This invention relates to a process for the removal of wax from petroleum products, the term "petroleum products" being used herein to designate the substances that may be dewaxed in accordance with this invention and including crude petroleum and fractions thereof, and mixtures thereof, and distillates or residues or other fractions or intermediate or final products occurring in or resulting from the refining of crude petroleum, and mixtures thereof.

One aspect of this invention is that it is an improved centrifugal process for the dewaxing of petroleum products, but important features of the invention are not limited to that point of view and are of general application in the dewaxing of petroleum products by other processes.

The known practice in the removal of wax from petroleum products is a subject to numerous limitations and to many difficulties. In known practice wax has been removed from petroleum products by filter pressing and by cold settling and more recently, but on a large scale, by centrifugal separation. In each of these methods the wax is precipitated, preparatory to its removal, by chilling the product or mixture from which the wax is to be removed, the mixture being especially fluid prior to chilling because of either added naphtha or light petroleum products formed in the preparation, as by cracking distillation, of the product to be dewaxed; and it has been proposed to add to the oil-naphtha solution foreign particles to which wax may adhere but in that operation one of several difficulties is the removal of the particles from whatever wax adheres to them. But each of these methods of removing wax from petroleum products is subject to numerous limitations and to various degrees of difficulty. If a wax-containing petroleum product is merely chilled, with or without dilution, to precipitate the wax, filter pressing can only be employed to remove the precipitated wax when it is distinctly crystalline in nature, as in the case of cracked distillates. Crystalline wax-containing fractions of crude petroleum are usually produced by methods which cause such fractions to contain relatively light petroleum products and usually enough of such products to give wax by chilling will be sufficiently fluid to facilitate filter pressing—if not, the fraction is subjected to further cracked distillation or may be diluted with naphtha. Cold settling can only be employed when the wax precipitated by chilling is distinctly amorphous in nature, as in the case of steam refined cylinder stocks. In cold settling the wax-containing product is preliminarily diluted with naphtha in order that the solvent-oil solution will be sufficiently fluid after the chilling step to permit precipitated wax to settle and sufficiently light to permit all of the wax to settle. Ordinary centrifugal dewaxing of petroleum products, consisting of diluting with naphtha and chilling and centrifugally removing, with the use of a carrier liquid, the precipitated wax, has been highly successful in removal of wax that is distinctly amorphous when precipitated and is capable of dewaxing certain distillates and the long residuum (the residue after removal of gas, naphtha and burning oil) of some crude oils. Other petroleum products may be dewaxed successfully by centrifugal methods which involve special steps whereby the particular characteristics of the wax are taken into account.

When some petroleum products are merely mixed with naphtha and chilled the precipitated wax is neither sufficiently crystalline to be removed by the commonly practiced pressing operation nor sufficiently amorphous to be removed by cold settling or by ordinary centrifugal separation. Also when some petroleum products are merely mixed with naphtha and chilled a part of the precipitated wax is lighter than the oil-naphtha solution or of substantially the same specific gravity as that solution, and part of such wax is heavier than that solution and largely amorphous and such petroleum products cannot be dewaxed by processes depending upon differences between the specific gravity of the oil and the wax, or by filtering. It has been common practice to subject such petroleum products to cracking distillation to bring the wax content into crystalline form but that step has resulted in considerable losses due to conversion of large fractions of the oil into non-lubricating oils. Such petroleum products may be dewaxed centrifugally when naphtha is employed as a solvent provided special processes are used and carried out with considerable care. If naphtha of especially low specific gravity is used in order to reduce the specific gravity of the oil-naphtha solution after chilling, for the purpose of causing the oil-naphtha solution to be lighter than all of the precipitated wax or for the purpose of increasing the difference between the specific gravities of the wax and solution, large evaporation losses occur, particularly in the heating of the mixture preparatory to the chilling. If the petroleum naphtha is used as a solvent, that is added to the wax-contain-
ing product prior to chilling is increased for the purpose of reducing the specific gravity of the oil-naphtha solution to a value below that of light constituents of the wax precipitated by chilling, the final oil is impaired because there is less oil in the resulting oil-naphtha solution and the wax that remains in solution in the oil-naphtha solution after chilling remains in solution in that reduced quantity of oil after naphtha is distilled therefrom and produces an unusually high wax content in the final oil product. In commercial operation filter pressing produces oil having a cold test of 25° F. to 30° F. and cold settling produces oil having a cold test of about 50° F. and ordinary centrifugal de-waxing produces oil with a cold test of 15° F. to 25° F. Other limitations and defects in the known practice of de-waxing petroleum are well known to those skilled in the art and some of such defects and limitations will be referred to hereinafter.

