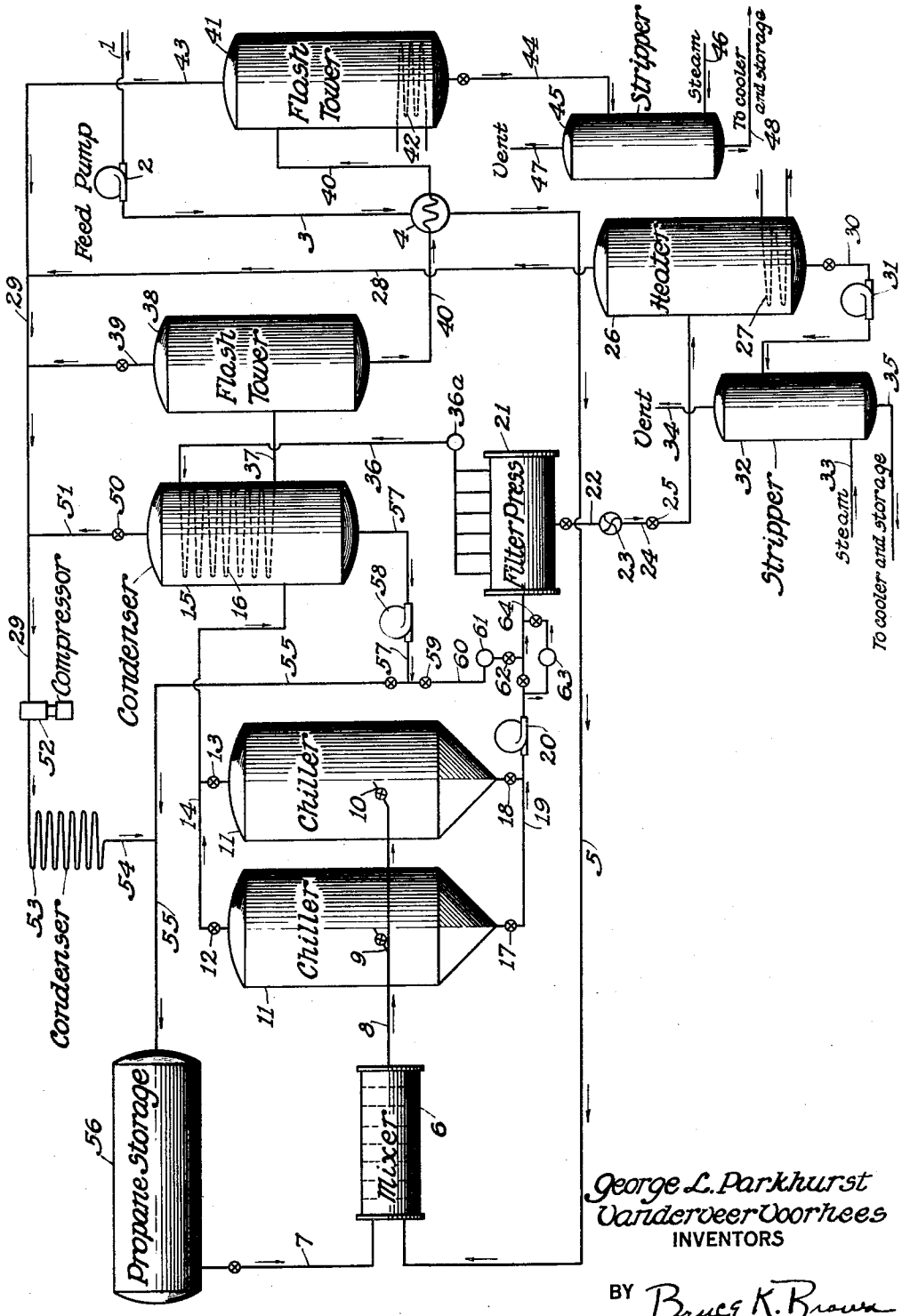
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DESTEARINIZING FATTY OILS

