

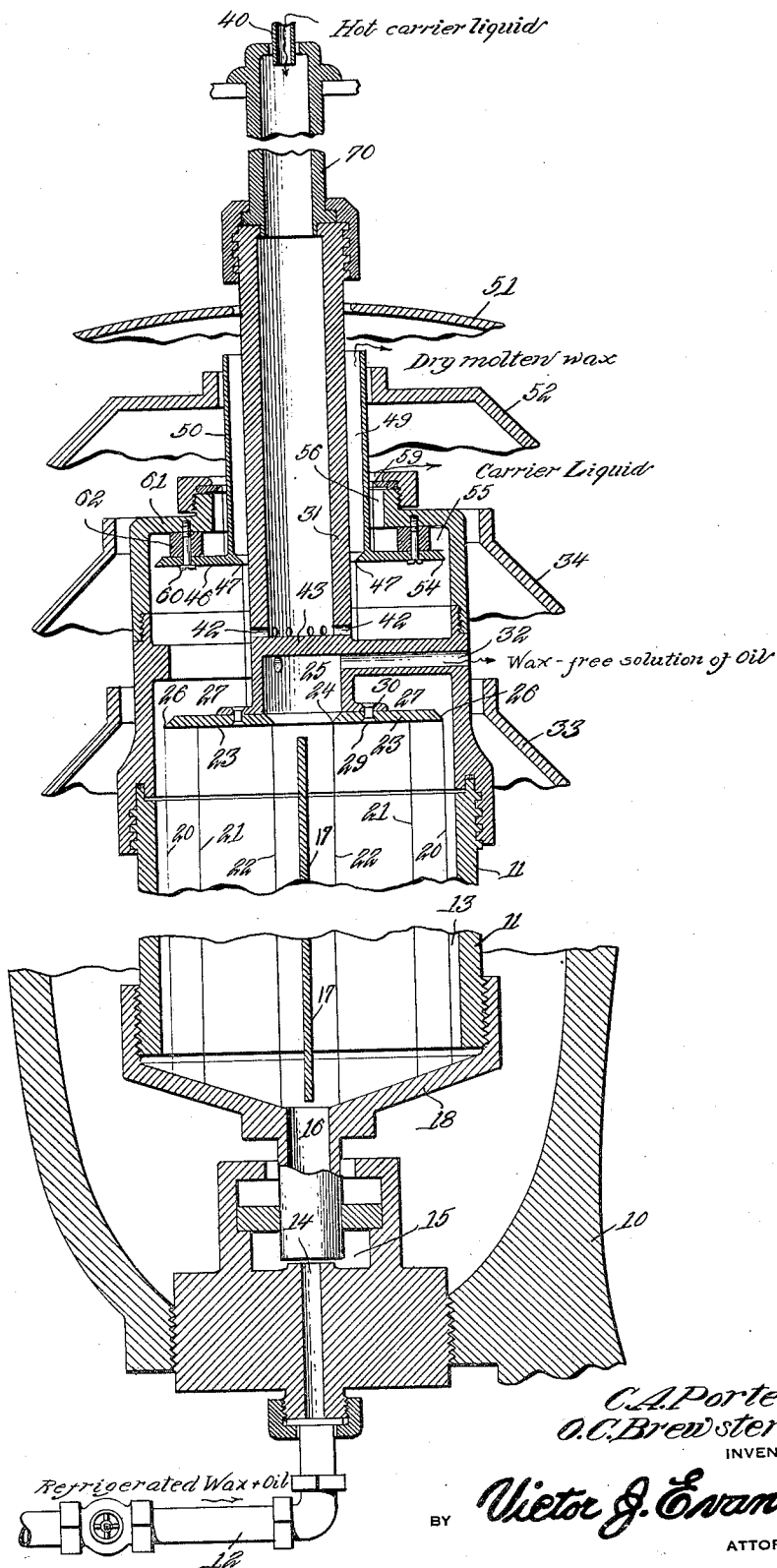
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C. A. PORTER ET AL

PROCESS AND APPARATUS FOR CENTRIFUGAL SEPARATION

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WITNESS:

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PROCESS AND APPARATUS FOR CENTRIFUGAL SEPARATION.

Application filed November 19, 1921. Serial No. 516,495.

To all whom it may concern:

Be it known that we, CLOVIS A. PORTER and OSWALD C. BREWSTER, citizens of United States, residing at Casper, Wyoming, have
5 invented new and useful Improvements in Processes and Apparatus for Centrifugal Separation, of which the following is a specification.

The object of the present invention is the
10 production of a process and apparatus for treating lubricating oils containing waxy materials, particularly uncrystallized paraffin wax or petrolatum and similar materials, for the separation from such oils, of
15 such waxy materials.

Processes have already been proposed in which the oil is first diluted with a suitable liquid which at a relatively high temperature forms a solvent for both the oil
20 and waxy material, but which at a low temperature does not form a good solvent for the waxy material, but does form a good solvent for the oil. An example of such a liquid is ordinary naphtha produced in the
25 distillation of petroleum oils, as one of the lighter fractions.