It is an object of this invention to provide a process for the de-waxing of petroleum products in which the defects and limitations of prior practice are eliminated or minimized. Other and further objects and advantages of my invention will appear from the following description or will be apparent, in the light of such description, to those skilled in the art.

In accordance with my invention, wax-containing petroleum products are diluted with an oil solvent that is of such character and is present in such proportion that all of the wax precipitated by chilling of the mixture is lighter than the residual solvent-oil solution, and then the wax is precipitated by chilling and separated from the solvent-oil solution. The de-waxed oil is recovered from the solvent-oil solution in any suitable manner, as by distillation, and the wax is freed of solvent in any suitable manner. Thus, in the practice of my invention the precipitated wax rises to the surface of the chilled mixture under the action of gravity or accumulates in the inner zone of the centrifugal bowl. In prior practice an effort to have the solvent-oil solution lighter than wax precipitated therein limited the solvents used in commercial practice to light petroleum products. With such light solvents some of the wax in the product to be de-waxed might be lighter than the solvent-oil solution and the remainder of the wax heavier. In such case the use of a lighter solvent caused evaporation losses, and use of a greater proportion of solvent carried an undesirably large quantity of wax in the oil finally produced. In some of such cases neither the use of lighter solvent nor the use of a greater proportion of solvent would cause the solvent-oil solution to be lighter than all of the wax and the wax could not be removed from such a mixture by gravity or by centrifuging, and usually, in such a case, the precipitated wax could not be separated by filter pressing because it would be too amorphous as a whole. Thus, in former practice there were limitations upon the relative lightness of the solvent and those limitations imposed further limitations upon the kinds of wax that could be separated by particular operations. But, in accordance with my invention a solvent is selected the cold test of such solvents is greater than the specific gravity of different constituents of the wax present. Again solvents used in the practice of my invention may be less volatile than the naphtha ordinarily employed and may be largely employed in the de-waxing of oils containing some relatively light wax. The difference between the specific gravities of the wax and of the oil-solvent solution was obtained by selection of the solvent, it is not necessary in the practice of my invention to use excessive quantities of solvent or to use very light solvent that is undesirably volatile or to adopt both of those expedients in order to obtain the necessary difference of specific gravities, and the objectionable results of those expedients are avoided.

Examples of solvents that may be used in the practice of my invention are gas-oil, benzene, dichlor ethane, carbon tetrachloride, dichlor propane, carbon disulphide, chlor benzene, etc. A distinguishing characteristic of such solvents is that a solvent may be selected that contains less wax in solution after precipitation of the wax by chilling than is contained in light petroleum products formerly employed. Thus, in the practice of my invention a solvent may be used that has a greater differential solubility as between wax and oil, especially at temperatures employed in commercial de-waxing, than solvents of the limited field herefore employed. Furthermore, with the use of such solvents, in the practice of my invention, the chilling for the precipitation of wax does not always have to be carried to a low temperature as mixtures of oil and naphtha, to produce oils of even lower cold test than oils produced by using light petroleum products as solvents and chilling to much lower temperatures. Moreover, while the solvents herefore used have been limited to light petroleum products having a specific gravity up to 55° Baumé, solvents employed in the practice of my invention are not limited to petroleum products and have characteristics differing greatly from light petroleum products, and a solvent may be selected that has characteristics best suited for the separation of wax from the particular oil that is being handled. Also, in the practice of my invention it becomes possible to use solvents consisting of mixtures of substances, each of which possesses some property that contributes toward the efficiency or economy of the de-waxing operation. When light petroleum products have been used as solvents it has been necessary to exercise care in chilling the mixture in order to avoid any sudden lowering of the temperature thereof, but in using solvents contemplated in my invention, and particularly ethylene dichloride, good results have been obtained with various rates of chilling and the precipitation is not as sensitive to variations in chilling as in the case when naphtha is employed. In all de-waxing processes involving the addition or presence of a solvent it is important that the chilled solution be sufficiently fluid to facilitate the removal of wax. But it is desirable and is entirely possible in the practice of my invention to avoid using a proportion of solvent in excess of this requirement. Increasing the proportion of solvent beyond that which is necessary to meet this requirement increases the amount of wax that
goes into solution in the solvent and ultimately passes into the final oil product.

