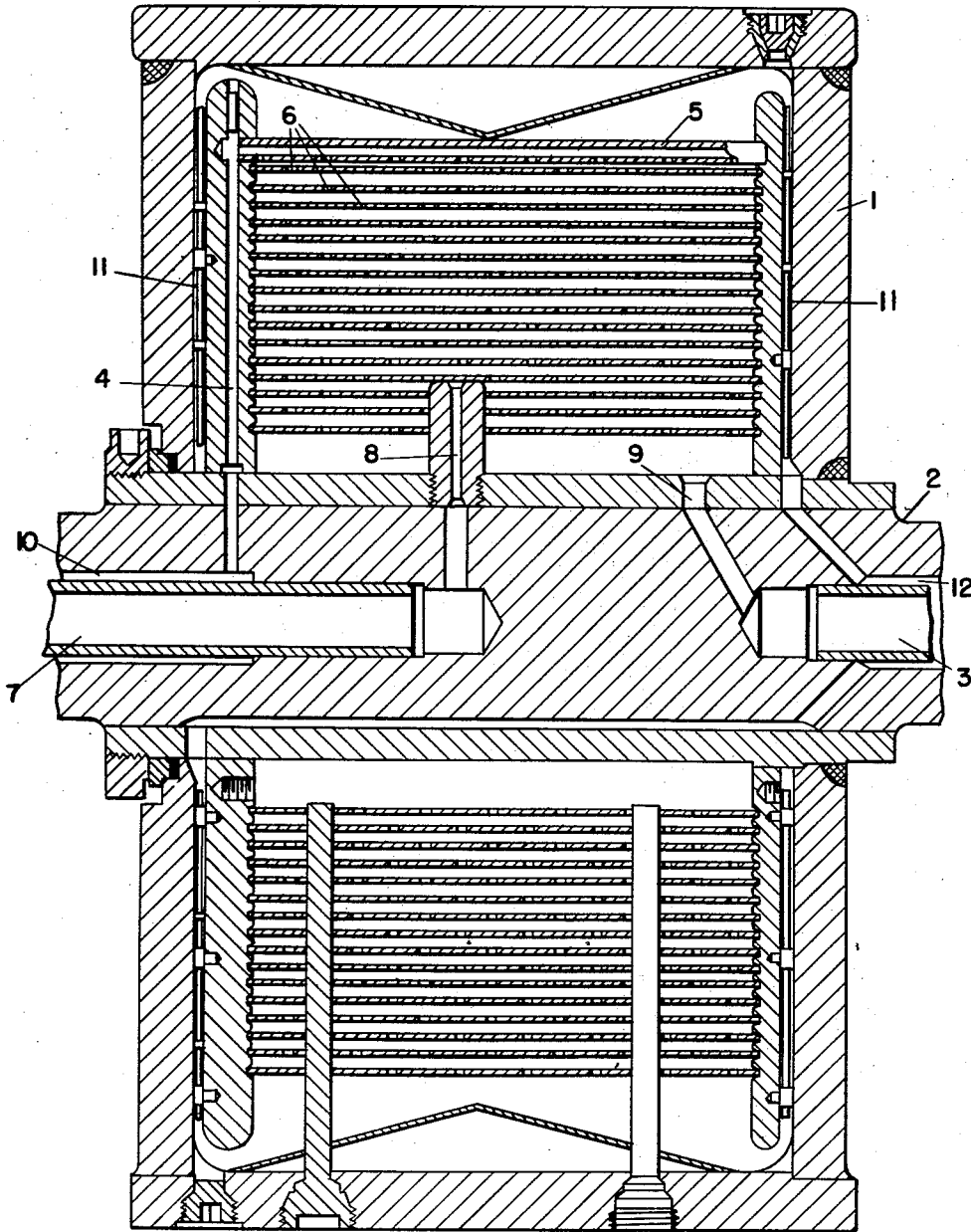


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CENTRIFUGAL DEWAXING PROCESS

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CENTRIFUGAL DEWAXING PROCESS

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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 The oil-solvent stream withdrawn from the centrifuge is distilled to recover the solvent which is then re-used.

Centrifugal devices are known in which countercurrent contact of separate phases is effected through a series of perforated baffles located between the hub and periphery of the rotating centrifugal wheel. A device of this type which can be used to separate wax from oil and countercurrently wash the wax phase with a suitable oil solvent is disclosed in United States Patent No. 2,652,975. In applying such device for this purpose, the chilled waxy hydrocarbon charge, diluted with a dewaxing solvent, would be fed into the centrifugal wheel through a channel in the hub at one of its sides and introduced into the interior at a point intermediate the hub and periphery of the wheel. Chilled dewaxing solvent would be fed through a channel in the hub at the other side of the wheel and introduced into its interior at a point nearer the periphery. The centrifugal force due to rotation of the wheel would cause the wax to pass through the perforations in the series of concentric baffles toward the periphery, while the solvent would flow toward the hub countercurrent to the wax. Dewaxed oil in admixture with solvent would be withdrawn from the wheel through another channel in the hub located on the same side of the wheel as that at which the waxy charge is introduced. Wax collected at the periphery of the wheel would be removed through another channel leading through the hub on the side at which the dewaxing solvent is introduced. Operation of the device of the aforesaid patent hence would involve passage of the waxy charge and the dewaxed oil effluent in opposite directions through the separate hub channels at one side of the wheel and similar countercurrent passage of the solvent and wax through the separate hub channels at the other side. Any differences in temperature of the separate streams at each side of the wheel hence would result in heat transfer between the streams passing into and out of the device through the hub.