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DESTEARINIZING FATTY OILS

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This invention relates to the removal of stearin, palmitin and other relatively high melting substances from fatty oils and particularly vegetable oils. One object of the invention is to provide a more rapid and economical method of removing stearin from fatty oils. Another object of the invention is to provide a method of destearinizing fatty oils by the use of solvents which facilitate the separation of stearin and the like but do not introduce any contamination into the oil. Still another object is to employ the refrigerating effect of volatile solvents for the purpose of crystallizing stearin and other solid substances by the direct evaporation of a portion of the solvent from the oil. Other objects of the invention will become apparent as the description proceeds.

In the manufacture of salad oils, particularly from vegetable oils such as corn oil, arachis and cotton seed oils, it is necessary to remove substantially all the stearin, palmitin, arachidin and other high melting fats in order that the refined product will remain bright and fluid at low temperatures. This requirement has become more rigid recently as a result of the wide-spread use of automatic domestic refrigerators where salad oils are kept at temperatures as low as 40–50° F. for an extended period of time. Any stearin remaining in the oil will crystallize at these temperatures and prevent the oil from flowing freely from the container. The previous method of destearinizing fatty oils and salad oils in particular has consisted in chilling the oil at a temperature of about 40–45° F. to cause the stearin to crystallize, after which it is removed by pressing in bags placed in a hydraulic press. Numerous attempts have been made to improve upon this practice by the introduction of diluents and the use of modern filter presses, but without success, largely because it has not been found possible to remove the diluent quantitatively from the oil so that its edible properties will not be injured.

In contrast to the prior art the process of the present invention employs diluents far more volatile than those previously employed for destearinizing fatty oils. Because of the high volatility of these diluents it is necessary to operate the process under pressure in order to maintain the diluent in liquid form. The finished oils can then be completely freed of diluent by merely relieving the pressure and supplying a gentle heat.

As examples of the normally gaseous liquid diluents suitable for carrying out our process we may mention the low boiling normally gaseous hydrocarbons such as butane, propane, butylene, iso-butylene, iso-butane, propylene, ethane, ethylene or commercial mixtures of all or part of these.

The operation of the process will be clearly understood from the accompanying drawing and the following description thereof. The fatty oil to be destearinized, which may consist of lard oil, cotton seed oil, corn oil and the like is introduced by line 1 and feed pump 2 through line 3 and heat exchanger 4 where the oil is partially cooled. The oil is then led by line 5 to mixer 6 where it is mixed and diluted with from one to four volumes of liquid propane introduced simultaneously by line 7. The diluted oil passes through line 8 and valves 9 or 10 into one of the chilling tanks 11. These tanks are preferably provided with a conical bottom outlet as illustrated and are thoroughly heat insulated. The tanks are alternately filled to approximately three-fourths their capacity with the diluted oil, whereupon the inlet valve is closed and the vapor release valve 12 or 13 is gradually opened permitting the propane to vaporize from the chiller, thereby lowering the temperature of the diluted oil therein. The vapors leaving the chillers enter line 14 and pass into condenser 15 where they come into contact with cooling coil 16, to be described later.

By regulating the pressure, sufficient propane is allowed to evaporate from the diluted oil in the chiller to lower its temperature sufficiently to crystallize all or most of the stearin, palmitin and other relatively high melting substances which it contains, the remaining propane serving as a diluent to maintain the oil in a fluid condition and facilitate separation from the crystallized solid fats. This will usually require a temperature of about zero to −10° C., but may be somewhat higher or lower depending upon the particular oil being processed. The exact temperature to be employed is a matter of plant procedure and can be varied within wide limits to meet the exigencies of any particular situation.