In the dewaxing of oils in which the precipitated wax is of such nature that it cannot be removed by special steps because it is to amorphous for one operation or too crystalline for the other or because the naphtha-oil solution cannot practically be made lighter than all of the precipitated wax, losses occurring in the early practice of subjecting the oil to cracking distillation to bring the wax to a crystalline condition have largely been avoided by later practice. In such later practice the wax in such oils is brought as a whole to a condition in which it is all heavier than an oil-naphtha solution after chilling and in which it can readily be discharged from the centrifuge, this condition being achieved by adding amorphous wax or oil containing amorphous wax or by adding or otherwise adjusting or regulating the content of color-forming impurities that occur in petroleum oil, or in resorting to two or more of such expedients, centrifugal separation employing a carrier liquid being preferably for the removal of such wax from such a mixture. But, in accordance with my invention petroleum products containing wax of such characteristics may be dewaxed without cracking and without using such special steps, because the precipitated wax can be caused to be lighter than the oil-solvent solution by selecting a suitable solvent that is not undesirably volatile and need only be used in economical proportions.

By the practice of my invention it is readily possible to obtain petroleum oils and particularly lubricating oils having a cold test of zero degrees Fahrenheit; and it is possible to produce on a commercial scale lubricating oils from paraffin-containing crude oils, which have a lower cold test than such oils previously produced commercially.

From the foregoing it will be apparent that in the practice of my invention many limitations and difficulties of prior dewaxing processes are avoided and that certain advantages of my invention are obtainable regardless of the nature of the step by which the precipitated wax is removed from the oil-solvent solution—regardless of whether filter pressing, cold settling or centrifugal separation is employed.

My invention is generally applicable to the dewaxing of petroleum products, and, while it is not limited to the centrifugal removal of wax from the chilled mixture, it is particularly adapted to that type of wax removal. In centrifugal dewaxing the above described advantages and many other advantages of my invention are obtained.

In the centrifugal separation of precipitated wax from a chilled solution of oil, when naphtha has been used as the solvent, the wax constitutes the heavier constituent and several difficulties arise that are avoided in the practice of my invention. The centrifugal bowl contains a dividing wall through the center of which the lighter constituent of a mixture is directly discharged through a relatively simple passage. The dividing wall extends radially outward to a point near the inner surface of the bowl, and when wax is the heavier constituent in the mixture a carrying liquid that is employed to fill the outer zone of the bowl and engages the outer edge of the dividing wall and forms a liquid surface facilitating the movement of wax that might adhere to the inner surface of the bowl; and a body of carrier liquid occupies the space between the dividing wall and the end of the bowl and maintains hydraulic balance with the wax and oil in the main body of the bowl. Thus, when wax is the heavier constituent it must pass through the outer edge of the dividing wall and up through the carrier liquid in the auxiliary compartment and then pass through relatively complicated discharge passages. When naphtha is used as a solvent it is necessary that the naphtha-oil solution shall all be lighter than the precipitated wax and necessary that the wax be capable of passing around the edge of the dividing wall and through the discharge passages, even though the presence of crystalline wax and hard asphalt impose difficulties upon the discharge of wax from the centrifugal bowl. To avoid these difficulties it has been necessary at times to use excessively light solvent or excessive quantities of solvent or to add to the oil to be dewaxed petroleum or petroleum-containing oil or to add or otherwise adjust or regulate the content of color-forming impurities therein, or to resort to two or more of such expedients to bring the wax content, as a whole to a specific gravity and consistency suitable for centrifugal separation, it having been necessary to remove hard asphalts by mild acid treatment preliminary to centrifugal dewaxing. The complications in the discharge passage for the heavier substance from the centrifuge make it difficult to apply heat in such a way as to assist the discharge of crystalline wax or hard wax, or hard asphalt, without heating the contents of the bowl and thereby impairing the wax separation.

In the practice of my invention the wax is 110 lighter than the solvent-oil solution and therefore passes to the central zone of the centrifuge and is discharged directly through the relatively simple discharge passage leading therefrom while the wholly-liquid solvent-oil solution passes to the outer zone and flows through the more or less complicated discharge construction. The discharge of wax from the central zone of the centrifuge imposes fewer difficulties upon the discharge of hard- and crystalline wax and asphalt and affords greater opportunity for the application of any necessary heat to a substance so discharged.

