Nov. 15, 1927. 1,649,095

O. C. BREWSTER

PROCESS OF REFINING LUBRICATING OILS

Filed Oct. 18, 1921 2 Sheets-Sheet 1

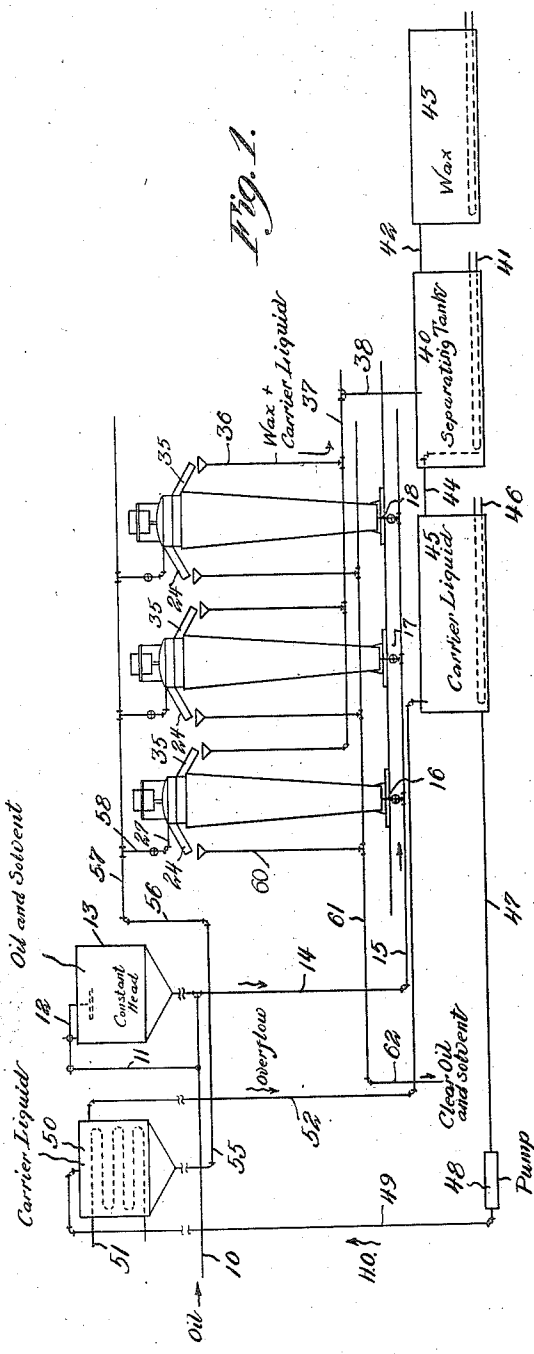


Fig. 1.

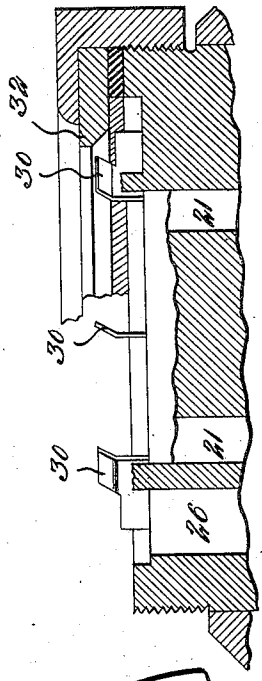


Fig. 3.

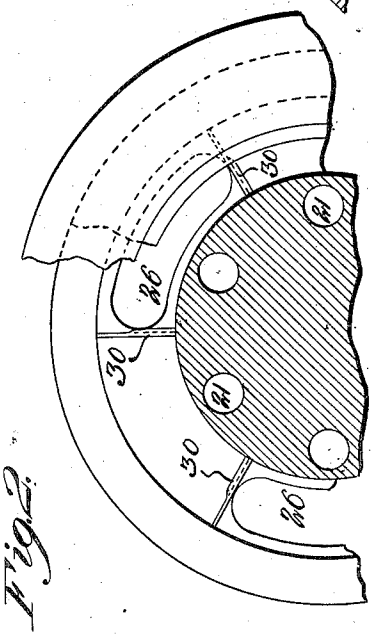


Fig. 2.

