May 24, 1960 J. VAN DYCK FEAR 2,937,985

CENTRIFUGAL SEPARATION OF WAX AND OIL

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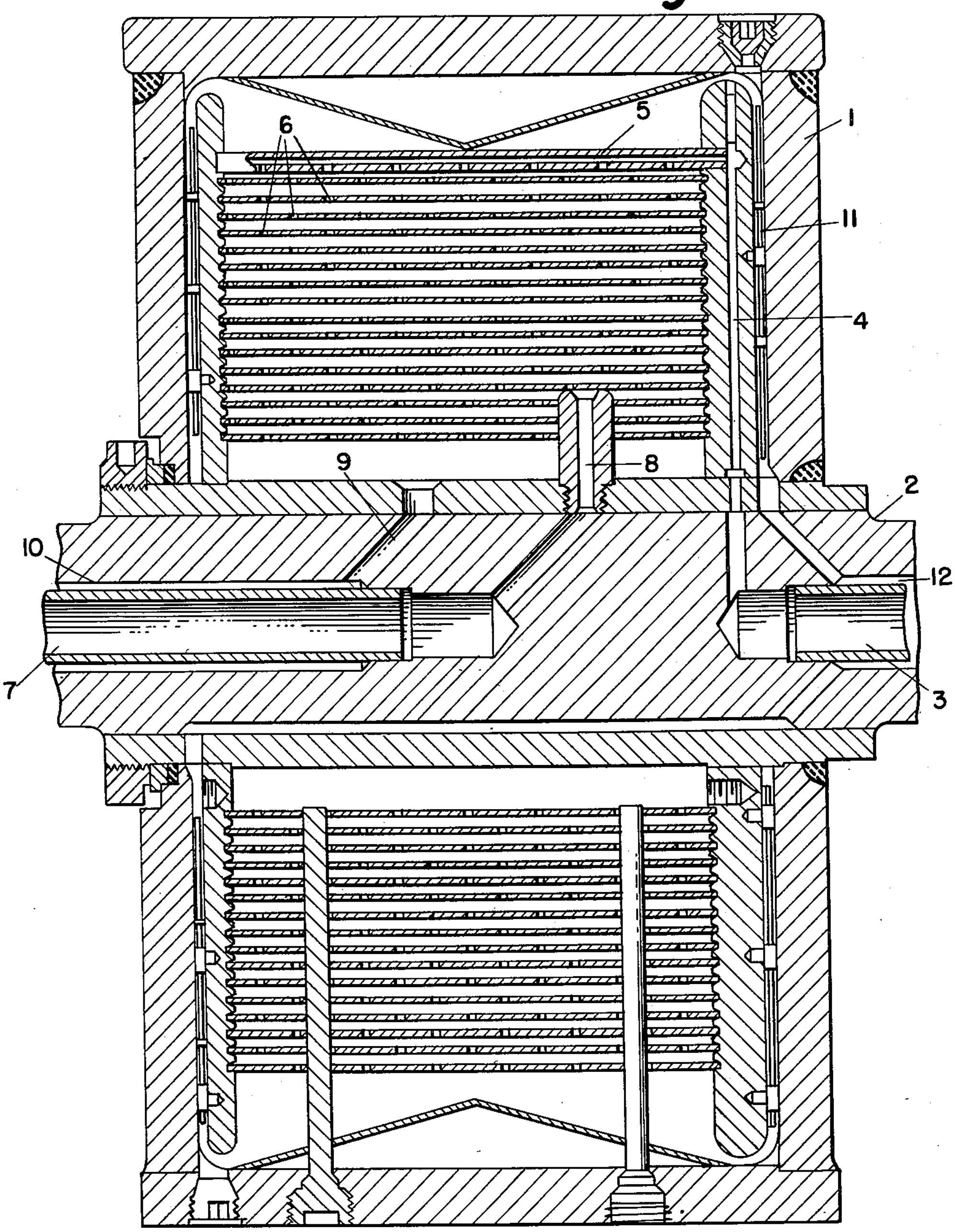
Fig. 1