The use of carrier liquid is not necessary in the practice of my invention in which the wax 125 discharges from the central zone of the bowl. It will now be apparent that the difficulties of centrifugal dewaxing due to the presence of crystalline wax or asphalt, or due to relative lightness of some part of the wax or variations in the specific gravity of different constituents of the wax, are avoided by my invention and that the use of carrier liquid is dispensed with and that it becomes relatively simple to apply heat to other treatment to facilitate the discharge or to change the character of the wax. And, it will be apparent that in the practice of my invention all petroleum products including distillates and residues and mixtures may be dewaxed by oil and the same process.

To assist in the further understanding of my invention, but with the understanding that my invention is not limited thereto, there is shown in the single figure of the drawing a centrifugal machine useful in the practice of my invention. Referring to the drawing, a centrifugal bowl 1 is suspended by a spindle 2, supported in a bearing (not shown) carried by the upper part of the frame 3 and driven by pulley 4 receiving power from a motor driven shaft 5. The solvent is
added to the wax-containing product and it is chilled to precipitate the wax and introduced through pipe 6 to the centrifugal bowl 1. The bowl has a member 7 having three radial wings and held in position by resilient members 8 and acting to cause liquid to assume the speed of the bowl. Under the influence of centrifugal force the oil-solvent solution will be segregated at the outer zone of the bowl and passed around the outer edge of the dividing wall 9 thereof and will be discharged through passages 10 (only one of which is shown). The wax will be segregated in the inner zone of the bowl and will pass over the weir 11 of the dividing wall 9 and will be discharged through passages 12 (only one of which is shown). The level of the oil-solvent solution is determined by the inner diameter of the ring-like weir 13 which is replaceably held in position by the nut 14 and the radial depth of oil-solvent solution between the inner edge of the weir 13 and the outer edge of the dividing wall 9 will be so adjusted by selection of a weir 13 of proper internal diameter, that that depth of oil-solvent solution will maintain hydraulic balance with the wax and oil-solvent solution in the main compartment of the bowl. Oil-solvent solution will be collected in the receiving cone 15 and discharged therefrom through spout 16 and wax will be collected in receiving cover 17 and discharged therefrom through a spout 18. To facilitate discharge of unusually firm or adhesive wax from cover 17, there may be provided an annular chamber 20 receiving hot fluid through pipe 20 and jetting it through orifices 21, liquid so discharged against the neck of the bowl being dispersed in cover 17 and thrown against the walls thereof to facilitate the flow of wax from the cover. Spout 16 is preferably provided with a trap 22 while wax from spout 13 is collected in a receiver 23.

From the foregoing it will be apparent that in accordance with my invention the wax-containing petroleum products may be dewaxed centrifugally with only the simple operations of diluting and chilling as preparatory steps and that such products may be so dewaxed regardless of the nature of the wax—regardless of whether it is crystalline, amorphous, or mixed—and regardless of the manner in which the particular petroleum product was produced.

Examples of the separation of wax from oil that further illustrate my invention are as follows:

A lubricating distillate of Mid-Continent crude oil—a fraction that is termed slop distillate in commercial practice—was diluted with naphtha and chilled and subjected to centrifugal treatment in accordance with the best known previous practice but without successful results, because some of the wax was lighter than the oil-naphtha solution and was not removed even when the presence of crystalline wax, discharged of wax from the bowl ceased. Then petroleum from Mid-Continent crude oil was added in such proportion as to bring the wax content of the distillate to such specific gravity and consistency as to permit centrifugal separation of the wax, and with the mixture properly chilled centrifugal separation produced oil having a cold test of 25° F. Then a mixture was made of which 30%, by volume, consisted of another quantity of the same lubricating distillate and 70%, by volume, consisted of ethylene dichloride, and this mixture was rapidly chilled to −10° F., and centrifugal separation of the mixture produced lubricating oil having 0° F. cold test.

Again, light distillate of Mid-Continent crude oil—the fraction between 100 seconds and 250 seconds Saybolt Universal viscosity at 100° F.—was similarly treated. When this distillate was merely diluted with naphtha and chilled and centrifugally treated in the manner and under the conditions of the known previous practice, the centrifugal separation was not successful. When a proper quantity of petroleum was added to the oil and it was diluted with naphtha and chilled and centrifugally dewaxed, the final oil product had a cold test of 25° F. A final oil having 0° F. of cold test was obtained when ethylene dichloride was used as a solvent in the proportions used in the first example and the chilled mixture was centrifugally dewaxed, and the wax obtained was so crystalline that it sweated itself out to a hard paraffin. It has heretofore been impossible to remove such wax from oil by merely diluting and chilling and then removing wax by a process dependent upon differences in specific gravity between the wax and the oil, and it has not been found possible to remove wax from oil of this nature by any other process or by any other known process. It has not been found possible to remove wax from oil of this nature by any other process or by any other known process.