O. C. Brewster
INVENTOR

BY Victor J. Evans
ATTORNEY

WITNESS:
L. M. Evans

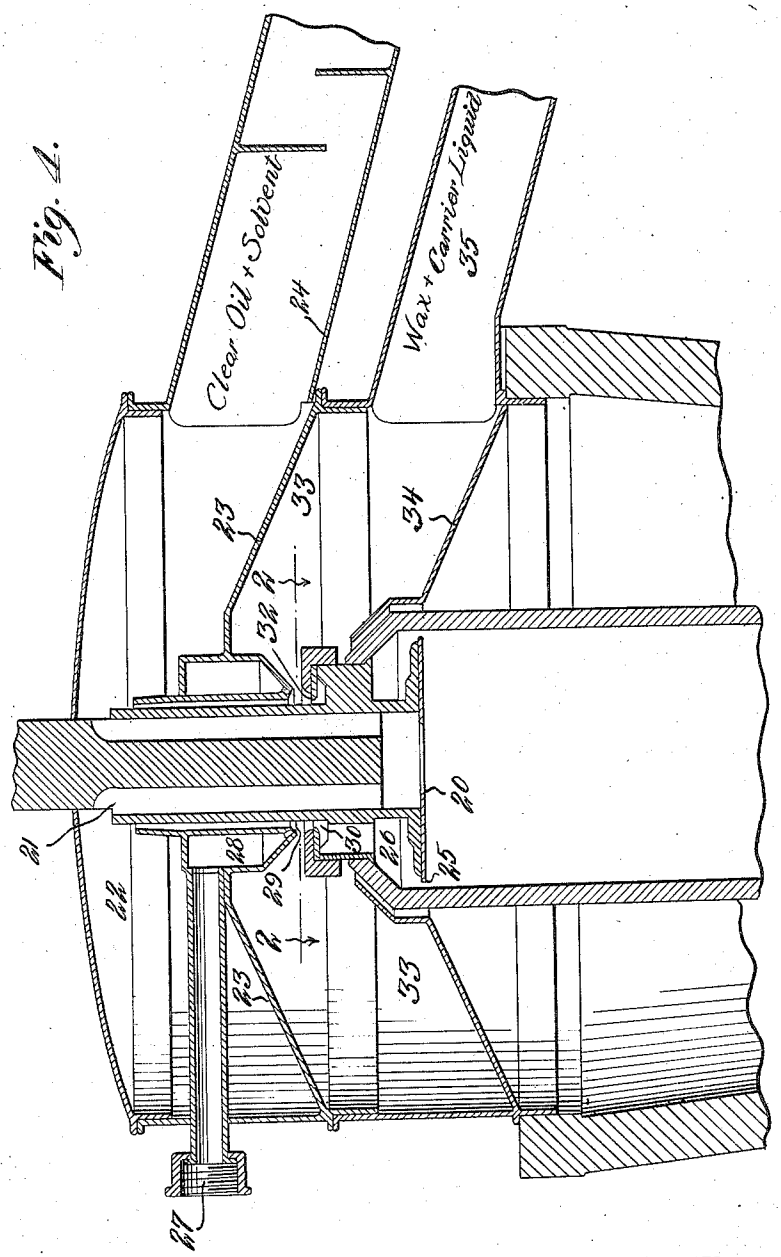
Nov. 15, 1927. 1,649,095

O. C. BREWSTER

PROCESS OF REFINING LUBRICATING OILS

Filed Oct. 18, 1921 2 Sheets-Sheet 2

Fig. 4.



O. C. Brewster
INVENTOR

BY Victor J. Evans
ATTORNEY

J. M. Evans

WITNESS:

Patented Nov. 15, 1927. 1,649,095

UNITED STATES PATENT OFFICE.

