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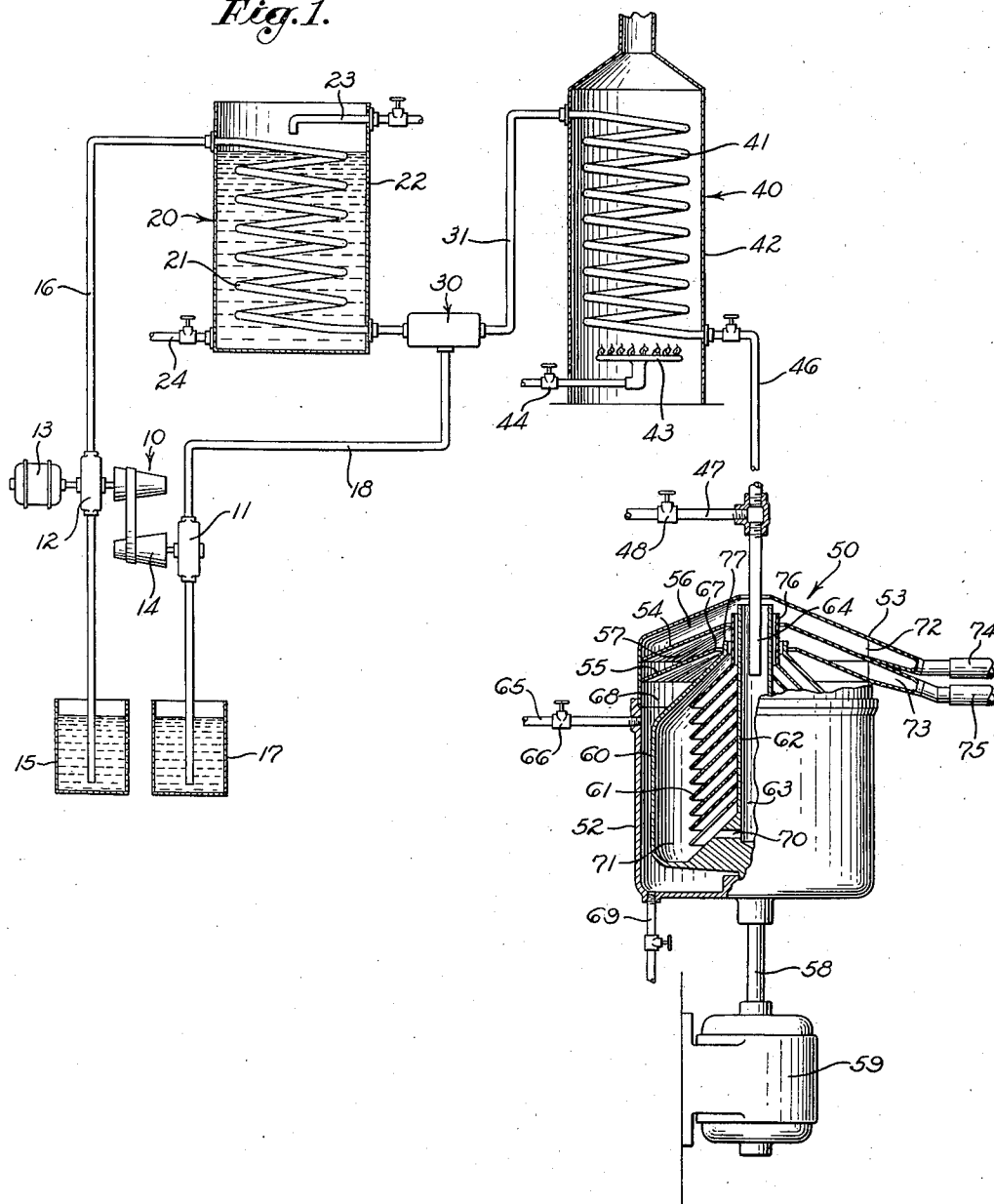
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METHOD FOR REFINING FATTY OILS

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Fig. 1.



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METHOD FOR REFINING FATTY OILS

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My invention relates to a process and apparatus for removing impurities from fats, oils, and greases. The term "fatty oils" is herein used with reference to such materials of which the vegetable, fish, animal, and nut oils are typical. The impurities to be removed often comprise fatty acids but the process is well adapted to the removal of various other impurities by use of appropriate reagents.