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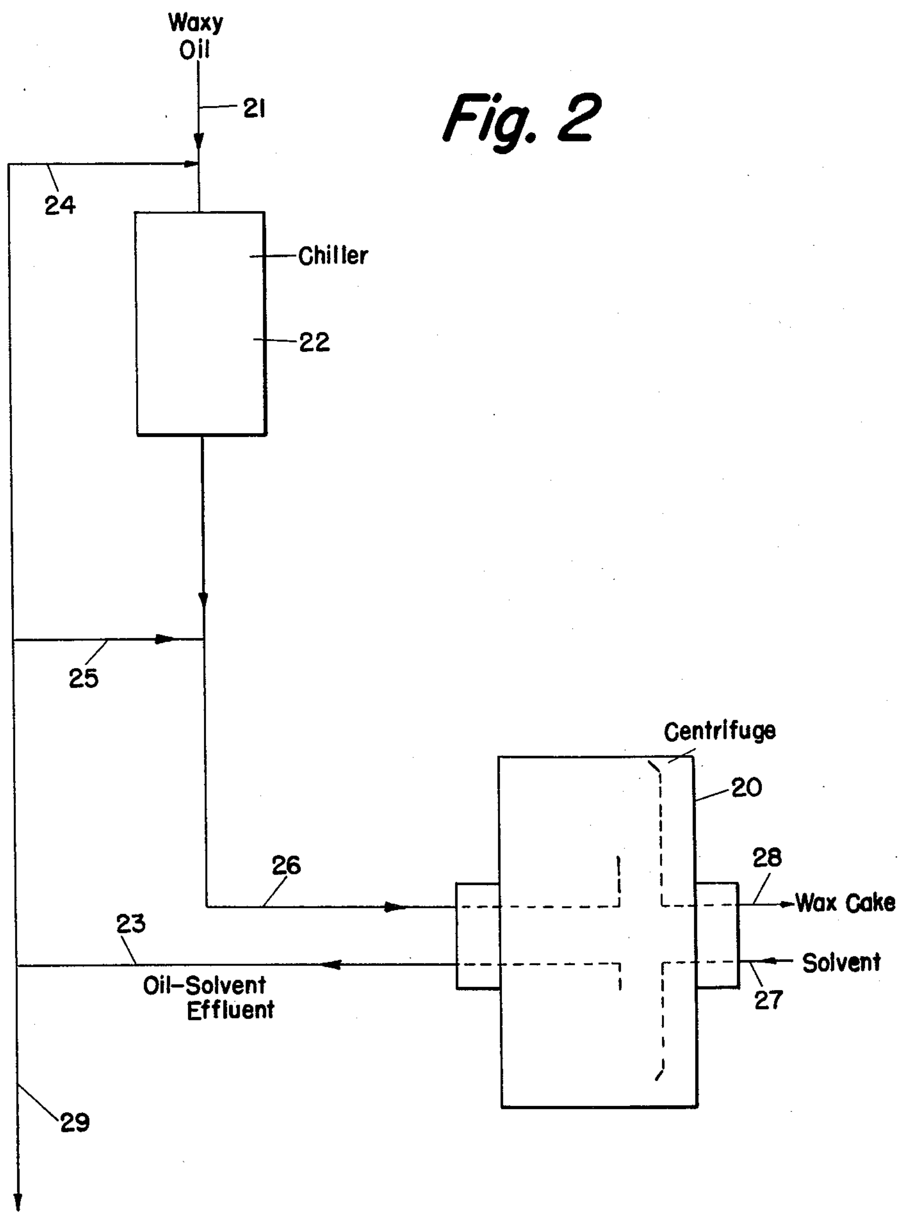

Fig. 2

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CENTRIFUGAL SEPARATION OF WAX AND OIL

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4 Claims. (Cl. 208—33)

This invention relates to the separation of wax and oil and more particularly is directed to a continuous process for dewaxing oils or deoiling waxes utilizing a rotating centrifugal wheel.

The use of centrifuges for effecting separation of wax and oil from each other has long been known. In processes of this type the waxy charge usually is admixed with fresh solvent which is capable of dissolving the oil but is an anti-solvent for the wax, and the mixture is chilled to a suitable dewaxing temperature to precipitate the wax and then is fed to the centrifuge wherein the wax is caused to separate from the oil and solvent. The oil-solvent stream withdrawn from the centrifuge is distilled to recover the solvent which is then re-used.

The present invention is directed to an improvement in the centrifugal separation of wax from oil, which permits effective separation while minimizing the amount of solvent required in the system. In the process provided by the invention, addition of fresh solvent to the waxy charge is avoided and the total amount of fresh solvent fed to the system is utilized as wash liquid for washing the separated wax crystals.

The process according to the invention utilizes a rotating centrifugal wheel in which both the separation of wax from oil and washing of the wax crystals is effected. The waxy hydrocarbon charge, instead of being diluted with fresh solvent, is admixed with a portion of the oil-solvent effluent obtained from the wheel. The resulting mixture is continuously introduced at a dewaxing temperature into the interior of the wheel at a locus intermediate its hub and periphery. Fresh dewaxing solvent, having a density less than that of the wax and chilled to the dewaxing temperature, is continuously introduced into the wheel at a locus between its periphery and the point of introduction of the charge mixture. The centrifugal force within the wheel causes the oil to flow toward its hub and the wax to flow toward the periphery countercurrent to the wash solvent. A stream of wax is withdrawn from adjacent the periphery of the wheel while the oil-solvent mixture is continuously withdrawn as effluent from adjacent the hub. A portion of this effluent is returned for admixture with the waxy charge.

