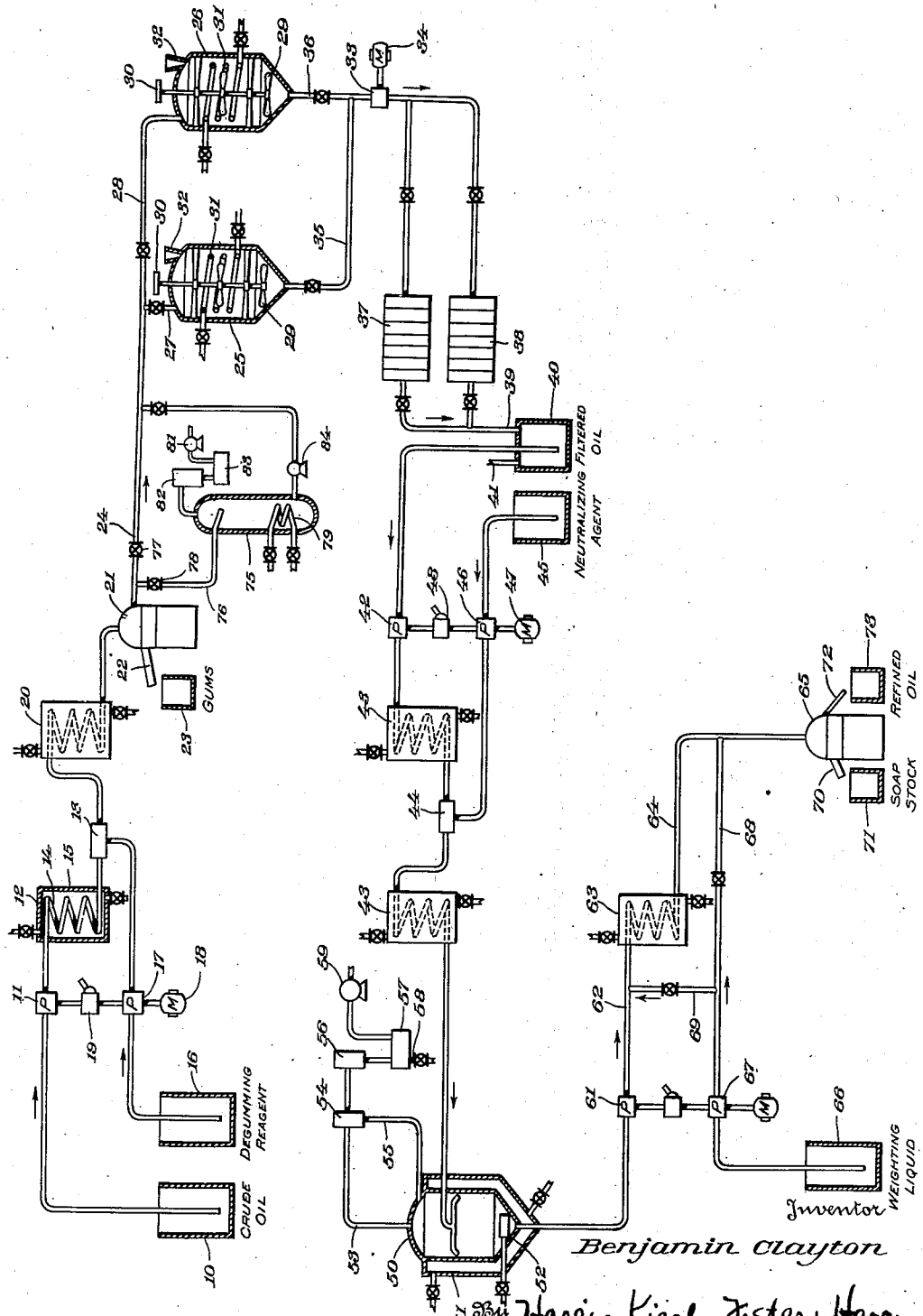
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REFINING OF ANIMAL AND VEGETABLE OILS

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REFINING OF ANIMAL AND VEGETABLE OILS

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This invention relates to a process of refining glyceride oils, and more particularly to a process in which the color of the oil is reduced prior to neutralization of the free fatty acids in order to enable neutralization to be carried out in a manner which does not cause saponification of neutral oil.