The chilled oil-propane solution containing the separated stearin, etc. in suspension is removed from the chilling tank through valve 17 or 18 into line 19 and pump 20 from whence it is delivered under pressure to filter press 21. This press may suitably be of the enclosed pressure type in order to avoid loss of valuable diluent vapors. The filter cake may be removed continuously or intermittently from the filter press by line 22 and expeller 23 which forces the semi-solid cake through line 24, controlled by valve 25 and into heater

26. Here the stearin is melted by steam coil 27 and the diluent is vaporized and driven off through line 28 into vapor collecting line 29 to be described later. The melted stearin is discharged from the heater through line 30 and pump 31 into stripper 32. Any residual diluent vapors which were not expelled in the heater are stripped from the melted stearin by means of live steam introduced through line 33. Steam and vapors are vented through line 34 while the melted stearin is discharged through line 35. The stripper 32 may be provided with suitable baffles but its construction will not be described in detail as it forms no part of this invention.

The filtrate leaving the filter press 21 is conducted by header 36*a* and line 36 to coil 16 and is allowed to expand therein where it provides refrigeration for the vapors withdrawn from the chilling tanks previously described. The solution of oil in liquid propane, together with propane vapors resulting from the heat absorbed in coil 16, are next led by line 37 to flash drum 38 where the propane vapors are permitted to escape by line 39 to propane vapor collecting line 29. The unevaporated propane and the oil solution is withdrawn from the base of flash drum by line 40, through heat exchanger 4 and into flash tower 41 where the remainder of the propane is expelled by heating coil 42. The vapors from tower 41 are withdrawn through line 43 into propane vapor collecting line 29 while the oil is discharged from the base of the tower through line 44 to stripper 45. Live steam is introduced into the base of this stripper through line 46 and vented through line 47 for the purpose of removing the last traces of propane from the oil. The oil is withdrawn from the base of the stripper by line 48 to cooler and storage not shown.

Propane vapors uncondensed in condenser 15 previously described are released through valve 50 and line 51 to the propane vapor collecting line 29 where they are mingled with propane vapors from lines 39, 28 and 43. The combined vapors are introduced into compressor 52 where they are compressed to a pressure of the order of 50–200 lbs. per square inch, sufficient to cause them to become liquefied in condenser 53. The liquid propane from condenser 53 is then returned by lines 54 and 55 to propane storage reservoir 56. Liquid propane collected in the base of condenser 15 is likewise delivered by line 57 and pump 58 to liquid propane line 55 and thence to propane storage reservoir 56.

In the operation of our destearinizing process we may employ a battery of filter presses 21, operating each press through a batch cycle. The filter slurry from the chillers may be charged by pump 20, header 63 and valves 64 to one or more presses until the leaves become coated with sufficient filter cake to substantially reduce the rate of filtration and the capacity of the presses. Thereupon the stream of filter slurry may be diverted to other presses and the filter cake may be washed by cold propane. Cold propane for this purpose may suitably be drawn from condenser 15 by pump 58, valve 59 and line 60 which may be suitably connected with header 61 whereby the washed propane can be distributed to any press at will by means of control valves 62.

Before charging a clean press with filter slurry we find it advisable to pre-cool the press to approximately the temperature of the slurry. This may conveniently be done by admitting the cold washed propane thereto through the washed propane system just described. Evaporation of liquid propane in the empty presses assists in the cooling operation.

There are numerous obvious modifications of our destearinizing apparatus which we will not describe in detail but which we intend to include as part of our invention insofar as they make use of the principle of self-refrigeration of fatty oils by evaporation of a suitable diluent whereby stearin and other relatively high melting substances are crystallized and removed from the oil. Thus we may settle out by gravity or centrifuging the crystallized stearin from the diluted oil and we find that the separation by this method is greatly facilitated by the low viscosity of the normally gaseous diluent and its low specific gravity. We may likewise bring about the chilling of the diluted oil by introducing liquid propane directly into the base of the chilling tanks. We may also suitably precool the liquid propane before mixing with the oil, employing for this purpose waste refrigeration from various parts of the system.