In general, the present invention involves the use of a refining agent selected with reference to the impurities to be removed. The refining agent should be such as to react with, or combine with, the impurities to be removed to form foots, and the process includes as one step the separation of these foots from the refined oil. Such refining agents are well known in the art. For example, in refining oils containing fatty acids, it is customary to use an aqueous alkaline solution which will react with the fatty acids to form foots, the quantity and composition of such agent being related to the fatty acid content of the fatty oil and usually being used in excess of that amount theoretically required, as is well known in the art. Similarly, some oils can be refined or treated advantageously by use of acid reagents which will react with impurities present to form foots. Here again, the types, concentrations, and total amounts of such acid reagents are known in the art. The present invention is well adapted to the use of known refining agents in known quantities, and its novelty is based dominantly in a novel sequence and arrangement of steps and in the novelty of the steps themselves, and in the apparatus, rather than in the refining agents used.

Removal of such impurities as mentioned hereinbefore is commonly referred to as refining. In commercial batch-refining, the fatty oil is mixed with a refining agent while at substantially room or storage temperatures, usually between 65° F. and about 75° F. This mixing takes place in a large kettle and heat is applied to the mixture until the "break" occurs, after which the mass is permitted to settle into layers of refined oil and foots. One desideratum of a process for alkali refining vegetable oils is the removal of coloring material from the oil, and an excess of the refining agent is used in this connection. Commonly employed excesses can be used with the present process, though one attribute of the present invention is its ability to reduce colors of the refined oil, measured after separation from the foots or after conventional bleaching, more than is possible with various other processes.

The invention is applicable particularly to those

fatty oils which can be refrigerated below room temperature or conventional storage temperatures and, preferably, to a temperature materially below 60° F., without solidifying to such an extent as to be incapable of being mixed with the refining agent. In this connection, many fatty oils can be cooled to a temperature below that ordinarily recognized as a solidifying or freezing temperature without either freezing the fatty oil or so changing its physical state that mixing with a refining agent is impractical. This is especially true if the fatty oil is cooled or chilled rather suddenly, and particularly so if the oil is cooled while flowing as a stream in an elongated passage. If desired, treatment of the fatty oil, before the refining contemplated in the present invention, can be resorted to to insure a mixable condition when refrigerated in accordance with the following teachings.

The present invention uses refrigeration in the refining process in such manner that the resulting mixture of fatty oil and refining agent will be at a temperature lower than heretofore contemplated. Usually, the temperature of this mixture will desirably be materially below 60° F. by use of refrigeration suitably applied, usually to one or both of the incoming materials. The preferred mode of operation is to refrigerate a stream of the fatty oil to a temperature materially below 60° F. before mixing the refining agent therewith. In some instances, it is possible also to refrigerate the refining agent as well as the fatty oil, though this is not usually essential. In many instances, I have found excellent results to accrue from a refrigeration of the fatty oil to a temperature between 30° F. and 50° F. For example, cottonseed oil has been found to give excellent results in the neighborhood of 35° F., with materially decreased colors of the resulting refined oil, good separation, and very low refining loss. In some instances, I have used temperatures as low as 0° F. with highly beneficial results.

I have found that lower mixture temperatures decrease, and often eliminate, emulsion difficulties and decrease the length of time required to produce a desired bleach of the oil. The reaction or combination of the impurities and the refining agent forms foots, but these are readily separable from the refined oil by various expedients. I prefer to use centrifugal separation in this regard and find best results to accrue from a relatively quick heating of the oil-foots mixture just prior to, or during, centrifugal separation. The presence of refrigeration-produced temperatures prior to this heating decreases the tendency for the

refining agent to attack the oil itself, thus decreasing that portion of the refining loss known to accrue from this phenomena in conventional refining processes. In addition, the application of heat, being usually of very short duration, gives little opportunity for reaction with the oil. The application of heat is beneficial in facilitating centrifugal or other separation and only sufficient heat need be used to accomplish this end. Heat appears to put the mixture of oil and foots in excellent condition for continuous separation. In some instances, I prefer to apply heat to the zone of centrifugal separation, as by heating the exterior of the rotating centrifugal bowl, with attendant advantages that the soapstock is made more fluid, sticking thereof to the bowl is prevented, and cleanly separated, uniformly-flowing effluents are obtained.

