ grams of manganese stearate are added and mixed by

stirring. An emulsion is made from 15 grams lard fatty acids and 15 grams of the reaction product from a previous run and 0.5 gram of sodium soap made from the fatty acids of a previous run. The mixture of fatty acids and soap is melted and then a solution of 3 grams potassium per-chlorate in 50 cc. of hot water is stirred into the fatty acid-soap mixture until a good emulsion is achieved. The remaining proceeding is as in Example 6. After 6 hours the saponification number is 95 and after 12 hours the saponification number is 158.

Example 10

600 grams of paraffin having a melting point of 52-55° C. is melted and the temperature raised to about 100° C. Six grams of zinc oleate and 0.25 gram of potassium per-manganate are dissolved in 50 cc. of hot water. One gram of soap made from the fatty acids of a previous run is melted with 30 grams of such fatty acids, and the remainder of the proceedings are the same as in the other examples. After 6 hours the saponification number is 112 and after 12 hours the saponification number is 175.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that I do not limit myself to the specific embodiments herein except as defined by the appended claims.

This application is a continuation-in-part of my application Serial No. 455,937 filed August 24, 1942.

What I claim is:

1. The process which comprises heating a high molecular weight paraffinic hydrocarbon to a temperature such that the hydrocarbon is liquefied, said temperature being not in excess of 150° C., intimately admixing with the heated liquid hydrocarbon catalytic amounts of a heavy metal soap and a metal per-salt, the latter at least being carried by an emulsion of water, a water-soluble soap, and an oleaginous material selected from the class consisting of fats and fatty acids, then dispersing throughout the reaction mass a gas comprising oxygen and a minor amount of moisture, while maintaining the emulsion throughout the oxidizing process and separating the reaction product so formed in the process.

2. The process of claim 1 further characterized in that the heavy metal soap and metal persalt are both carried in the emulsion.

3. The process of claim 1 further characterized in that the heavy metal soap is dissolved in the hydrocarbon, the metal persalt being carried by the emulsion.

4. The process of claim 1 wherein the catalytic amounts of heavy metal soap and metal persalt are added in several portions throughout the reaction.

5. The process which comprises heating a high molecular weight paraffinic hydrocarbon to a temperature such that the hydrocarbon is liquefied, said temperature being not in excess of 150° C., intimately admixing with the heated liquid hydrocarbon catalytic amounts of a heavy metal soap wherein the metal is selected from the class consisting of zinc, manganese, cobalt, lead and iron and a metal persalt, the latter at least being carried by an emulsion of water, a water soluble soap and an oleaginous material selected from the class consisting of fats and fatty acids, then dispersing throughout the reaction mass a gas comprising oxygen and a minor

amount of moisture, while maintaining the emulsion throughout the oxidizing process, and separating the reaction product so formed in the process.

6. The process which comprises heating a high molecular weight paraffinic hydrocarbon to a temperature such that the hydrocarbon is liquefied, said temperature being not in excess of 150° C., intimately admixing with the heated liquid hydrocarbon catalytic amounts of a heavy metal soap and an alkali persalt wherein the alkali is selected from the class consisting of sodium, potassium, lithium and ammonium and the persalt is selected from the class consisting of permanganate, perborate, perchlorate, perchromate and persulphate, at least the alkali persalt being carried by an emulsion of water, a water soluble soap and an oleaginous material selected from the class consisting of fats and fatty acids, then dispersing throughout the reaction mass a gas comprising oxygen and a minor amount of moisture while maintaining the emulsion throughout the oxidizing process, and separating the reaction product so formed.

7. The process which comprises heating a high molecular weight paraffinic hydrocarbon to a temperature in the range of 100-130° C., intimately admixing with the heated liquid hydrocarbon 0.05% to 3.0% of a heavy metal soap and 0.05% to 3.0% of a metal persalt, at least the latter being carried by an emulsion of 1% to 10% water, a water soluble soap and 2% to 10% oleaginous material selected from the class consisting of fats and fatty acids, all said percentages being based upon the amount of hydrocarbon undergoing processing, and simultaneously dispersing in the reaction mixture a gas comprising oxygen and containing a minor amount of moisture, while maintaining the emulsion throughout the oxidizing process, and separating the reaction product so formed in the process.