OSWALD C. BREWSTER, OF CASPER, WYOMING, ASSIGNOR TO THE SHARPLES SPECIALTY COMPANY, A CORPORATION OF DELAWARE.

PROCESS OF REFINING LUBRICATING OILS.

Application filed October 18, 1921. Serial No. 508,530.

The present invention relates to the treatment of lubricating oils for the removal of waxy materials, namely, materials which are liable to solidify when the temperature of the oil is reduced. Oils containing waxes are less desirable for certain classes of lubrication. The removal of the wax improves the "cold test" of the oil.

It has heretofore been proposed to dilute lubricating oil of the character referred to with a solvent thereof such as naptha or gasoline, to refrigerate the mixture, and to inject the refrigerated mixture, together with a refrigerated carrier liquid of about the same temperature, into a centrifugal bowl separator, the liquid oil flowing out from the outlet nearest the center and the carrier liquid and wax flowing out through the outlet nearest the periphery.

In accordance with the present invention, I preferably dilute the lubricating oil with a light hydrocarbon liquid such as naptha or benzine, the amount of dilution depending upon the viscosity of the oil and the amount of waxy material which it contains. I then pass the said diluted oil, in a refrigerated condition, through a centrifugal bowl separator, in which is provided a substantially stationary (i. e. a non-progressing) carrier liquid, which liquid is refrigerated by the refrigerated mixture of solution (oil and solvent) and solid waxy material held in suspension, which is introduced. The carrier liquid originally placed in the bowl remains, as a film or layer covering the side of the bowl, and it is not necessary to continue to introduce carrier liquid with the mixture as was done in the prior process above referred to. I withdraw the wax from the oil continuously, from the centrifugal bowl separator, and preferably at the end opposite to where the refrigerated mixture is introduced. It is to be understood that the introduction and withdrawal are substantially continuous.

During the operation of the centrifugal process the wax is separated in the centrifugal bowl from the oil, and the wax passes into a compartment, through which it moves to its outlet from the bowl, as substantially solid wax. The wax in this compartment is melted by introducing into said compartment a hot liquid, which liquid is preferably of the same character and same density as the carrier liquid forming the stationary or non-progressing film or layer on the interior of the bowl.

The process will be described more in detail in connection with the annexed drawings in which Fig. 1 represents in a diagrammatic way, an elevation of the entire apparatus, three centrifugal machines being shown therein, but it is obvious that any desired number can be employed. Figure 2 represents a horizontal section with parts broken away of a preferred form of the centrifugal separator, which I preferably employ in carrying out the process, taken approximately on line 2—2 of Figure 4. Fig. 3 is a detailed section with parts broken away of the upper part of the preferred centrifugal separator shown in Fig. 2, and Fig. 4, is a vertical section with parts broken away of a preferred construction of the upper part of the same centrifugal liquid separator.

In carrying out the process, the refrigerated oil or preferably the refrigerated mixture of oil and solvent with precipitated waxy material enters through pipe 10, pipe 11 and pipe 12 into a tank 13 in which a constant head of liquid is maintained, for example by a suitable float in the tank connected with a valve in pipe 12. The liquid flows downwardly continuously through pipe 14 into the header 15 from which it is supplied continuously in regulated quantities to the centrifugal machines, by the valve pipes 16, 17 and 18. The bowls of the centrifugals (which are usually vertical) already carry the film of carrier liquid, which may be any liquid which is not miscible with the oil or solution or oil under treatment, a solution of calcium chloride, common salt or the like, or in some cases clear water being suitable for the purpose. There is then produced in the centrifugal bowl three strata, the outermost or heaviest being the carrier liquid, the next being the precipitated wax and the innermost being the oil and solvent freed from wax by the centrifugal action. The liquid oil and solvent overflows (passes inside of) the ring dam 20 and passes upwardly through the channels 21 into the upper cover 22, from which it falls down on to the plate 23 and is drawn off through spout 24. The wax passes under (outside of) the edge 25 of the dam, and into the space 26. The wax is melted by hot carrier liquid introduced