It is an object of the present invention to use refrigeration in the refining of fatty oils to remove impurities therefrom, and to produce a mixture of fatty oil and refining agent which is at a temperature below room or storage temperatures.

Another object of the invention is to refrigerate the fatty oil, preferably during stream flow thereof, before mixing the refining agent therewith.

Another object of the invention is to mix the refining agent with an oil which is at a temperature materially below 60° F. while maintaining the oil in such condition that mixing of the refining agent can be accomplished.

A further object of the invention is to provide a novel process and apparatus for refining fatty oils by a continuous process involving refrigeration, and in which the refining operation can be carried out in a space from which air can be excluded. In this connection, the preferred embodiment permits refrigeration, mixing and heating in the same elongated passage, if desired.

Another object of the invention is to heat the refrigerated mixture to facilitate separation of the foots. Heat is applied to the mixture either before or during separation and, in many instances, application of heat at both points will be found beneficial.

Still a further object of the invention is to provide a quick process for refining fatty oils in which the reduction in color is improved, emulsion difficulties are reduced, and the refining losses are minimized. In this connection, the period of application of heat is maintained short to reduce any tendency for the refining agent to act upon the oil itself.

Further objects and advantages of the invention will be made evident hereinafter.

The drawing shows one system by which the process can well be performed, though it will be understood that the refrigeration step and the subsequent steps can be performed in different manners without departing from the spirit of the invention. This drawing is diagrammatic and illustrates a general assembly view of this embodiment of the apparatus.

Referring to the drawing, the general elements include a pumping or proportioning means 10, a refrigerating means 20, a mixing means 30, a heating means 40, and a separating means 50.

The pumping means 10 is shown as including proportioning pumps 11 and 12 driven by a suitable motor 13. Suitable means is provided for varying the relative amounts of the liquids pumped by these pumps, this means being diagrammatically shown as a variable-speed transmission 14, which may be made in the form of a speed-changing gear.

The pump 12 draws the fatty oil from a tank 15 and discharges a stream thereof continuously to the refrigerating means 20 through pipe 16. The pump 11 continuously withdraws the refining agent from a tank 17, discharging a stream thereof through a pipe 18 into the mixing means 30 which will be more fully described hereinafter.

While various refrigerating means may be utilized, the preferred embodiment refrigerates during stream flow. As shown, this refrigerating means includes a coil 21 positioned in a shell 22, there being a valved inlet pipe 23 which may be used to introduce a suitable refrigerant, such as brine, into the shell from a source of supply not shown. A valved outlet pipe 24 removes the refrigerant from the shell 22. The coil 21 is connected at one end to the pipe 16 and at the other end to the mixing means 30, the shell 22 preferably being maintained full of refrigerant so as to cool the coil 21 and the material flowing therein. Although I have shown a preferred type of refrigerating means, it is to be understood that I do not intend to be limited thereto and that any suitable refrigerating means may be used in conjunction with a mixing means to produce the refrigerated mixture herein-contemplated.

If desired, the refining agent may also be refrigerated by similar means, though this is not usually necessary.

The function of the mixing means 30 in the embodiment shown is to intimately mix the refrigerated fatty oil with the refining agent, the mixture passing through the pipe 31 to the heating means 40. The mixing means 30 may be of any type appropriate for performing this intimate mixing function. In a continuous refining system, it is sufficient to bring the flowing streams of fatty oil and refining agent into contact in a chamber formed by the mixer 30 under such conditions that an intimate mixture is formed so that the refining agent will immediately combine with the impurities of the fatty oil to form foots. Various auxiliary mixing expedients can be utilized, using mechanical agitation or other mixing expedients, if desired, so long as a refrigerated mixture of uniform character is discharged into the pipe 31.

The heating means 40 is shown as one expedient for increasing the temperature of the refrigerated mixture to such a degree as to facilitate the centrifugal separation contemplated in this embodiment of the invention. As shown, this heating means consists of a coil 41 positioned in an outer shell 42 and externally heated by any suitable means, such as a burner 43, supplied with fuel through a pipe having a valve 44. Gas, oil, or any other suitable combustible material may be used as fuel, the hot products of combustion passing upward inside the shell 42 and supplying heat to the coil 41 and the oil-foots mixture flowing therein. However, other methods of heating the coil 41 may be utilized, for example by immersing the coil in a heated fluid. The coil 41 is preferably of such size that stream flow of the mixture therethrough will maintain the foots uniformly dispersed in the oil so that a mixture of uniform character is delivered through a pipe 46 to the separating means 50.