8. The process which comprises heating a high molecular weight paraffinic hydrocarbon to a temperature such that the hydrocarbon is liquefied, said temperature being not in excess of 150° C., intimately admixing with the heated liquid hydrocarbon catalytic amounts of a heavy metal soap and a metal per-salt, the latter at least being carried by an emulsion of water, a water soluble soap and an oleaginous material selected from the class consisting of fats and fatty acids, then dispersing throughout the reaction mass a gas comprising oxygen and a minor amount of moisture, while maintaining the emulsion throughout the oxidizing process, then separating the fatty acid reaction product by lowering the temperature of the reaction mass to a temperature between the congealing point of the fatty acids and the congealing point of the residue of the hydrocarbon starting material, and separating the thus solidified residue of the hydrocarbon starting material.

9. The process which comprises heating a high molecular weight paraffinic hydrocarbon to a temperature such that the hydrocarbon is liquefied, said temperature being not in excess of 150° C., intimately admixing with the heated liquid hydrocarbon catalytic amounts of a heavy metal soap and a metal per-salt, the latter at least being carried by an emulsion of water, a water-soluble soap and an oleaginous material selected from the class consisting of fats and fatty acids, then dispersing throughout the reaction mass a gas comprising oxygen and a minor amount of moisture, while maintaining

the emulsion throughout the oxidizing process, then lowering the temperature of the reaction mass to a temperature between the congealing point of the so formed fatty acids and the congealing point of the residue of the hydrocarbon starting material and separating fatty acids from said residue by centrifuging.

10. An oxidation process which comprises heating paraffin wax to a temperature between 100° C. and 130° C., intimately admixing therewith catalytic amounts of zinc stearate and potassium permanganate, the latter at least being carried by an emulsion of water, an alkali soap and a fat, dispersing throughout the reaction mass air containing a minor amount of moisture, while maintaining the emulsion throughout the oxidizing process and separating the so-formed fatty acids.

11. The process of claim 10 further characterized in that the reaction temperature is maintained at about 110° C.

12. The process of claim 10 further characterized in that the fat in the emulsion is animal fat.

13. An oxidation process which comprises heating paraffin wax to a temperature between 100° C. and 130° C., admixing therewith catalytic amounts of zinc stearate and potassium permanganate, the latter at least being carried by an emulsion of water, an alkali soap and fatty acids, dispersing throughout the reaction mass air containing a minor amount of moisture, while maintaining the emulsion throughout the oxidation process and separating the resultant fatty acid mixture.

14. The process which comprises heating a high molecular weight paraffinic hydrocarbon to a temperature such that the hydrocarbon is liquefied, said temperature being not in excess of 150° C., intimately admixing with the heated liquid hydrocarbon catalytic amounts of an oxidation catalyst and a metal persalt, the latter at least being carried by an emulsion of water, a water-soluble soap, and an oleaginous material selected from the class consisting of fats and fatty acids, then dispersing throughout the reaction mass a gas comprising oxygen and a minor amount of moisture, while maintaining the emulsion throughout the oxidizing process and separating the reaction product so formed in the process.

15. The process which comprises heating a high molecular weight paraffinic hydrocarbon to a temperature such that the hydrocarbon is liquefied, said temperature being not in excess of 150° C., intimately admixing with the heated liquid hydrocarbon catalytic amounts of a heavy metal soap and a metal persalt, the latter at least being carried by an emulsion of water, a water soluble soap, and products of a previous run, then dispersing throughout the reaction mass a gas comprising oxygen and a minor amount of moisture, while maintaining the emulsion throughout the oxidizing process and separating the reaction product so formed in the process.

16. The process which comprises heating a high molecular weight paraffinic hydrocarbon to a temperature such that the hydrocarbon is liquefied, said temperature being not in excess of 150° C., intimately admixing with the heated liquid hydrocarbon catalytic amounts of an oxidation catalyst and a metal persalt, the latter at least being carried by an emulsion of water, a water-soluble soap, and products of a previous run, then dispersing throughout the reaction

mass a gas comprising oxygen and a minor amount of moisture, while maintaining the emulsion throughout the oxidizing process and separating the reaction product so formed in the process.

17. The process which comprises heating a high molecular weight paraffinic hydrocarbon to a temperature such that the hydrocarbon is liquefied, said temperature being not in excess of 150° C., intimately admixing with the heated liquid hydrocarbon catalytic amounts of an oxida-

tion catalyst and a persalt of an alkaline reacting cation, the latter at least being carried by an emulsion of water, a water-soluble soap, and an oleaginous material selected from the class consisting of fats and fatty acids, then dispersing throughout the reaction mass a gas comprising oxygen and a minor amount of moisture, while maintaining the emulsion throughout the oxidizing process and separating the reaction product so formed in the process.

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