through pipe 27 into the chamber 28 provided with a narrow slit or small holes 29 at its lower end. This liquid is projected into the space 26 by means of fins or blades 30, three of which are illustrated in Fig. 3, the left hand one being bent backward and the right hand one being bent forward. The middle one of these three fins shows the preferred amount of bending. These fins, rapidly rotating, engage the liquid projected from 29 and impart to such liquid the same rotary motion which the bowl has, and project the liquid downwardly into the compartment 26. This liquid is hot and accordingly melts the wax in the compartment 26, the molten wax and hot carrier liquid flowing out over the ring dam 32, into the space 33 on to the lower cover 34 and out through the spout 35 which spout may be, as shown in Fig. 4, on the same side of the machine as the spout 24, or these two spouts may be on opposite sides, as shown in Fig. 1.

During the centrifugal separating operation the oil weir or dam 20 and the wax weir or dam 32 bear such relation to the axis of the bowl and to each other that separation to a desired degree will occur and the liquid balance will be maintained in the bowl. Thus, centrifugal force of the strata of oil and wax below the ring dam 20—25 will be in liquid balance with the centrifugal force of a supplemental body of liquid consisting of the carrier liquid (and whatever wax is contained therein) in the compartment 26 which lies between dam 20—25 and dam 32, but the weir 32 is so adjusted that the stratum of wax has the proper thickness in a radial direction to insure proper separation of the wax from oil and the discharge of substantially oil-free wax. The centrifugal bowl is preferably operated at high speed, for example, 15,000 revolutions per minute.

The amount of hot liquid injected through 27 is preferably such as to maintain the wax in a freely molten condition in the spout 35, pipes 36, header 37 and pipe 38. The mixture of wax and carrier liquid flows into the separating tank 40, which tank is provided with a suitable heating coil 41, a steam coil being suitable for this purpose. In the tank 40 the liquids stratify the wax flowing through pipe 42 into a tank 43, from which the wax can be drawn off and further treated in any desired way, for distilling off the small amount of naptha present in the wax and the production of petrolatum or other suitable products. The hot carrier liquid which separates in tank 40 is drawn off through pipe 44 into a heating tank 45 in which the temperature of this liquid is kept up by a suitable coil 46. This liquid is pumped out through pipe 47, pump 48 and pipe 49 into a liquid tank 50 which tank is likewise provided with a suitable steam coil or other heating coil 51. A pipe 52 from the upper part of the tank 50 may carry away any excess of carrier liquid taken into the tank 45. The liquid from tank 50 flows through 55, 56 into the header 57, from which branch pipes 58 provided with suitable valves supply the liquid to pipes 27.

The clear oil flowing out from spouts 24 runs into spouts 60 into the header 61 and may be drawn off at 62 either to a storage tank or to a still for separating the oil from the solvent, in case the latter was used.

In the operation above described, in which carrier liquid is fed into the wax discharge outlet of the bowl, there occurs a more complete separation of wax and oil than in the operation in which carrier liquid is continuously fed to the bowl together with a mixture of wax, oil and solvent. And, when the carrier liquid is fed hot into the wax discharge the wax, which at the temperature of separation may be of a stiff and adhesive character, may be disposed of and caused to flow out of the spout 35 by adjustment of the amount of hot liquid introduced through pipe 27 and the amount of mixture introduced through pipe 16.

The amount of dilution of the oil, in the first step of the process depends largely on the gravity and viscosity of the oil and on the extent to which it is desired to separate the wax from the oil. As an example, it is found that a certain grade of heavy cylinder stock, 24.4° Bé. gravity, should be diluted till the gravity of the solution at 60° F. is 42° Bé.—thus, when using 57° Bé. naptha, representing a proportion of about 40% stock and 60% naptha. The addition of the naptha serves not only to reduce the viscosity of the oil, but it also lowers the specific gravity of the oil, and hence makes a greater difference in specific gravity between the oil solution and the wax, thus facilitating the separation of the wax from the oil solution. In fact, in most stocks the wax is of slightly lower specific gravity than the oil and the addition of the light solvent reverses this condition and makes the specific gravity of the oil much less than that of the wax.