Another expedient which can be used alternatively or in conjunction with heat applied to the coil 41 is to introduce steam or other heating medium into the mixture. For example, such a heating medium may be introduced into the pipe 46 through a pipe 47 having a valve 48

therein, the heating medium mixing with the reaction products flowing in the pipe 46 and raising the temperature thereof. Either this expedient or the application of heat during flow through the coil 41 may be used to elevate the temperature of the mixture abruptly.

Various expedients can be used for separating the resulting oil-foots mixture, but I prefer to continuously separate the foots from the oil and to use a centrifuge in this regard. The separating means 50 is shown as such a centrifuge which may be of conventional design or which may be of the heated bowl type described in the patent to Benjamin Clayton, No. 2,100,277. As shown, the centrifuge has a stationary outer casing 52 provided with a cover 53. Inside the cover are downward sloping cones 54 and 55 which, in conjunction with the cover, form an oil space 56 and a foots space 57. Rotatable inside the casing 52 on a shaft 58 projecting thereinto and driven by a motor 59 is a bowl 60 which carries cones 61. These cones are positioned on a hollow column 62 having a longitudinal passage 63 therethrough which receives the incoming mixture or reaction products from a pipe 64 connected to the pipe 46 and projecting into the passage 63. If it is desired to heat externally the bowl 60, steam or other heating medium may be introduced through a pipe 65, provided with a valve 66, directly into a space 68 between the casing 52 and the bowl 60. The sloping cone 55 has a central opening 67 therein around the column 62 through which steam may flow upwardly into the foots space 57. Any steam condensing in the space 68 may be withdrawn from the centrifuge through a valved drain pipe 69.

Radial openings 70 are provided through the column 62 connecting the passage 63 with a space 71 inside the bowl 60. An oil spout 72 is provided for removing oil from the oil space 56, and a foots spout 73 removes the foots from the foots space 57. The oil and foots may be delivered through pipes 74 and 75, respectively, to appropriate storage. The uppermost cone 61 is provided with a vertical cylindrical wall 76 to carry the separated oil upward inside the oil space 56. The upper portion of the bowl 60 provides a vertical lip 77 which carries the foots into the foots space 57.

By way of example, the apparatus will be described with reference to the refining of cottonseed oil, using one of the known refining agents well suited to the refining of this particular oil in conventional concentration and amount. An aqueous alkaline solution will be described in this connection, containing, for example, caustic soda in conventional excess over and above the amount theoretically required to react with the fatty acids.

In this example, the tank 15 contains the cottonseed oil and the tank 17 an aqueous alkaline solution. The proportioning pumps 11 and 12 are so adjusted as to deliver the desired proportions of these materials to the mixing means 30, and these pumps should be capable of forcing these materials and the resulting reaction products through the apparatus. Piston pumps are usually used in this capacity.

The cottonseed oil passing through the coil 21 is cooled by the brine or the cooling medium positioned in or circulating through the shell 22. Beneficial results arise from the present invention if the cottonseed oil is refrigerated to a temperature substantially below 60° F. and usually, though not invariably, below 50° F. In many instances, I prefer to reduce the temperature to a

very low value and have obtained excellent results at a temperature in the neighborhood of 35° F. I have also found it possible, with distinctly beneficial results, to refrigerate the cottonseed oil to a temperature as low as 0° F. The controlling lower limit is that temperature at which the solidification of the oil becomes such as to make intimate mixing of the refining agent impractical.

When the alkaline solution is mixed with the refrigerated cottonseed oil in the mixing means 30, a reaction takes place between the fatty acids and the alkaline solution to form foots. Reactions also begin to take place between the alkaline solution and the color impurities of the cottonseed oil. The reaction products moving through the coil 41 include, predominantly, refined oil and foots suspended therein.

While the action between the fatty acids and the alkaline solution is usually complete before the mixture enters the heating means 40, this heating means may serve to perform various functions advantageous to the refining process. For example, heat applied at this point may loosen or break any emulsion which was formed and may be used to agglomerate the foots during flow through the elongated passage defined by the coil 41 to facilitate subsequent separation. Some further reaction may take place in this elongated passage, particularly color-removing or bleaching reactions involving such reaction or combination of color impurities in the oil as will cause these color bodies to become associated with the foots so as to be removed therewith.