The apparatus of the present invention is shown, more or less diagrammatically, in the annexed drawing, in which 10 represents
30 a suitable frame and 11 represents a bowl of a centrifugal liquid separator. This bowl is ordinarily made of considerable length, only the top portion and the bottom portion being shown in the drawing. 12 indicates a pipe through which the mixed and refrigerated liquid is introduced, this liquid
35 for example being a mixture of the heavy lubricating oil to be treated, and a solvent such as gasoline or naphtha, already refrigerated to the desired low temperature.
40 There is already provided in the centrifugal machine, a layer 13 of a suitable liquid which is not miscible with the oil or solvent, and which will not freeze at the lowest temperatures attained by it, as employed in the
45 process. A solution of calcium chlorid may be mentioned, by way of example. The liquid is fed in through the connection 14 into the space 15, from which it passes into the conduit 16 and into the bottom of the centrifugal rotary bowl. One or more fins
50 or blades 17 are positioned in the bowl, adjacent to the inlet opening 16, for giving the liquid a rotary motion, corresponding
55 with that of the bowl, as soon as said liquid

enters the said bowl. The said blades are rigidly attached to the sides of the bowl or to the cap 18 forming the bottom of the bowl.

In the bowl 11 the liquid accordingly will
60 rotate with the same speed as the bowl itself, whereby it readily becomes stratified, forming layers which are more or less distinct from each other. The line 20 indicates the inner wall of the layer of carrier
65 liquid in the bowl. Line 21 indicates the inner wall of the layer of waxy material, which is separated by the centrifugal force, from the solution of oil in solvent. Line
70 22 represents the inner wall of the layer of oil in solvent. 23 represents an annular double dam plate; the inner edge of this plate at 24 forms the wall over which the
75 light liquid, namely, solution of oil in solvent, from which the wax has been removed, passes into the chamber 25. The
80 outer edge of the plate 23 at 26 forms the dam under which the separated waxy material passes from the main bowl into the space 27 hereinafter referred to as auxiliary
85 compartment. It is to be understood that the plate 23 can be made in one piece, as illustrated, or if desired, can be made in two pieces which either fit against each other
90 or overlap. The plate 23 is secured by suitable screws or rivets 29 to the flange 30 carried at the lower end of pipe 31, this pipe forming the shaft by means of which
95 the bowl is rotated. The liquid entering the compartment 25 flows out through the radial pipes 32, into the space above the cone 33 and below the cone 34. From the said space or compartment the wax-free
100 solution of clear oil is run off in any suitable manner to a storage tank or to a still
105 in which the naphtha is separated from the wax-free oil.

It is understood that the liquid 13 is previously introduced into the bowl of the separator in any suitable manner, before the
110 introduction of oil begins. This liquid need not be refrigerated at the time it is introduced, but the mixture of oil in solvent introduced through pipe 12 is already at a
115 sufficiently low temperature to maintain the liquid 13 cold. It is not necessary to refrigerate the liquid during its passage through the centrifugal machine, as in ordinarily running, by sufficiently cooling the liquid before the same enters through the
120

pipe 12, the liquid will not warm up in its passage through the bowl 11 sufficiently to redissolve any substantial portion of the precipitated wax.

5 A heated carrier liquid, preferably of the same composition as the liquid 13 enters through the pipe 40 at the top of the apparatus. This liquid travels downwardly through the pipe 31 and passes outwardly 10 through the radial holes 42 which are placed near the lower end of the pipe 31, and preferably just above the plate 43 which forms a complete closure in the lower part of the pipe 31, just above the outlets 32, through 15 which the wax-free solution of oil leaves the bowl. The passages 42 being radial, the liquid passing out through these passages acquires the same circumferential velocity as the bowl itself, which condition is also 20 assisted by the pipes 32 in the compartment 27. The liquid introduced by 40 being hot, the wax in compartment 27 will readily be melted and the centrifugal force will cause the separation of the wax in a 25 molten state from said hot carrier liquid. In the upper end of the compartment 27 is a second annular ring dam plate 46, the inner edge 47 of which forms the overflow for the wax, this wax then passing out 30 through the tubular passage 49 formed by the tube 50, said dry molten wax passing out of the tube 50 at its top into the space between the cover 51 and the cone 52, from which space the dry molten wax is drawn 35 off in any suitable manner. The hot carrier liquid in the compartment 27 passes under the outer edge 54 of the plate 46, into the space 55, from which it passes through the tubular space 56 and over the dam 59, into 40 the space between the cone 52 and the cone 34, from which space the said carrier liquid is drawn off in any suitable manner. The plate 46 is preferably, as indicated in the drawing, made integral with the tube 50, 45 and this plate is fastened by means of the screws 60 to the ring 61, suitable spacing blocks 62 being placed at intervals around the upper side of the plate 46, in the compartment 55.