In dewaxing an oil it is generally essential that the dewaxing operation be conducted at a particular temperature dependent upon the desired pour point of the oil product. For example, in order to obtain a pour point not above 0° F., it generally is necessary to use a dewaxing temperature of -10° F. or lower. In employing a centrifugal device of the type disclosed in the aforesaid patent to carry out the dewaxing step, we have

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found that a considerable amount of heat is generated within the rotating wheel due largely to friction between the perforated baffles and the materials being processed and, to a minor extent, to mechanical friction in the hub of the rotor. The amount of heat generated depends upon such factors as speed of rotation, physical dimensions of the device, number of baffles therein and the like, but in any case it is substantial. As an example, heat generation in amount equivalent to a temperature rise of 48° F. within the wheel has been observed. The temperature rise occurring from frictional effects requires that the waxy charge and solvent streams fed to the centrifuge be chilled considerably below the desired dewaxing temperature.

The present invention involves a modification in the above-described dewaxing operation which avoids heat transfer between the entering and effluent streams and thereby reduces the amount of chilling necessary to secure the desired temperature within the centrifuge. According to the invention, the waxy charge and wash solvent streams, chilled to a temperature below the desired dewaxing temperature, are fed into the same side of the centrifugal wheel through separate channels in the hub and the dewaxed oil and wax streams are removed separately from the other side. This establishes at each side of the wheel concurrent flow of streams having essentially the same temperature and thus eliminates transfer between the entering and effluent streams. By operating in this manner the incoming waxy charge is not heated by the relatively warmer dewaxed oil effluent and the entering wash solvent stream likewise is not heated by the relatively warmer wax effluent stream. The streams entering the centrifuge thus do not need to be chilled as much as would be required when operating with the centrifugal device disclosed in the aforesaid patent.

The following more detailed description of the invention is made with reference to the accompanying drawing which is a fragmentary cross-sectional view of a centrifugal wheel of a type adapted for practicing the invention.

Referring to the drawing, 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 a suitable dewaxing solvent, chilled to a temperature below the desired dewaxing temperature, is continuously admitted to the interior of the rotating wheel under pressure through inlet line 7 and passage 8 to an intermediate point between the hub and periphery of the wheel. The mixture of charge and solvent entering the centrifuge should have a temperature which is lower than the desired dewaxing temperature by an amount approximately equivalent to the temperature rise resulting from friction between this material and the internal parts of the centrifugal device, particularly the concentric perforated baffles 6. 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 and which has been chilled to a temperature below the dewaxing temperature and preferably to about the same temperature as the waxy charge stream, is continuously introduced under pressure to the interior of the wheel near the periphery through annulus 10, inlet passage 4 and distributor 5. Under influence of the centrifugal force generated in wheel 1, the solvent flows through perforated baffles 6 toward the hub of the wheel, while the wax in the charge introduced through passage 8 passes toward the periphery making countercurrent 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 outlet line 3. The wax in admixture with some of the wash

solvent is collected at the periphery of wheel 1 and 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 time sufficient pressure in the interior of wheel 1 to force the wax cake through the passages provided therefor.

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 preferred 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 device illustrated in the accompanying drawing can be used in the manner described for either dewaxing oil or deoiling wax. Examples of these operations are given below to illustrate the advantages in practicing the invention:

A dewaxing operation is conducted according to the invention to obtain a 0° F. pour point oil from a charge stock which is a solvent refined distillate oil derived from a paraffinic crude oil and typically having a viscosity of 150 S.U.S. at 100° F. and a wax content of 25% by volume. The rate of feeding the charge stock to the dewaxing operation is 100 bbls./hr. and the required dewaxing temperature is about -10° F. The charge stock is first diluted with 300 bbls./hr. of dewaxing solvent and the mixture is chilled to a temperature of about -24° F. and then fed to the centrifuge through inlet line 7. Another portion of dewaxing solvent in amount of 100 bbls./hr. is likewise chilled to a temperature of about -24° F. and then introduced into the centrifuge through annulus 10 and passage 4. Friction generated within the centrifuge raises the temperature therein to about -10° F. From the opposite side of the centrifuge 400 bbls./hr. of an oil-solvent stream, comprising 75 bbls. of oil and 325 bbls. of solvent, is withdrawn through line 3, while 100 bbls./hr. of wax cake, comprising 25 bbls. of wax and 75 bbls. of solvent, is removed via annulus 12. The temperature of each of these effluent streams is about -9° F., which results from a temperature rise of about 1° above the dewaxing temperature due to frictional effects in the hub of the centrifugal wheel.