By use of the heating means 40, or injection of a heating medium into the reaction products, I prefer to raise the temperature thereof abruptly to a degree facilitating centrifugal separation. Some beneficial action on cottonseed oil can be obtained by raising the temperature to approximately 70° F., though better results are obtained at higher temperatures, for example, temperatures above 100° F. and, preferably, from 130° F. to 140° F. Even higher temperatures can be used if the period of application of heat is sufficiently short.

The heated mixture discharges continuously into the centrifuge with the foots uniformly dispersed in the refined oil. This mixture passes outward through the openings 70 into the bowl 60. The water and foots, being heavier than the oil, are thrown to the periphery of the bowl 60 from whence they discharge upward over the lip 77 and into the foots space 57. Steam or other heating medium introduced into the centrifuge through the pipe 65 will be found desirable in facilitating uniform discharge of the foots and preventing sticking thereof. By applying heat externally of the rotating bowl, the layer of foots is selectively heated to counteract any tendency thereof to cool. If desired, the temperature of the foots may be raised several degrees above the temperature of the outflowing refined oil. This expedient of adding heat to the foots is very desirable in preventing sticking of certain constituents to the bowl and building up a layer of foots which might then discharge into the foots space at intervals, setting up a consequent oscillation and a shifting of the neutral zone in the centrifuge to prevent the desired clean separation of oil and foots.

The separated oil moves upward in the center of the bowl 60 and is thrown outward over the cylindrical wall 76 to the oil space 56 from which it is continuously removed.

As a specific example, the process has been used to refine crude cottonseed oil containing

1.80% free fatty acids, using as a refining agent an aqueous solution of sodium hydroxide, 14° Bé., with an excess of 0.28. The temperature of the incoming crude was 75° F. The comparative results between refining this oil without refrigeration and refrigerating the crude oil before introducing the refining agent to a temperature of about 40° F. showed considerable improvement in the color of the refined oil, with no increase in refining loss and with good separation of the oil and foots. By use of refrigeration, it was found possible to decrease materially the length of the coil 41, thus decreasing the total time of contact before separation. It was also found possible to use somewhat lower temperatures ahead of the centrifuge than were desirable on the same oil when the refrigerating step was eliminated.

In general, it will be found that my process works best if the following conditions are adhered to:

As to the fatty oil to be refined, this oil can be any fatty oil which will not assume a state precluding intimate mixture with the refining agent when refrigerated to a temperature materially below room temperature or conventional storage temperature. I prefer to refrigerate in such manner that the resulting mixture will be at a temperature substantially lower than has been used in previous practice. In this connection, the temperature of the mixture is preferably substantially below room or storage temperatures. I prefer to obtain this refrigeration by cooling one or both of the materials which are to be mixed, preferably to a temperature materially below 60° F., while avoiding such temperatures as would make uneconomical or impossible the mixing of the refining agent with the oil.

The temperature to which such a fatty oil can be refrigerated without precluding the possibility of satisfactory mixing with the refining agent will vary with different oils. However, in general, I have found that refrigeration can be carried to a point substantially below the usually recorded freezing or solidification temperatures if the cooling is relatively rapid, and particularly if a stream of the fatty oil is cooled during flow through an elongated passage. As examples of the more common fatty oils which can be refrigerated, if desired, to temperatures as low as 35° F. or lower in the present process, there may be cited cottonseed oil, castor oil, corn oil, sesame oil, soya bean oil, linseed oil, olive oil, etc. However, various other oils can be refined by my process, some at a temperature as low as 0° F. and others at a temperature somewhat closer to 60° F. but still materially lower than this value. Temperatures from 30° F. to 50° F. are very satisfactory.

The impurities to be removed and which are contained in such fatty oils may be fatty acids, color bodies, or other impurities. The refining agent is such that it will react or combine with such impurities to form foots. Most commonly, this refining agent is alkaline, particularly if fatty acids are to be removed, though neutral or acid refining agents can sometimes be used to advantage. It is not necessary to depart from present refining practice insofar as the amount of the refining agent or the character thereof is concerned, and those skilled in the art can readily determine the amount of impurities in the fatty oil removed, the amount and type of refining agent preferable, and the excess, if any, which would conventionally be employed.