Again, heavy pipestill distillate of Mid-Continent crude oil—practically a cylinder stock—was mixed, after light acid treatment, that removed hard asphalt, with ethylene dichloride in the volumetric proportion of 55 to 63 and the mixture was chilled to 15° F. and centrifugally dewaxed. The oil produced, freed of ethylene dichloride, had a cold test of 10° F. and did not cloud at 0° F. The wax obtained had a melting point of 124° F.

In the practice of my invention the wax-containing oil is mixed with a solvent of such nature that the wax will be lighter than the remaining solution after the mixture has been sufficiently chilled to effect precipitation of the wax. Sufficient solvent is used to insure that the mixture will be sufficiently liquid after chilling to permit proper removal of wax. When light petroleum products have been used as the solvent, the mixture has heretofore been chilled to −10° F. or only slightly lower for the purpose of precipitating the wax, and even more extensive chilling has been desirable but has been prevented by economical considerations. However, in the practice of my invention, the chilling need only be carried to a point at which suitable precipitation occurs and I have found that when ethylene dichloride is employed as a solvent, a lower cold test oil is obtained by centrifugal separation from a mixture that has been chilled to 15° F. than could be obtained if a wax-containing oil had been chilled to −10° F. in connection with the use of naphtha as a solvent.

It will be apparent from the foregoing that in accordance with my invention wax-containing petroleum products may be dewaxed to a degree higher than that previously attained in commercial practice and by simple steps and that the procedure is effective independent of the character of the wax that is to be removed. It is to be noted, however, that important advantages of my invention that are obtained without regard to the manner in which the wax is actually removed from the chilled mixture.

The use and advantages of solvents heavier than wax in the separation of wax from oil, particularly by processes depending upon differences of specific gravity between wax and oil-solvent mixtures, constitute this invention and other advantages and results of the use of such solvents constitute a separate invention described and claimed by me in another application.

In the practice of this invention, as in all de-
waxing involving the use of a solvent, the precipitate formed by chilling the solution of wax-containing oil is not, strictly speaking, mere wax but comprises wax, oil and solvent, and the residual liquid in which the precipitate is formed comprises both oil and solvent and sometimes contains some residual wax that is not precipitated. Accordingly, it will be understood that the reference herein to precipitated wax is intended as a reference to a precipitate of the character above mentioned; and references herein to oil are intended to include both oil and solutions of oil, which may also contain wax.

1. In the production of dewaxed lubricating oil from wax-containing lubricating-oil residues and distillates obtained from wax-containing mineral oil, the steps comprising mixing a wax-containing lubricating-oil fraction with dichlor ethane, cooling the mixture to a temperature at which wax precipitates and oil and the solvent remain liquid, separating precipitated wax from the cooled mixture by centrifugal sub-sidence, and separately discharging continuously from the centrifuging operation wax and clear solution of dewaxed oil.

2. In the production of dewaxed lubricating oil from wax-containing lubricating-oil residues and distillates obtained from wax-containing mineral oil, the steps comprising mixing a wax-containing lubricating-oil fraction containing amorphous wax with dichlor ethane, cooling the mixture to a temperature at which wax including amorphous wax precipitates and oil and the solvent remain liquid, separating precipitated wax from the cooled mixture by centrifugal sub-sidence, and separately discharging continuously from the centrifuging operation wax and clear solution of dewaxed oil.

3. In the production of dewaxed lubricating oil from wax-containing lubricating-oil residues and distillates obtained from wax-containing mineral oil, the steps comprising mixing a wax-containing lubricating-oil fraction containing crystalline wax with dichlor ethane, cooling the mixture to a temperature at which wax including crystalline wax precipitates and oil and the solvent remain liquid, separating precipitated wax from the cooled mixture by centrifugal sub-sidence, and separately discharging continuously from the centrifuging operation wax and clear solution of dewaxed oil.

4. In the production of dewaxed lubricating oil from wax-containing fractions of mineral oil, the steps comprising mixing the wax distillate of crude wax-containing petroleum with an oil solvent containing sufficient dichlor ethane to cause the resulting solvent-oil solution to possess a specific gravity higher than that of wax precipitated in the mixture by cooling thereof, cooling the mixture to a temperature at which wax precipitates therein and oil and the solvent remain liquid, separating precipitated wax from the cooled mixture by centrifugal sub-sidence, and separately discharging continuously from the centrifuging operation wax and clear solution of dewaxed oil.