Although the self-refrigeration feature of our invention is ordinarily a very important one it is not essential to the success of this type of process. Thus, for example, the volatile solvents mentioned herein may be used in connection with ordinary indirect chilling by means of brine coils, but certain advantages in heat transfer, and crystal structure are lost by this method of chilling.

Our process of destearinizing vegetable oils may suitably be combined with extraction processes wherein the liquefied normally gaseous diluent is employed as a solvent for removing the oil from seeds, animal tissue, plant fibre, etc. The seeds, for example, are comminuted and treated with liquid dimethyl ether or propane, usually under pressure. The solvent is withdrawn from the pulp and suitably subjected to filtration or clarification, for example, by treatment with decolorizing carbon, clays, sulfuric acid, alkalies, etc. The solution may then be employed in the destearinizing process as above described, with or without the addition of further quantities of propane, dimethyl ether, etc.

We have described our process as applied to the removal of stearin from vegetable salad oils. However, we contemplate using the process for removal of relatively high melting substances from fatty oils in general and may, for example, use this method for removing spermaceti from sperm oil, stearin and palmitin from lard oil, soy bean oil, etc. The yield and purity of stearic acid from fatty oils are increased by the use of our process for separating the stearin from the oil prior to its saponification to stearic acid. By this process low cold test fatty oils are also obtainable and suitable for soft soap manufacture and for blending to make harness oil, low cold test lubricating oils, etc. We may also separate free fatty acids such as stearic, palmitic, arachidic and elaidic acids from fatty oils in the same manner as the high melting fats.

The scope of our invention is intended to be limited only by the following claims.

We claim:

1. The process of removing stearin and other relatively high melting substances from fatty oils comprising diluting the oil under pressure with a liquefied normally gaseous hydrocarbon, maintaining the diluted oil under pressure to retain the gases in liquefied condition, gradually reducing the pressure on the solution to permit evaporation of a portion of the solvent thereby lowering the temperature sufficiently to crystal-

lize the stearin and other solid fats and allow the liquid fats to remain in solution, sufficient solvent being retained in the liquid state to maintain the diluted oil in a fluid condition, mechanically removing crystallized high melting substances from the solution and evaporating the remaining solvent from the solution to recover the oil therein.

2. The process according to claim 1 wherein the solvent which is evaporated from the solution is recompressed and condensed for further use in the process.

3. The process according to claim 1 wherein the initial solution of fatty oils in hydrocarbon solvent is derived from the extraction of fatty oil-containing vegetable and animal tissues.

4. The process of producing low cold test, purified fatty oils comprising extracting fatty oil-containing vegetable and animal tissues with a liquefied normally gaseous hydrocarbon, subjecting the resulting extract to a chemical purification treatment to remove undesirable color and other impurities contained therein, while maintaining the extract under pressure to retain the gases in liquefied condition, gradually reducing the pressure on the extract to permit evaporation of a portion of the solvent, thereby lowering the temperature sufficiently to crystallize the stearin and other high melting fats and allow the liquid fats to remain in solution, sufficient solvent being retained in the liquid state to maintain the diluted oil in a fluid condition, mechanically removing crystallized high melting substances from the solution and evaporating the remaining solvent from the solution to recover the oil contained therein.

5. The process of refining cottonseed oil to produce low cold test oil which comprises diluting the oil, under pressure, with 1 to 4 volumes of a liquefied normally gaseous hydrocarbon solvent selected from the class consisting of butane and propane, maintaining the diluted oil under pressure to retain the gases in liquefied condition, gradually reducing the pressure on the solution to permit the evaporation of a portion of the solvent thereby lowering the temperature of the solution to a point between about 0 and about −10° C. to cause stearin, palmitin and other insoluble materials to separate from the solution sufficient solvent being retained to maintain the diluted oil in fluid condition, filtering to remove separated substances, evaporating the remainder of the solvent from the filtrate to recover the oil and expelling the final traces of solvent from the oil by stripping with an inert gas.

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