This invention is particularly adaptable to highly colored oils, such as cottonseed oil, but is advantageous for refining various other oils, such as soya bean oil, corn oil, sesame oil, rapeseed oil, etc., and may be employed in refining other glyceride or fatty oils such as animal and fish oils. Many oils, particularly cottonseed oil, are highly colored, and this color must be reduced to produce a commercially acceptable oil. It has been the practice in refining such oils to employ a caustic alkali, usually caustic soda, as a refining reagent and use a considerable excess of such reagent for reaction with color impurities in the oil. However, caustic alkalies saponify neutral oil and, when employed in the necessary excess, cause substantial refining losses due to saponification of neutral oil. Other neutralizing reagents, such as sodium carbonate, trisodium phosphate, sodium silicate, etc., or equivalent potassium salts, will neutralize the free fatty acids, but will not substantially reduce the color of the oil. The same is true of such neutralizing agents as ammonia or amines, for example, methylamine, ethylamine, or triethanolamine. In general, neutralizing reagents other than caustic alkalies have the advantage of not attacking neutral oil, but have not been extensively employed because they do not substantially reduce the color of the oil. Bleaching agents, or color adsorbents, such as acid treated clay, fuller's earth, activated carbon, etc., when employed in bleaching processes subsequent to treating with neutralizing reagents other than caustic alkalies, are also not sufficiently effective.

It has been found that the color adsorbents just referred to are effective to reduce the color of the oil to within commercial limits, if employed prior to neutralization treatments. Vegetable oils in general, however, contain substantial quantities of gummy materials, such as phosphatides, proteins, resins, etc., which interfere with the employment of the bleaching materials referred to. In the presence of such gums, large amounts of color adsorbents are necessary. Also, the gums interfere with the separation of the adsorbents from the oil and cause a large amount of valuable oil to be retained therein. It is possible to recover a portion of this oil from the adsorbent, but in the presence of the gums referred to, the oil is of poor quality. By treating an oil which has been denuded of gums with a color adsorbent, it has been found that the color of the oil is substantially reduced, and that the amount of adsorbent necessary and the amount of oil retained in the adsorbent are markedly reduced. Also, a major portion of this oil can be recovered as high quality oil by treating the filter cake with an oil solvent. The present invention, therefore, contemplates removing gums from the oil prior to the employment of color adsorbents or starting with an oil which is substantially free of gums and treating this oil with a color adsorbent.

In addition, the degumming step may be carried on so as to assist in removing color from the oil. Thus, degumming agents having bleaching properties such as oxygen liberating materials, for example, solutions of hydrogen peroxide, organic peroxides, alkali metal or alkaline earth metal peroxides, hypochlorites, perborates, percarbonates, persulphates, etc., may be employed as part or all of the degumming agent to produce a degummed oil of lighter color so as to reduce the amount of color adsorbent necessary to be used in the following step. Furthermore, certain degumming agents which do not liberate oxygen, for example, boric acid, have color removing properties when the mixture of crude oil and degumming agent is subjected to relatively high temperatures. With some oils sufficient color reduction may be accomplished by solutions of the abovementioned forming part or all of the degumming agents so that treatment with an adsorbent after degumming is rendered unnecessary.

As indicated above, effective color reduction can thus be produced, and the oil conditioned for treatment with neutralizing agents which do not substantially reduce color. It is preferred to employ a non-saponifying neutralizing agent which will not attack neutral oil. However, caustic alkalies in amounts substantially equivalent to the free fatty acids can be employed with or without additional non-saponifying neutralizing agent without substantial attack on neutral oil. Also, the soap stock resulting from neutralization is relatively free from gums and coloring materials, so that entrainment of neutral oil therein is lessened and such entrained oil can be recovered as high quality oil.

It is, therefore, an object of the present invention to provide a process of refining animal and vegetable oils in which oils substantially free of

gums are treated with bleaching agents prior to neutralizing the free fatty acids thereof.

Another object of the invention is to provide a process of refining glyceride oils in which refining losses are minimized by preventing saponification of neutral oil in the neutralizing step while producing an oil of acceptable color.

A further object of the invention is to provide a process of refining fatty oils in which the oil is bleached in a manner avoiding substantial losses of neutral oil and then subjected to neutralization and separation of resulting soap stock, in which steps saponification of neutral oil and entrainment of oil in the soap stock can be largely prevented.

Other objects and advantages of the invention will appear in the following description of the invention given in connection with the attached drawing which is a diagrammatic showing of an apparatus suitable for carrying out a preferred process.