The following more detailed description of the invention is made with reference to the accompanying drawings in which:

Fig. 1 is a fragmentary cross-sectional view of a centrifugal wheel of a type useful in practicing the invention; and

Fig. 2 is a schematic flowsheet illustrating an embodiment of the present process.

Referring to Fig. 1, centrifugal wheel **1** and its hub **2** are adapted to be rotated by a suitable driving means, not shown. A mixture of a waxy charge oil and oil-solvent effluent previously withdrawn from wheel **1** is continuously admitted to the interior of the rotating wheel under pressure at a suitable dewaxing temperature, for example, at −20° F., through inlet line **7** and passage **8** to an intermediate point between the hub and periphery of the wheel. An oil solvent, which has a lower density than the wax and which has low solubility for the wax, such as a mixture of 65% methyl ethyl ketone and 35% propane, is continuously introduced under pressure and at the dewaxing temperature to the interior of the wheel near the periphery through inlet line 3, inlet passage **4** and distributor **5**. Under the influence of the centrifugal force generated in wheel **1**, the solvent flows through perforated baffles **6** towards the hub of the wheel, while the wax in the charge introduced through passage **8** passes toward the periphery making countercurernt contact on its way with the solvent. From the outlet of passage **8**, oil dissolved in solvent flows inwardly toward the hub and is removed through passage **9** and annulus **10**. The wax, washed substantially free of oil, is collected at the periphery of wheel **1** and, being of plastic character, can be forced continuously therefrom through passage **11** and annulus **12**. Suitable means, such as a back pressure valve on the oil-solvent effluent line (not shown), should be provided to insure that there will be at all times sufficient pressure in the interior of wheel **1** to force the wax cake through the passages provided therefor.

Fig. 2 schematically illustrates a preferred manner of practicing the invention, wherein two portions of the oil-solvent effluent are mixed at separate points with the wax-bearing charge prior to centrifuging. Numeral **20** illustrates the centrifugal wheel shown in more detail in Fig. 1. Waxy charge oil enters the system through line **21** and is sent to chiller **22**. Before entering the chiller it preferably is admixed with only a part of the total effluent which is recycled from centrifuge **20** through line **23**. This first portion of effluent is sent through line **24** for admixture with the charge oil, and the amount used should be sufficient to prevent the material passing through the chiller from becoming so viscous that excessive pumping pressure and inadequate heat transfer rates result. Following the chilling step, the remainder of the recycled effluent is added to the charge via line **25**. The temperature to which the mixture is cooled in chiller **22** depends upon the dewaxing tempearture desired and the temperature and amount of effluent added through line **25**. Usually this effluent will have a temperature somewhat above the desired dewaxing temperature due to frictional effects within the centrifuge and heat transfer through the flow lines, and consequently it generally will be necessary to cool in chiller **22** somewhat below the dewaxing temperature so that the final mixture fed to centrifuge **20** will be at the desired temperature level.

The cold charge mixture enters the centrifuge through line **26** and is introduced into its interior at a locus as described in connection with Fig. 1. Wash solvent is admitted through line **27** and wax cake is withdrawn via line **28**, also as described with reference to Fig. 1. The oil product in admixture with solvent is withdrawn through line **29** and sent to a distillation zone (not shown) for recovery of the solvent for re-use.

In practicing the invention any of the known dewaxing solvents which have a density substantially less than that of the wax in the charge stock may be used. It is preferred to employ as the solvent a mixture comprising a good anti-solvent for wax, such as a ketone, and a good oil solvent such as an aliphatic or aromatic hydrocarbon. A prefered solvent mixture comprises methyl ethyl ketone and a saturated hydrocarbon of the C_3–C_6 range such as propane, butane, pentane, isopentane or a hexane. Particularly satisfactory proportions of the solvent components are within the range of 60–70% of the ketone and 30–40% of the saturated hydrocarbon.