5. In the production of dewaxed lubricating oil from wax-containing lubricating-oil residues and distillates obtained from the wax-containing mineral oil, the steps comprising forming a mixture of the wax-containing oil and an oil-solvent containing sufficient dichlor ethane to cause the resulting solvent-oil solution to possess a specific gravity higher than that of wax precipitated from the mixture by cooling, cooling the mixture to a temperature not substantially below that at which the wax is precipitated to a desired degree, separating precipitated wax from the cooled mixture by centrifugal sub-sidence, and separately discharging continuously from the centrifuging operation wax and clear solution of dewaxed oil.

6. In the production of dewaxed lubricating oil from wax-containing lubricating-oil residues and distillates obtained from wax-containing mineral oil, the steps comprising forming a mixture of the wax-containing oil and an oil-solvent containing sufficient dichlor ethane to cause the resulting solvent-oil solution to possess a specific gravity higher than that of wax precipitated from the mixture by cooling, cooling the mixture to a temperature not substantially below that at which the wax is precipitated to a desired degree, separating precipitated wax from the cooled mixture by centrifugal sub-sidence, and separately discharging continuously from the centrifuging operation wax and clear solution of dewaxed oil.

7. In the production of dewaxed lubricating oil from wax-containing lubricating-oil residues and distillates obtained from the wax-containing mineral oil, the steps comprising adding the dichlor ethane to cause the resulting solvent-oil solution to possess a specific gravity higher than that of wax precipitated from the mixture by cooling, cooling the mixture to a temperature not substantially below that at which the wax is precipitated to a desired degree, and separating precipitated wax from the cooled mixture to produce clear solvent-oil solution.

8. In the production of dewaxed lubricating oil from wax-containing lubricating-oil residues and distillates obtained from wax-containing mineral oil, the steps comprising adding dichlor ethane and a petroleum fraction lighter than the oil to be dewaxed, said solvent having such specific gravity and being added in such proportion that the resulting solvent-oil solution will possess a specific gravity greater than that of wax precipitated in the mixture by cooling, cooling the mixture to a temperature at which wax precipitates and the oil and solvent remain liquid, and separating precipitated wax from the mixture and thereby producing clear solvent-oil solution.

9. A method for producing dewaxed residual lubricating oil having a pour point of substantially 0° F. from wax-containing petroleum which comprises mixing a residue of wax-containing petroleum with a solvent comprising a dichlor ethane, the solvent having such specific gravity and being present in such proportion that the specific gravity of the solvent-oil solution is greater than that of wax precipitated in the mixture by cooling, cooling the mixture to a temperature at which wax is precipitated to a desired degree while the oil to be dewaxed remains in solution in the solvent, separating the precipitated wax from the cooled mixture, and separating the solvent from the dewaxed solvent-oil solution and thereby producing dewaxed, natural, residual lubricating oil having a pour point of 0° F. to 10° F.

10. A method for producing natural, dewaxed lubricating oil having a pour point of substantially 0° F. from distillates and residues of wax-containing petroleum, which comprises mixing a substantially uncracked fraction of wax-containing petroleum with an oil-solvent comprising...
dichlor ethane, said solvent having such specific gravity and being present in such proportion that the resulting solvent-oil solution has a specific gravity greater than that of wax precipitated in the mixture by cooling, cooling the mixture to a temperature at which wax is precipitated to a desired degree while the oil to be dewaxed and the solvent remain liquid, separating precipitated wax from the cooled mixture, separating the solvent from the dewaxed solvent-oil solution and thereby producing natural dewaxed lubricating oil having a pour test between 0° F. and 10° F. from wax containing petroleum oil.

11. In the production of dewaxed lubricating oil from wax-containing lubricating-oil residues and distillates obtained from the wax-containing mineral oil, the steps comprising forming a mixture of the wax-containing oil and sufficient of an oil solvent of the group consisting of dichlor propane and dichlor ethane to cause the resulting solvent-oil solution to possess a specific gravity higher than that of wax precipitated from the mixture by cooling, cooling the mixture to a temperature not substantially below that at which the wax is precipitated to a desired degree, separating precipitated wax from the cooled mixture by centrifugal subsidence, and separately discharging continuously from the centrifuging operation wax and clear solution of dewaxed oil.