The apparatus disclosed is capable of being used to carry out a process in which the oil is continuously degummed, treating with a color adsorbent to reduce the color thereof, then continuously treated with a neutralizing agent, and the resulting soap stock continuously separated from the oil. As will appear below, certain of the steps referred to may be carried on as batch operations, and still provide an improved process.

Referring more particularly to the drawing, crude oil is withdrawn from a source of supply shown as a tank 10 by a pump 11 and forced through a heat exchanger 12 to a mixing device 13. The heat exchange device 12 may include a coil 14 through which the oil is passed and a casing 15 surrounding the coil 14. Any suitable heating medium may be circulated through the casing 15 in order to heat the oil. A degumming reagent is withdrawn from a source of supply shown as a tank 16 by a pump 17 and delivered to the mixing device 13. The pumps 11 and 17 are shown as being driven by a variable speed electric motor with a variable speed device 19 positioned between the motor and the pump 11. This provides for delivering accurately proportioned streams of oil and degumming reagent under pressure to the mixer 13, but any other suitable type of proportioning mechanism may be employed in lieu thereof. The mixer 13 is preferably closed from the atmosphere and of the flow type in which a stream of degumming reagent is injected at right angles into a flowing stream of oil, but may be of any suitable type of flow mixer such as a closed mechanical agitator. The degumming reagent, when admixed with the oil in the mixer 13 precipitates the gummy materials contained in the oil and the mixture of oil, foots, and excess degumming reagent is preferably passed through a second heat exchange device 20, which may be similar to the heat exchange device 12 and delivered to a continuous centrifugal separator 21. The separator 21 is preferably of the heated type similar to that disclosed in Patent No. 2,100,277, granted November 23, 1937, but may be of any type of separator capable of separating gums from oil. The gums are discharged from the centrifugal separator as the heavy effluent through a spout 22 into a receiver 23, and refined oil is discharged as the light effluent through a pipe 24.

The oil discharged from the centrifugal separator 21 is substantially free of gummy materials and may be directly discharged into a mixing tank 25 in which it is mixed with a bleaching or color reducing agent such as an adsorbent earth. A second tank 26 is shown so that the oil may be delivered into one of these tanks, while another body of oil is being mixed with the bleaching agent in the other tank and discharged therefrom. Thus, by opening the valve in the pipe 27 connected to the tank 25 and closing the valve in the pipe 28 connected to the tank 26, oil may be delivered from the centrifugal separator 21 into the tank 25. Conversely, by closing the valve on the pipe 27 and opening the valve on the pipe 28, oil may be discharged into the tank 26. Each of the tanks 25 and 26 may be provided with an agitator 29 driven from any suitable source of power through a pulley or sprocket 30. Tanks 25 and 26 may also be provided with heat exchange coils 31 through which any desirable heating or cooling medium may be circulated in order to maintain the oil in the tanks at a desired temperature. The tanks 25 and 26 are preferably closed to the atmosphere in order to prevent contact between the atmosphere and the heated oil in the tanks and also prevent air from being stirred into the oil during agitation thereof. Adsorbent earth or other bleaching agents may be introduced into the tanks through a hopper 32 for each tank. Thus, mixing with the bleaching agent and withdrawal of oil from one tank may take place simultaneously with introduction of oil into the other tank. Alternatively, mixing and introduction of oil may take place simultaneously in one tank while oil is being withdrawn from the other tank.

The oil can be withdrawn from the tanks 25 and 26 by means of a pump 33 driven by a motor 34. By opening the valve in the pipe 35 connected to the tank 25 and closing the valve in the pipe 36 connected to the pipe 26, oil is withdrawn from the tank 25; and conversely, closing the valve in the pipe 35 and opening the valve in the pipe 36 allows oil to be withdrawn from the tank 26. The agitator 29 in the tank from which the oil is being withdrawn is preferably maintained in motion during withdrawal so as to maintain the bleaching agent in substantially uniform admixture with the oil.