The type of mixing action utilized is not critical and any mixing expedient can be used which will form an intimate mixture between the fatty oil and the refining agent. This mixture is preferably formed out of contact with the atmosphere, and reaction products are preferably kept from contact with air at least until they enter the centrifuge.

The subsequent heating of the oil-foots mixture can be used to perform the functions previously described. It is desirable to limit the degree of heating to a minimum, particularly in those processes in which the refining agent may react with the oil itself. The temperature applied need be only sufficient to facilitate subsequent separation of the foots from the oil. In accordance with my process, it is desirable to use low temperatures produced by refrigeration during the time that the major reactions with the impurities are taking place, and then to increase the temperature of the resulting products during or prior to separation, minimizing the length of time that heat is applied.

In some instances, increase in temperature to between 70° F. and 80° F. will be found to give beneficial results. In other instances, somewhat higher temperatures applied for a limited time are desirable. Using a centrifugal process, temperatures above 100° F. are preferred and best results are often obtained if the temperature is increased to between 120° F. and 150° F. The apparatus shown in the drawing and operating on vegetable oils will give excellent results if the mixture is introduced into the centrifuge at a temperature of 130° F. to 140° F.

Such temperatures can be applied in the coil 41. In other instances, the heating therein may be supplemented by, or superseded by, the injection of a heating medium through the pipe 47. Introduction of a heating medium at this point may serve not only to heat the mixture but may also be used to add water or other material to the mixture which will tend to separate with the foots and increase the ease and efficiency of separation. By way of example, injection of steam through the pipe 47 will not only quickly heat the mixture but will also form a condensate which will be separated with the foots in the centrifuge.

Application of heat to the centrifuge itself is a valuable expedient, as mentioned above. Heat applied at this point may supplement or supersede any previous heating, and will facilitate uniform discharge of the effluents and give a cleaner separation. If steam is introduced into the space around the rotating bowl, it will usually be found that the temperature of the foots, when discharged from the centrifuge, will be several degrees higher than that of the refined oil effluent.

It will be understood, however, that the invention is not necessarily limited to centrifugal separation as other separating expedients can be used. It will also be clear that, if the foots formed in the refining operation are lighter than the oil, the zones in which the foots and oil are withdrawn from the centrifuge will be reversed. It will be further understood that the employment of a heated centrifuge is not essential to the operativeness of the process, though advantageous in practically all instances.

I believe it to be novel to refrigerate and apply heat at successive points in an elongated passage used in a refining system, irrespective of the degree of refrigeration or subsequent heating, particularly when a portion of this passage forms a

mixing zone in which a refining agent is introduced and mixed with the oil. Likewise, I believe it to be new to refrigerate a fatty oil to a temperature substantially below 60° F., subsequently mix in the refining agent, and separate under a somewhat elevated temperature designed to facilitate this separation. In general, I believe it to be new to apply refrigeration in the refining of fatty oils to make possible the refining of these oils at low temperatures and to obtain a process in which refining losses are kept extremely low and in which superior products are obtained.

Various changes and modifications can be made without departing from the spirit of the invention as defined in the appended claims.

This application is a continuation of my application Serial No. 23,872, entitled "Refining process using pre-refrigeration," filed May 28, 1935.

I claim as my invention:

1. A process of removing impurities from a fatty oil, comprising a first material, which fatty oil is of a character to remain in a mixable state when refrigerated to a temperature materially below 60° F., the refining reagent comprising a second material and being capable of combining with said impurities to form flocs, which process includes the steps of: continuously producing a mixture containing proportioned quantities of said first and second materials and which is at a temperature materially below 60° F. by bringing together and mixing proportioned amounts of said materials and by refrigerating at least one of said materials; quickly heating said mixture to a temperature facilitating separation; and continuously separating the resulting product into refined oil and flocs.

2. A process of removing impurities from fatty oils, which can be refrigerated to a temperature materially below room temperature without solidifying to such an extent that a refining agent cannot be mixed therewith, which refining agent is capable of combining with said impurities to form flocs, which process includes the steps of: flowing said fatty oil as a stream into and along a passage of small cross-sectional area in which is interposed a mixing zone; introducing into the mixing zone and mixing with a fatty oil therein a stream of said refining agent to form a mixture of oil and flocs which continues its flow along said passage; refrigerating a portion of said passage to chill the stream flowing therein; applying heat to a subsequent portion of said passage in a zone where the stream therein contains oil and flocs, thereby heating this stream to a temperature facilitating separation of the oil-flocs mixture; and separating the refined oil from the flocs.