The following example, in which parts and percentages are by volume, specifically illustrates the present process carried out in the manner depicted in Fig. 2. The charge stock is a solvent refined distillate oil derived from a paraffinic crude and typically having a viscosity of 150 S.U.S. at 100° F. and a wax content of 20%. The charge stock is fed to the system at a rate of 100 parts per unit of time and, prior to chilling, is admixed with a portion of cold recycled effluent from the centrifuge comprising 50 parts of dewaxed oil and 150 parts of solvent. The mixture is chilled to a temperature somewhat below −15° F. and is then admixed with a second portion of recycled effluent comprising 50 parts of oil and 150 parts of solvent having a temperature somewhat above −15° F. The resulting mixture, which has a temperature of about −15° F., is continuously introduced to the centrifuge at a rate of 500 parts per unit of time. Fresh solvent is introduced into the centrifugal wheel near its periphery at a temperature of about −15° F. and a rate of 300 parts per unit of time. Under these conditions the stream of wax cake withdrawn from the centrifuge per unit of time is composed of 20 parts of wax, 1 part of oil and 63 parts of solvent. This material is sent to a distillation unit for recovery of the solvent. The oil-solvent effluent stream is removed from the centirfuge at the rate of 716 parts per unit of time and 400 parts of this are recycled in the manner previously described. The remainder, comprising 79 parts of dewaxed oil and 237 parts of solvent, is sent to a second distillation unit for recovery of the solvent. The resulting dewaxed oil has a pour point of about 0° F.

The following conventional manner of carying out a dewaxing operation utilizing a centrifuge is given for purposes of comparison with the foregoing operation. In the conventional operation, 100 parts of the charge stock is admixed with 200 parts of fresh solvent and the mixture is chilled to −15° F. and then fed into the centrifuge. Wash solvent is introduced into the centrifuge near its periphery at a temperature of about −15° F. and a rate of 100 parts per unit of time. The stream of wax cake withdrawn from the centrifuge comprises 20 parts of wax, 5 parts of oil and 75 parts of solvent, while the filtrate effluent stream comprises 75 parts of oil and 225 parts of solvent. These products are separately distilled to recover the solvent.

The foregoing comparative operations are based upon using the same total amounts of fresh solvent, namely, 300 parts per unit of time. The conventional operation yields a wax product having 5 parts of oil for each 20 parts of wax, while operation according to the invention yields a product having only 1 part of oil to 20 parts of wax. Thus, practice of the invention permits a substantially more effective separation of the oil and wax.

Alternatively, in operating according to the invention, the total amount of fresh solvent used can be reduced considerably while securing the same degree of separation between the wax and oil as is obtained in the conventional manner of operation employing a larger amount of fresh solvent.

I claim:

1. Process for separating wax from oil by means of a rotating centrifugal wheel which comprises admixing an undiluted hydrocarbon charge consisting of oil and wax with hereinafter specified effluent from the wheel, continuously introducing the mixture at a dewaxing temperature into the interior of the wheel at a locus intermediate its hub and periphery, continuously introducing a chilled dewaxing solvent having low solubility for wax and a density less than that of the wax into the interior of the wheel at a locus between the first-mentioned locus and the periphery, said solvent being the sole amount of solvent employed in the process, withdrawing wax from the wheel at a locus adjacent its periphery via a conduit connecting the periphery with an outlet adjacent to the hub, withdrawing from the wheel adjacent its hub effluent comprising oil and solvent, and returning a major portion of said effluent comprising oil and solvent for admixture with the charge.

2. Process according to claim 1 wherein said solvent comprises a mixture of methyl ethyl ketone and a saturated hydrocarbon of the C_3–C_6 range.

3. Process for separating wax from oil by means of a rotating centrifugal wheel which comprises admixing an undiluted hydrocarbon charge consisting of oil and wax with a first portion of hereinafter specified effluent from the wheel, chilling the mixture to a dewaxing temperature, admixing the chilled mixture with a second portion of said effluent, continuously introducing the resulting mixture into the interior of the wheel at a locus intermediate its hub and periphery, continuously introducing a chilled dewaxing solvent having low solubility for wax and a density less than that of the wax into the interior of the wheel at a locus between the first-mentioned locus and the periphery, said solvent being the sole amount of solvent employed in the process withdrawing wax from the wheel at a locus adjacent its periphery via a conduit connecting the periphery with an outlet adjacent to the hub, withdrawing from the wheel adjacent its hub effluent comprising oil and solvent, and returning a major amount of said effluent comprising oil and solvent as said first and second portions for admixture with the charge as herein specified.

4. Process according to claim 3 wherein said solvent comprises a mixture of methyl ethyl ketone and a saturated hydrocarbon of the C_3–C_6 range.

References Cited in the file of this patent

UNITED STATES PATENTS

1,968,239	Adams	July 31, 1934
2,052,124	Anderson	Aug. 25, 1936
2,612,466	Kiersted et al.	Sept. 30, 1952
2,652,975	Angelo	Sept. 22, 1953
2,726,988	Macke	Dec. 13, 1955
2,773,812	Tench	Dec. 11, 1956
2,782,142	De Vault	Feb. 19, 1957