The mixture of oil and bleaching material is then delivered to a filter press 37 or a filter press 38. Two filter presses have been shown, in order to provide for filtration in one filter press while the other is being cleaned. As many filter presses as necessary to provide for continuous filtration of oil or a continuous filtration system may be employed. The filtered oil from either of the filter presses 37 or 38 is discharged therefrom through a pipe 39 into a container 40 which is preferably a closed tank provided with a vent 41. The filtered oil collected in the tank 40 is free of gummy materials and is of reduced color, but still contains free fatty acids. The filtered oil may be withdrawn from the tank 40 by a pump 42 and passed through a heat exchanger 43 to a mixer 44. A neutralizing agent is withdrawn from a source of supply shown as a tank 45 by a pump 46 and delivered to the mixer 44. The pumps 42 and 46 may be driven by a variable speed electric motor 47 with a variable speed device 48 positioned between the motor and the pump 42, although any other apparatus capable of delivering accurately proportioned streams to the mixer 44 may be employed. The mixer 44 is also preferably of the flow type in which a stream of the neutralizing reagent is injected at right angles into a flowing stream of the oil, but, as in the case of

mixer 13, may be any type of flow mixer such as a closed mechanical agitator. The neutralizing agent reacts with the free fatty acids of the oil to produce soap stock, and the mixture of oil and soap stock is preferably passed through another heat exchanger 49 and delivered into a vacuum chamber 50.

The vacuum chamber 50 is preferably provided with a heating jacket 51 through which any desired heating medium may be circulated and with a steam distributor 52 positioned in the lower portion of the tank to enable steam, preferably superheated, to be passed through a body of oil contained in the vacuum chamber 50. The vacuum chamber 50 is employed to remove vaporizable material, including at least a portion of the water in admixture therewith, and any gases such as air or carbon dioxide occluded in the soap stock particles. Vapors and gases are withdrawn from the vacuum chamber 50 through a pipe 53 and passed through an entrainment separator 54 to separate any liquid materials entrained with the gases and vapors. The entrainment separator may be of any known conventional type, and liquid materials separated from the gases or vapors are returned to the vacuum chamber through a pipe 55. Vapors and gases are then delivered to a condenser 56 in which vaporizable materials including water are condensed and delivered to a receiver 57. The condensed material may be withdrawn from the receiver 57, for example, by means of a pump (not shown) through a pipe 58. A vacuum pump 59 connected to the receiver 57 is provided for withdrawing uncondensed gases and maintaining a vacuum in the vacuum chamber 50. The mixture of oil and soap stock is preferably delivered into the vacuum chamber 50 through nozzles 60 positioned so as to direct the mixture against the heated walls of the vacuum chamber so that the mixture flows down the walls as a thin film. This provides for efficient separation of gases and vapors from the mixture, and further provides for unobstructed passage for the gases and vapors inwardly and upwardly through the vacuum chamber 50 to the pipe 53 so as to minimize entrainment in said gases and vapors.

The dehydrated mixture of oil and soap stock, which is substantially free of gases, is withdrawn from the vacuum chamber 50 by a pump 61 and delivered through a pipe 62, heat exchanger 63 and a pipe 64 to a continuous centrifugal separator 65. Water or other weighting liquid is withdrawn from a tank 66 by a pump 67 and preferably delivered through a pipe 68 into the pipe 64 so as to be admixed with the oil and soap stock therein. Alternatively, the weighting liquid may be delivered into the pipe 62 between the pump 61 and the heat exchanger 63 through a pipe 69 or centrifugal separator 65 may have provision for delivering the weighting liquid from the tank 66 directly into the centrifugal bowl. In any case, the separator 65 is preferably of the heated type disclosed in the patent above referred to, although any type of centrifugal separator capable of separating the soap stock from the oil may be employed. Soap stock, along with weighting liquid, is discharged as the heavy effluent through a spout 70 into a receiver 71, and refined oil is discharged as the light effluent through a spout 72 into a receiver 73.

Color adsorbents such as fuller's earth, activated clay, etc., are in most cases more effective when dry and as the degummed oil from the centrifugal separator 21 usually carries a small amount of water, it is many times advantageous to dry this oil before delivering it to the mixing tanks 25 or 26. This may be accomplished by delivering the oil to a dehydrating chamber 75 through a pipe 76 by closing the valve 77 in the pipe 24 and opening the valve 78 in the pipe 76. The chamber 75 may be provided with a heating coil 79 and a vacuum pump 81 connected to the chamber through a condenser 82 and a receiver 83 for removing moisture from the oil. The dried degummed oil may be continuously removed from the dehydrating chamber 75 by a pump 84 and returned to the pipe 24 for delivery to the mixing tanks 25 and 26.