3. A process of removing impurities from fatty oils which can be refrigerated to a temperature materially below 60° F. without solidifying to such an extent that a refining agent cannot be intimately mixed therewith, which refining agent is capable of combining with said impurities to form flocs, which process includes the steps of: refrigerating said fatty oil to a temperature materially below 60° F. while maintaining said fatty oil sufficiently non-solidified that said refining agent can be mixed therewith; mixing said refining agent and the refrigerated fatty oil; and separating the oil from the flocs resulting from the combination of said refining agent and said impurities.

4. A process of removing impurities from fatty oils which can be refrigerated to a temperature materially below 60° F. without solidifying to such an extent that a refining agent cannot be in-

timately mixed therewith, which refining agent is capable of combining with said impurities to form flocs, which process includes the steps of: refrigerating said fatty oil to a temperature materially below 60° F. while maintaining said fatty oil sufficiently non-solidified that said refining agent can be mixed therewith; mixing said refining agent and the refrigerated fatty oil; moving the resulting mixture containing oil and flocs as a stream through an elongated passage while maintaining the stream in sufficient movement to prevent separation of the flocs and maintain these flocs uniformly dispersed in the oil; applying heat to said stream to increase the temperature thereof to a value facilitating separation; and separating the flocs from the oil.

5. A process of removing impurities from fatty oils which can be refrigerated to a temperature materially below 60° F. without solidifying to such an extent that a refining agent cannot be intimately mixed therewith, which refining agent is capable of combining with said impurities to form flocs, which process includes the steps of: refrigerating said fatty oil to a temperature materially below 60° F. while maintaining said fatty oil sufficiently non-solidified that said refining agent can be mixed therewith; mixing said refining agent and the refrigerated fatty oil; moving the resulting mixture of oil and flocs to a zone of centrifugal separation; and separating the flocs from the oil in said zone while applying heat thereto adjacent the zone of centrifugal separation in sufficient amount to facilitate centrifugal separation of the flocs from the oil.

6. A process of removing impurities from fatty oils which can be refrigerated to a temperature materially below 60° F. without solidifying to such an extent that a refining agent cannot be intimately mixed therewith, which refining agent is capable of combining with said impurities to form flocs, which process includes the steps of: refrigerating said fatty oil to a temperature materially below 60° F. while maintaining said fatty oil sufficiently non-solidified that said refining agent can be mixed therewith; mixing said refining agent and the refrigerated fatty oil; abruptly heating the resulting mixture of oil and flocs to a temperature facilitating centrifugal separation; and subjecting said mixture to centrifugal force to separate said flocs from said oil.

7. A process of removing impurities from fatty oils which can be refrigerated to a temperature materially below 60° F. without solidifying to such an extent that a refining agent cannot be intimately mixed therewith, which refining agent is capable of combining with said impurities to form flocs, which process includes the steps of: refrigerating a stream of said fatty oil while flowing through an elongated passage as a stream of restricted cross-sectional area while maintaining said fatty oil sufficiently non-solidified that said refining agent can be mixed therewith; mixing said refrigerated fatty oil with said refining agent whereby said refining agent combines with said impurities to form a mixture of oil and flocs; and separating the flocs from the oil.

8. A method of removing impurities from fatty oils, which method includes the steps of: continuously moving through an elongated passage a stream of said fatty oil; refrigerating said fatty oil as it flows through said elongated passage to cool it to a temperature which is below 60° F. while maintaining said fatty oil sufficiently non-solidified that a refining agent can be mixed therewith, said refining agent being capable of

combining with said impurities to form foots; continuously moving the refrigerated fatty oil from said elongated passage into a mixing zone; continuously introducing a stream of a refining agent into said mixing zone and mixing same with said fatty oil while in said refrigerated condition to form a mixture of oil and foots; continuously moving the resulting products from said mixing zone as fast as they are formed; applying heat to a stream of said resulting products in sufficient amount to facilitate separation thereof; and separating the foots from the oil. 5

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