50 It is to be understood that a suitable motor will be attached to some portion of the length of the tubular shaft 70, for spinning the centrifugal device at a high speed, sufficient for separating the solidified wax 55 from the solution of clear oil in solvent, which speed will, of course, be amply sufficient for causing the separation of wax from carrier liquid in the compartment 27. It will be understood that the portion of the 60 bowl 11, between the inlet 16 and the plate 23 will form the main centrifugal bowl, while the compartment 27, or space between the plate 23 and plate 46 will form the auxiliary compartment. The speed of the cen- 65 trifugal, the temperature of the liquid en-

tering thru pipe 12 and the speed of flow of this liquid, as well as the temperature and speed of flow of the liquid entering thru pipe 40, will depend upon the character of the oil being treated, and the degree to 70 which it is desired to remove the wax from the oil under treatment. Without limiting ourselves to details, we will state that in treating ordinary cylinder stock, the bowl may be rotated at a speed of 17,000 revolu- 75 tions per minute, the liquid entering thru pipe 12 being for example 40% heavy oil and 60% naphtha, and being refrigerated to 0° F., while the liquid entering thru pipe 40 may have a temperature of say 175 to 80 200° F. Then by regulating the valve in pipe 12 and the valve in pipe 40, the desired separation may be obtained.

The present invention comprises a substantial improvement over the copending 85 cases of O. C. Brewster, Serial No. 508,530 filed October 18, 1921 and Serial No. 516,500 filed concurrently herewith, based upon the fact that in the present case the injection of the carrier liquid into the upper com- 90 partment of the bowl is much more positive, thereby rendering control and adjustment of the degree of separation easier. A further advantage consists in that by centrifugally separating the wax from the carrier 95 liquid, the separation is made much more complete and very much quicker, and this is particularly true when certain kinds of waxes which are liable to form persistent emulsions are present, particularly when 100 such carrier liquid contains substances which promote emulsification of wax. In this connection, it may be noted that the carrier liquid coming out at 59 is fed into a heater from which it again is introduced 105 into the pipe 40, and by completely separating the carrier liquid from the wax, no wax is reintroduced with the circulating carrier liquid.

The plate shown at 17 preferably is con- 110 tinued from close to the inlet 16 up to close to the plate 23. This device may preferably take the form of a three wing device, namely, 3 wings or fins which radiate from the center to the periphery of the bowl. 115

In a modified form, it is sometimes advisable to allow the wax and carrier liquid to flow over the dam 59, after which the two may be separated by gravity, after further heating. This, however, is ordinarily not 120 to be recommended. It will be understood that the cones 33, 34 and 52, as well as the cover 51 are preferably stationary. These being spaced away a short distance from the rotating parts, and at the outer edges 125 of the 3 compartments formed between the 4 elements mentioned, suitable outlet spouts are provided, for separately drawing off the wax-free solution of oil, the carrier liquid and the molten wax. 130

We claim:—

1. A process of separating waxy material from oil, which comprises passing a mixture of such oil with a solvent in such proportions as to produce a liquid of low viscosity, while refrigerated sufficiently to cause solidification of a large part at least, of the waxy material, through a centrifugal separator while causing such mixture to float upon a substantially non-progressing layer of aqueous fluid, withdrawing the solution of clear oil in solvent from the centrifugal, withdrawing the precipitated waxy material to a separate compartment of the centrifugal, then adding to such waxy material, a warm, aqueous liquid in amount sufficient to melt said waxy material, subjecting the mixture of molten waxy material and water to centrifugal force and separately withdrawing the separated wax and aqueous liquid.

2. A process which comprises passing a solution of viscous lubricating oil containing waxes, in a solvent therefor, at a temperature at which the waxy materials are rendered largely insoluble, into and through a centrifugal rotor thereby, centrifugally separating the waxy materials from the clear solution, drawing off the latter, mixing the separated waxy material with a warm liquid in which the same is insoluble to melt said waxy material, centrifugally separating the resulting mixture and separately drawing off the molten waxy material and the said liquid in which same is insoluble.

3. A centrifugal machine comprising a main bowl and an auxiliary compartment rotating therewith, an inlet located axially of the main bowl, an annular double dam plate in the opposite end of main bowl, separating said main compartment from said auxiliary bowl, the inner edge of the double dam plate communicating with an outlet for light liquid, the space around the said double dam plate leading into said auxiliary compartment, a pipe leading centrally into said auxiliary compartment, and having a radial hole into said latter compartment, an annular double dam plate in said auxiliary compartment, the inner edge of said last named plate forming an outlet for light liquid from said auxiliary compartment, the space around said last named plate leading to a separate outlet for heavy liquid for said auxiliary compartment.

4. In a centrifugal liquid separator comprising a main bowl and an auxiliary compartment having the same axis of rotation, a main inlet at one end and an auxiliary inlet at the other end, said auxiliary inlet formed of a conduit which is provided with a dam, and having a series of holes in its sides in proximity to said dam, such holes being located within said auxiliary compartment.

In testimony whereof we affix our signatures.

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