In the preferred process carried out in the above described apparatus, effective degumming with most oils is produced by preheating the oil from the tank 10 in the heat exchanger 12 to a temperature between 110 and 160° F., prior to admixture with a degumming reagent. With other oils, it has been found most effective to mix at lower temperatures, for example, temperatures from 70 to 100° F., and then heat to a desired temperature of separation in the heat exchanger 20, in which case the heat exchanger 12 may be eliminated for the lower temperatures of mixing. As disclosed in the copending application of Benjamin H. Thurman, Serial No. 213,700, filed June 14, 1938, there is an optimum temperature and treating time between mixing and separation for each oil being degummed, such that no definite range of temperatures or treating times can be given for all oils contemplated by the present process. The temperature of separation and treatment and time of treatment will not only depend upon the particular oil being treated but also upon the type of degumming reagent employed. The degumming reagent may be water alone, aqueous solutions of neutral salts or weak acids or bases or dilute solutions of strong acids and bases. The degumming reagent also preferably includes a soluble alkali thiosulfate or thiocyanate, as disclosed in the copending application of Benjamin H. Thurman, Serial No. 248,355, filed December 29, 1938, as more liquid gums are thereby produced and less oil is entrained in the gums separated from the oil in the separator 21. The continuous degumming operation disclosed above is preferable, as a substantially complete separation of the gums from the oil is effected, and the entrainment of neutral oil in the gums is markedly reduced. However, it is possible to produce a degummed oil in which either the mixing or separation steps, or both, are batch operations. Thus, the oil and degumming reagent, such as water, may be admixed in a tank and the gums allowed to settle from the oil, or a continuous mixing step may be combined with a gravity settling step or a continuous centrifugal separation step combined with a batch mixing step. Such batch operations, however, tend to "set" the color in the oil and batch operation usually produces a less effectively degummed oil and greater losses due to entrainment of oil in the foots. The amount of degumming reagent will depend upon the process employed, the type of oil being treated, and the nature of the degumming reagent, and may range between wide limits, for example, from 1% to 50%.

The degumming agent may include a soluble bleaching agent such as the peroxides or hypochlorites above-mentioned, in which case it may be possible to eliminate a subsequent step of treating with a solid adsorbent or at least to decrease the amount of adsorbent employed. Also,

high temperature treatment in the presence of boric acid as the degumming agent has a marked effect in reducing color so as to reduce the amount of subsequently used color adsorbent or to make it possible to eliminate such a subsequent step. Ordinarily, any high temperature treatment of oils containing gums and coloring matter tends to "set" the color in the oil so as to render its subsequent removal more difficult. However, the reverse is true when employing a solution of boric acid as a degumming agent alone or in combination with other degumming agents. The high temperature referred to will usually range between 200 and 550° F., depending upon the amount of color it is necessary or desired to remove, and may be secured by preheating the oil in the heat exchanger 12 or heating the mixture in the heat exchanger 20. Separation may in some cases be performed at the high temperature, but the mixture may be cooled before separation, if desired.

The color adsorbent employed as a bleaching agent to bleach the substantially gum-free oils prior to alkali refining will also depend upon the nature of the oil being treated. For example, with highly colored cottonseed oil an extremely active bleaching agent, such as acid treated clay, may be required, while with oils containing less colors, such as corn oil, a less drastic bleaching agent such as fuller's earth or even activated carbon may be sufficient. Other examples of adsorbents which may be employed depending upon the nature and amount of color to be removed are aluminum oxide, aluminum silicates, diatomaceous earth, etc. The temperature of treatment of the oil with the solid bleaching agent will also vary with the oil being treated and the amount of color reduction necessary. Certain of the oxygen liberating bleaching agents may likewise be employed with the color adsorbents, if the color is difficult to remove. Thus, temperatures from substantially room temperature, i. e., 70° F. for light colored oils, up to as high as 200 to 400° F. for extremely dark colored oils may be required. This temperature may be adjusted by means of the heat exchange coils 31 located in the tanks 26, or, alternatively, a heat exchange device may be employed between the centrifugal separator 21 and the tanks 25 and 26. The oil may be alternately mixed with the bleaching agent in the tanks 25 and 26 and delivered to the filter presses 37 and 38 or a continuous mixing step may be employed. The filter presses may be of any conventional type capable of separating the bleaching agents along with adsorbed color from the oil. Also, it is possible to separate the bleaching agent from the oil by continuous filtering devices or by centrifugal separation, for example, continuous centrifugal separation with a flushing liquid for continuously washing the separated bleaching agent along with adsorbed color impurities from the centrifuge.