From the above description of a dewaxing operation operated according to the invention, it can be seen that the charge and solvent streams have to be chilled only 14° below the desired dewaxing temperature. If the operation were conducted with the charge and dewaxed oil effluent passing through the hub countercurrently at one side of the wheel and the wash solvent and wax cake doing likewise at the other side, the charge and wash solvent streams would have to be chilled to a temperature of -58° F. to secure the desired temperature in the centrifuge or in other words 48° lower than the dewaxing temperature. Operation according to the invention thus effects substantial economies in the amount of heat transfer surface required in the chillers.

A deoiling operation is carried out according to the invention, charging 100 bbls./hr. of a slack wax having an oil content of about 50% by volume. The charge stock is mixed with a suitable oil solvent at a rate of about 600 bbls./hr., and the mixture is chilled to a temperature of 36° F. and fed to the centrifuge through inlet line 7. Wash solvent, also chilled to a temperature of about 36° F., is fed to the centrifuge through annulus 10 at the rate of about 200 bbls./hr. Friction within the centrifuge raises the temperature therein to about 50° F. From the opposite side of the centrifuge an oil-solvent mixture, comprising 50 bbls. of oil and 650 bbls. of

solvent per hour, is withdrawn through passage 9, while wax cake, comprising 50 bbls. of wax and 150 bbls. of solvent per hour, is removed through annulus 12. The temperature of each of these effluent streams is about 51° F.

From the foregoing it can be seen that deoiling according to the invention requires that the charge and solvent streams be chilled only 14° below the desired deoiling temperature. By way of comparison, if the operation were conducted with the charge and dewaxed oil effluent passing countercurrent to each other through the hub at one side of the wheel and with the wax cake and wash solvent doing likewise at the other side, the charge and wash solvent streams would have to be chilled to a temperature of about 2° F. before introduction to the centrifuge in order for the temperature therein to be 50° F. In other words, due to heat transfer in the hub of the wheel, each of these streams would have to be chilled about 48° lower than the desired deoiling temperature, as compared to only 14° lower when practicing the present invention.

We claim:

1. In a process for separating wax and oil in the presence of a dewaxing solvent having a density less than that of the wax by means of a centrifugal wheel having between its hub and periphery spaced concentric perforated bands forming an annulus between each adjacent pair of bands and having baffle means closing each end of each annulus, and wherein friction between the flowing materials and said concentric perforated bands causes the materials to become heated above the temperature at which they were introduced to the wheel, the steps which comprise separately cooling a more dense stream comprising dewaxing solvent and waxy hydrocarbon charge and a less dense stream of dewaxing solvent alone each to a temperature below the desired dewaxing temperature, feeding said streams into the interior of the rotating wheel concurrently through separate channels of the hub at one side of the wheel, the dewaxing solvent and waxy hydrocarbon stream being introduced into the interior of the wheel at a locus intermediate its hub and periphery and the dewaxing solvent stream being introduced therein at a locus nearer to but spaced from the periphery, rotating the wheel whereby the less dense stream flows through the perforations in the bands toward said hub and a more dense stream flows concurrently thereto through the perforations in the bands, withdrawing wax from adjacent the periphery through a channel passing through the hub of the wheel at its other side and withdrawing effluent comprising oil and solvent from adjacent the hub through a second channel therein at its said other side.

2. In a process for separating wax and oil in the presence of a dewaxing solvent having a density less than that of wax by means of a centrifugal wheel having between its hub and periphery spaced concentric perforated bands forming an annulus between each adjacent pair of bands and having baffle means closing each end of each annulus and wherein friction between the flowing materials and said concentric perforated bands causes the materials to become heated above the temperature at which they were introduced to the wheel, the steps which comprise admixing a more dense hydrocarbon charge comprising oil and wax with a less dense dewaxing solvent, chilling the mixture to a temperature which is lower than the desired dewaxing temperature by an amount approximately equivalent to the temperature rise resulting from friction between the feed mixture components and said concentric perforated bands, feeding the chilled mixture through a channel in the hub at one side of the wheel and thence into the interior of the wheel at a locus intermediate its hub and periphery, separately introducing chilled dewaxing solvent at a temperature approximating the first-mentioned temperature through a second channel in the hub at said one side of the wheel and thence

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into its interior at a locus between the first-mentioned locus and the periphery, rotating the wheel whereby the less dense stream flows through the perforations in the bands toward said hub and a more dense stream flows countercurrently thereto through the perforations in the bands, withdrawing wax from adjacent the periphery through a channel passing through the hub of the wheel at its other side, and withdrawing effluent comprising oil and solvent from adjacent the hub through a second channel therein at its said other side.

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