The carrier liquid forming the stationary film in the centrifugal is preferably of the same composition as the hot carrier liquid introduced through pipe 27. While the layer of carrier liquid serving to furnish a frictionless surface over which the layer of wax in the main body of the separator may progress is first supplied hot it is evident that this layer being in effect stationary or non-progressing will be chilled by the wax in contact with it and will not appreciably heat the wax, thus causing it to return into solution. It is for this reason that such a carrier liquid must be used that it will not be frozen at the lowest tempera-

ture attained by it in the separator. In running solution chilled to −10° F. a 20°–25° Bé. gravity solution of calcium chloride has been found suitable. In other instances clear water has been used when separating oil and wax mixtures that have been chilled to a temperature between −1° F. and 35° F. The carrier liquid introduced through pipe 27 is of sufficiently high temperature to melt the waxes. A range of from 170° F. to 190° F. has been found suitable depending on the melting point of the wax being separated.

The temperature conditions in the centrifugal bowl will be substantially uniform from the bottom of the bowl, where the liquid is introduced, up to the dam 25, but when injecting relatively great quantities of hot liquid from 28, the temperature might rise a few degrees, just below the dam 25. However, the wax having reached this point, and having been substantially separated from the oil, it will not redissolve therein to any appreciable extent.

I claim:

1. The method of treating oils which comprises the centrifugal separation of mineral oil material comprising a waxy constituent capable of being easily melted in combination with the step of delivering a hot carrier liquid to the centrifugal rotor at the place of discharge of the said waxy constituent.

2. In the process of centrifugally separating wax from petroleum oil by methods involving the passage of a refrigerated solution of such oil into and through a centrifugal rotor in which separation is effected, and in which is provided a layer of cold carrier liquid within which such oily material flows, the herein described step of directing hot liquid into the wax outlet of the centrifugal rotor, such hot liquid being in amount sufficient to melt the said wax, and such hot liquid also being non-miscible with oil and non-miscible with molten wax.

3. In the process of centrifugally separating wax from petroleum oil by methods involving the passage of a refrigerated solution of such oil into and through a centrifugal rotor in which separation is effected, and in which is provided a layer of cold carrier liquid within which such oily material flows, the herein described step of directing a large number of streams of warm liquid into the wax outlet of the centrifugal rotor, to melt the wax and flush it out of the centrifugal.

4. In a process of treating lubricating oil containing waxy constituents, which comprises passing a refrigerated mixture of solvent and such oil into a high speed centrifugal liquid separator, while the rotating bowl of said centrifugal contains carrier liquid stationary relatively thereto which is non-miscible with the lubricating oil and while the solution of lubricating oil is at a temperature low enough to cause solidification of the waxy constituents, whereby said waxy constituents are caused to precipitate and to be forced out of contact with the lubricating oil, and discharging the wax separately from the oil, the step of jetting hot liquid into the passage through which wax is discharging.

5. The method which consists in subjecting a mixture of oil and precipitated wax to centrifugal force in a centrifugal bowl and maintaining therein a body of carrier liquid, separately discharging the wax, and feeding hot carrier liquid to the bowl at the natural place of discharge for the wax.

6. The method which consists in subjecting a mixture of oil and precipitated wax to centrifugal force in a centrifugal bowl and separating and separately discharging the wax and oil, and feeding hot liquid into contact with the wax after its separation from the oil and prior to its discharge from the bowl.

7. The method of separating wax from petroleum oil which comprises maintaining a main body of oil, containing wax precipitated by chilling, within the revolving rotor of a centrifugal machine and subjecting it to centrifugal force to separate wax from the oil, maintaining a supplemental body within the rotor, passing separated wax from said main body into said supplemental body, and feeding hot liquid into contact with said supplemental body through the wax discharge and discharging it therefrom with the wax.

In testimony whereof I affix my signature.

OSWALD C. BREWSTER.