The heat exchanger 43 is employed to provide an optimum temperature of mixing between the neutralizing agent and the oil. This temperature will depend upon the oil being treated and the neutralizing agent. Preheating is desirable in some cases, in which case mixing may take place at temperatures between approximately 110 and 160° F., while in other cases mixing at relatively low temperatures, for example, between 70° and 100° F. produces best results. The heat exchanger 49 may be employed to add heat to the mixture, particularly if mixing is at low temperatures, so as to assist in vaporizing water and other vaporizable materials from the mixture of oil and soap stock and also to assist in driving off gases such as air occluded in the oil or carbon dioxide produced during neutralization. If preheating is employed, the heat exchanger 49 may be eliminated, and the mixer 44 positioned closely adjacent the vacuum chamber 50. By positioning the mixer 44 closely adjacent the vacuum chamber 50, the vacuum may extend into the mixer 44 such that mixing is under vacuum conditions. Alternatively, the oil and neutralizing agent may be delivered as separate streams directly into the vacuum chamber 50 so as to provide for mixing therein. The heating jacket 51 for the vacuum chamber 50 may be employed to maintain a desired treating temperature in the vacuum chamber 50, and also superheated steam may be passed through a body of oil and soap stock in the chamber 50 to assist in carrying off the gases and vaporizing materials and supply additional heat to the mixture.

It is difficult to separate soap stock produced by neutralizing degummed oil from the oil without leaving a large amount of soap stock in the oil or a large amount of oil entrained in the soap stock. By dehydrating the mixture of oil and soap stock in accordance with the preferred process and then introducing a weighting liquid into the mixture shortly before it is delivered to the separating zone of the continuous centrifugal separator, an effective separation of the oil and soap stock can be obtained to produce a clean oil and a soap stock containing very little entrained oil. In this process, the heat exchanger 63 may be employed to adjust the temperature of the oil-soap stock mixture to that found most effective for separation of the oil being treated. This temperature will ordinarily vary from 110° to 160° F. If the oil withdrawn from the vacuum chamber 50 is at the most effective temperature for separation for the particular oil being treated, the heat exchanger 63 may be eliminated, although with certain oils it has been found more effective to introduce the water into the oil-soap stock mixture through the pipe 69 so that the mixture of oil-soap stock with the weighting liquid is passed through the heat exchanger 63, irrespective of whether this heat exchanger is employed to produce a change in temperature of the mixture. Although the vacuum treatment followed by continuous centrifugal separation in the presence of a weighting liquid is preferred, it is possible to settle the soap stock from the oil. This settling step may be combined with continuous mixing, as above described, or both the mixing and settling steps may be carried on as batch operations. Since non-saponifying neutralizing reagents or no substantial excess of saponifying neutralizing reagents are employed, no substantial attack on the neutral oil is produced, even in batch alkali refining operations. If sodium carbonate is employed as the neutralizing reagent in a batch operation, it is preferred to mix under vacuum conditions, or at least subject the resulting mixture of oil and soap stock to vacuum conditions prior to settling, in order to eliminate carbon dioxide. The presence of a weighting liquid is also desirable in batch settling steps, in which case the weighting liquid is usually a relatively concentrated aqueous solution of sodium chloride or other alkali metal salt. The soap stock separated by a settling operation usually contains a large amount of entrained neutral oil,

but because of the absence of substantial amounts of gums or coloring material in the soap stock, this oil may be recovered as high quality oil from the soap stock by diluting the same with water and again settling or centrifugally separating or by solvent extraction with an oil solvent.

It is also possible to employ with advantage vaporizable neutralizing reagents which do not attack neutral oil, for example, ammonia or amines such as referred to above. With such neutralizing agents, the soap stock produced is ordinarily flowable and no weighting liquid is usually necessary. Also, vacuum treatment of the mixture is omitted, as such treatment would remove the neutralizing reagent to again leave free fatty acids in the oil. The soap stock produced by ammonia, amines or other vaporizable neutralizing reagents is preferably continuously centrifugally separated from the oil, but may also be settled therefrom. When employing such vaporizable neutralizing reagents in the process, the mixing and separating is preferably carried on in a closed system under pressure to prevent loss of neutralizing agent. One advantage of such neutralizing agents is that the soap stock produced may be subjected to vacuum treatment to remove the neutralizing agent for reuse in the process and also to produce fatty acids.

It will be seen that I have provided a process wherein the oil is neutralized under conditions in which there is no substantial attack on the neutral oil so as to reduce refining losses due to saponification of neutral oil. Thus refining reagents which will not attack neutral oil can be employed, and also caustic alkalies can be employed in amounts substantially chemically equivalent to the free fatty acids contained in the oils. The neutralizing without substantial attack on the neutral oil is made possible by removing color impurities from the oil prior to neutralization. Thus, it is unnecessary to employ caustic alkalies in excess to reduce color. The removal of color impurities prior to neutralization by treatment with color adsorbents such as bleaching earths is made possible by carrying on such bleaching operations with an oil which is substantially free of gums. The color reduction is much more effective in the absence of such gums, and the amount of oil entrained in the non-recoverable form in the bleaching agent is reduced. The invention, therefore, contemplates treating oils containing gums by a degumming step in order to provide oils free from gums for the subsequent steps of color reduction and neutralizing.

This application is a continuation-in-part of my co-pending application, Serial No. 248,330, filed December 29, 1938.

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

I claim:

1. A process of refining glyceride oils and fats containing gums, color impurities and free fatty acids, which comprises, admixing a stream of an aqueous degumming reagent with a stream of said glyceride to precipitate gums therein, delivering the resulting stream to a centrifugal separator and continuously centrifugally separating the precipitated gums from said glyceride, treating said glyceride with an adsorbent material for color impurities and removing said adsorbent along with said color impurities from said glyceride, thereafter neutralizing the free fatty acids of said glyceride under conditions preventing substantial saponification of neutral glyceride, adding a solution of an alkali metal salt to the resulting mixture of oil and soap stock, and thereafter separating the soap stock from said glyceride by difference in specific gravity, in the presence of said added solution.

2. A process of refining glyceride oils and fats containing gums, color impurities and free fatty acids, which comprises, admixing a stream of an aqueous degumming reagent with a stream of said glyceride to precipitate gums therein, continuously centrifugally separating the precipitated gums from said glyceride, treating said glyceride with an adsorbent material for color impurities and filtering said adsorbent along with said color impurities from said glyceride, thereafter neutralizing the free fatty acids of said glyceride under conditions preventing substantial saponification of neutral glyceride, adding a solution of an alkali metal salt to the resulting mixture of oil and soap stock, and thereafter continuously centrifugally separating the soap stock from said glyceride in the presence of said added solution.

3. The process of refining glyceride oils and fats containing gums, color impurities and free fatty acids, which comprises, removing said gums from said glyceride, thereafter treating said glyceride with an adsorbent material for color impurities and removing said adsorbent along with said color impurities from said glyceride, thereafter neutralizing the free fatty acids of said glyceride with a non-saponifying alkali, adding a solution of an alkali metal salt to the resulting mixture of oil and soap stock, and thereafter separating the soap stock from said glyceride by difference in specific gravity in the presence of said added solution.

4. The process of refining glyceride oils and fats containing gums, color impurities and free fatty acids, which comprises, removing said gums from said glyceride, thereafter treating said glyceride with an adsorbent material for color impurities and removing said adsorbent along with said color impurities from said glyceride, thereafter neutralizing the free fatty acids of said glyceride with an aqueous solution of sodium carbonate to prevent substantial saponification of neutral glyceride, adding a solution of an alkali metal salt to the resulting mixture of oil and soap stock, and thereafter separating the soap stock from said glycerides by difference in specific gravity in the presence of said added solution.

5. The process of refining glyceride oils and fats containing gums, color impurities and free fatty acids, which comprises, removing said gums from said glyceride, thereafter treating said glyceride with an adsorbent material for color impurities and removing said adsorbent along with said color impurities from said glyceride, thereafter neutralizing the free fatty acids of said glyceride with a non-saponifying alkali, adding a solution of an alkali metal salt to the resulting mixture of soap stock, and thereafter separating the soap stock from said glyceride by difference in specific gravity in the presence of said added solution.

6. The process of refining glyceride oils and fats containing gums, color impurities and free fatty acids, which comprises, removing said gums from said glyceride, thereafter treating said glyceride with an adsorbent material for color

impurities and removing said adsorbent along with said color impurities from said glyceride, thereafter neutralizing the free fatty acids of said glyceride with sodium carbonate and subjecting the resulting mixture to vacuum treatment to produce a substantially completely neutralized glyceride admixed with dehydrated soap stock while preventing substantial saponification of neutral glyceride, rehydrating said mixture of glyceride and soap stock and separating said soap stock from said glyceride by difference in specific gravity.

7. The process of refining glyceride oils and fats containing gums, color impurities, and free fatty acids, which comprises, removing said gums from said glyceride, thereafter treating said glyceride with an adsorbent material for color impurities and removing said adsorbent along with said color impurities from said glyceride, thereafter neutralizing the free fatty acids of said glyceride with sodium carbonate, adding a solution of an alkali metal salt to the resulting mixture of oil and soap stock, and thereafter continuously centrifugally separating said soap stock from said glyceride in the presence of said added solution for causing said soap stock to separate from said glyceride and flow continuously from the centrifugal separator employed.

8. The process of refining glyceride oils and fats containing free fatty acids and color impurities, which comprises, treating a glyceride substantially free of gummy materials with a color adsorbing material, separating said adsorbing material from said glyceride along with color impurities, thereafter neutralizing the free fatty acids of said glyceride with a non-saponifying neutralizing agent, subjecting the resulting mixture of glyceride and soap stock to vacuum treatment sufficient to remove water and other volatile materials from said mixture, and continuously centrifugally separating said soap stock from said glyceride in the presence of a rehydrating medium for said soap stock.

9. The process of refining glyceride oils and fats containing free fatty acids and color impurities, which comprises, treating a glyceride substantially free of gummy materials with a color adsorbing material, separating said adsorbing material from said glyceride along with color impurities, thereafter neutralizing the free fatty acids in said glyceride with sodium carbonate, subjecting the resulting mixture of glyceride and soap stock to vacuum treatment sufficient to remove water and other volatile materials from said mixture, and continuously centrifugally separating said soap stock from said glyceride in the presence of a rehydrating medium for said soap stock.

10. The process of refining glyceride oils and fats containing free fatty acids and color impurities, which comprises, treating a glyceride substantially free of gummy materials with a color adsorbing material, separating said adsorbing material from said glyceride along with color impurities, thereafter mixing an aqueous solution of sodium carbonate with said glyceride under sufficient vacuum to cause water, carbon dioxide and other vaporizable and gaseous materials to be separated from the resulting mixture to produce a substantially dehydrated mixture of glyceride and soap stock, thereafter mixing a stream of said mixture with a stream of rehydrating liquid for said soap stock and continuously centrifugally separating said soap stock from said glyceride in the presence of said rehydrating liquid.

11. The process of refining glyceride oils and fats containing free fatty acids and color impurities, which comprises, treating a glyceride substantially free of gummy materials with a color adsorbing material, separating said adsorbing material from said glyceride along with color impurities, thereafter neutralizing the free fatty acids of said glyceride under conditions preventing substantial saponification of neutral glyceride, adding a solution of an alkali metal salt to the resulting mixture of oil and soap stock, and thereafter separating the soap stock from said glyceride by difference in specific gravity, in the presence of said added solution.

12. The process of refining glyceride oils and fats containing gums, color impurities and free fatty acids, which comprises, removing said gums from said glyceride, thereafter treating said glyceride with an adsorbent material for color impurities and removing said adsorbent along with said color impurities from said glyceride, thereafter neutralizing the free fatty acids of said glyceride under conditions preventing substantial saponification of netural glyceride, adding a solution of an alkali metal salt to the resulting mixture of oil and soap stock, and thereafter separating the soap stock from said glyceride by difference in specific gravity, in the presence of said added solution.

13. The process of refining glyceride oils and fats containing gums, color impurities and free fatty acids, which comprises, removing said gums and substantially all of said coloring matter from said glyceride oil, thereafter neutralizing the free fatty acids of said glyceride under conditions preventing substantial saponification of neutral glyceride, adding a solution of an alkali metal salt to the resulting mixture of oil and soap stock, and thereafter separating the soap stock from said glyceride by difference in specific gravity, in the presence of said added solution.

14. The process of refining glyceride oils and fats containing gums, color impurities and free fatty acids, which comprises, admixing a degumming agent containing a color reducing agent with said oil, separating the precipitated gums and coloring matter from said oil, thereafter neutralizing the free fatty acids of said glyceride under conditions preventing substantial saponification of neutral glyceride, adding a solution of an alkali metal salt to the resulting mixture of oil and soap stock, and thereafter separating the soap stock from said glyceride by difference in specific gravity, in the presence of said added solution.

BENJAMIN CLAYTON.