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CENTRIFUGE FOR THE DEWAXING OF OILS

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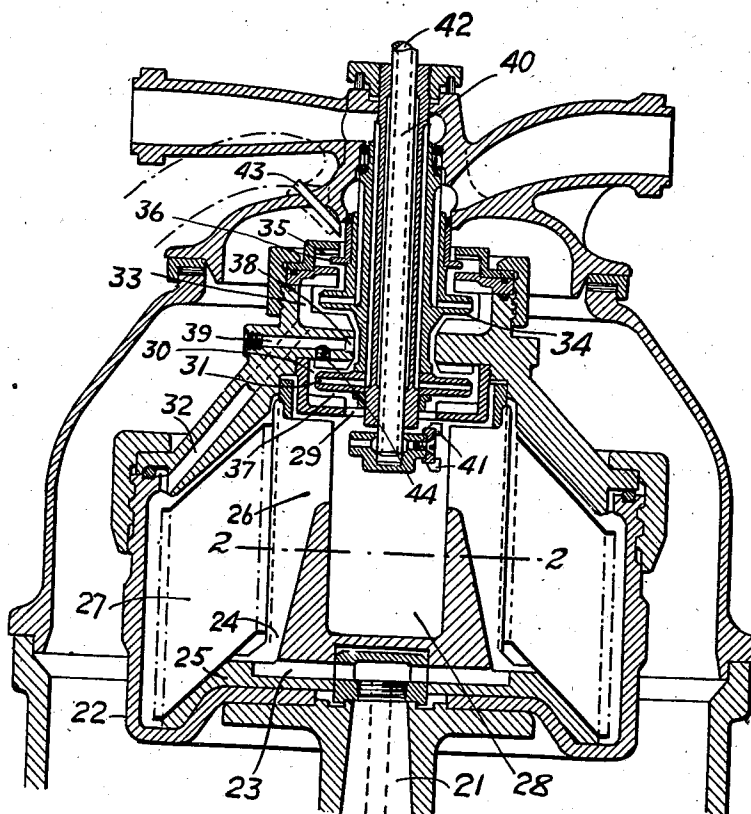


FIG. 1.

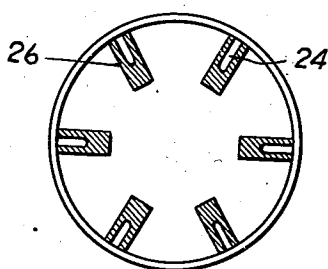


FIG. 2.

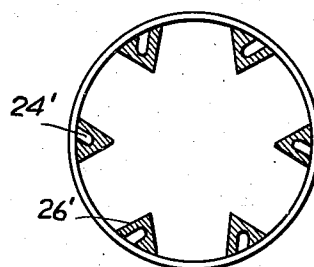


FIG. 3.

WITNESS:

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CENTRIFUGE FOR THE DEWAXING OF OILS

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5 Claims. (Cl. 233-40)

In centrifugal dewaxing of mineral oils, hydrogenated oils, etc., by the aid of a solvent added in order to make the oil sufficiently fluid at low temperature, the precipitated wax moves either inward or outward in the centrifugal bowl depending on whether the oil solution is heavier or lighter than the precipitated wax. In dewaxing with heavy solvents, the heavy solvents most commonly used are tri-chlor ethylene, dichlor ethane and carbon tetrachloride, with or without addition of other liquids such as acetone, methyl ethyl ketone, methyl acetate or methyl formiate. In the case of dewaxing with light solvents, naphtha or benzene are generally used, with or without similar additions. In both cases the wax is discharged from the centrifuge bowl as a more or less viscous mass.

It is very important that as small an amount of oil as possible be discharged with the wax, as the escape of any oil with the wax involves substantial loss, owing to the great difference between the prices of a high quality oil and wax. Consequently the centrifugal bowls are adjusted to produce as hard and dry a wax as possible. Consequently the pressure required for discharging the wax becomes very high. In ordinary centrifugal bowls this pressure can be generated only by displacing the boundary surface between wax and oil from its natural position with regard to the specific gravities of the various media, the rate of throughput, etc. By so doing, however, the separating chamber of the bowl is not utilized in the best way; that is, the amount of oil which can be treated per time unit in the bowl becomes inferior to what it would be if the said boundary surface were correctly located.

It has therefore been suggested to discharge the wax by means of a skimming or paring device. By changing the position of the orifice of this device in radial direction in relation to the rotation axis of the centrifugal bowl it is possible to obtain wax of varying consistency. Experience has shown, however, that arrangements of this type can be used only if the wax mass be comparatively fluid. Otherwise the resistance to movement and deformation in the tube or channel system of the skimming device become too great.

My invention comprises a centrifuge which, while adapted for the separation from any liquid of solid matter lighter than the liquid, is more particularly intended and adapted for the separation of wax from a heavier oil solution, and comprises means for insuring a more complete separation within the bowl of the wax and the heavier oil solution, means facilitating the dis-

charge of the thus separated wax from the bowl and also for imparting sufficient fluidity to the outflowing wax to enable it to be discharged through a paring device, and means whereby wax may be allowed to escape from a discharge channel communicating with the separating chamber of the bowl without flowing through the parer.

In the drawing: Fig. 1 is a vertical cross-section through a centrifuge embodying my invention. Fig. 2 is a horizontal section on the line 2-2 of Fig. 1. Fig. 3 is a view, similar to Fig. 2, of a modification.

The liquid to be separated is introduced through the hollow spindle 21, which advantageously communicates with the supply pipe for liquid by a packing device (not shown, but known in the art). In the bottom 22 of the bowl is a channel-system 23 in which the various channels communicate as uniformly as possible with the central hole in the spindle 21. The channels of the system 23 also communicate with grooves 24 positioned in the wings 26 of the distributor 25. The open sides of the grooves are turned outward and they are provided with bottoms sloping inward and upward. The object of this arrangement is to obtain a uniform distribution of liquid in the pile of discs 27, and to enable the solid particles which are separated already in the distributor to slide along the sloping bottom of the grooves upward and into the collecting chamber 28 situated inside the separating chamber as close to the overflow 29 for the solids as possible. By using channels of this shape I not only obtain a uniform distribution of the mixture, but also avoid re-mixing of separated solids and liquid, which would occur if the mixture were supplied through vertical openings directly communicating with the system of channels 23. The lateral walls of the grooves are suitably used for guiding the discs in known manner. It is important that the channel system 23 should be located below the upper edge of the lowermost disc, as shown on the drawing. The separated solid particles thereby move similarly in radial direction, which results in the accumulation in the central part of the bowl of a symmetrical cylinder of separated solids.

From an examination of the distributing wings 26, it will be seen that the separated solids are compressed on their way towards the centre. As it may thereby occur in some cases that the solid matters become so hard that all movement in direction inwards ceases, even if the pressure from the outside is increased to several kilograms per square centimetre, it may be advantageous to

construct the central portion according to Fig. 3 in which case there is no compression at all. In this figure, 26' are the wings and 24' the discharge grooves therein.

In spite of the precautionary measures indicated above, there is a risk that the time necessary for the solids separated at the bottom to travel to the overflow 29 at the top of the bowl is so long that the solids are thereby very much dried. The result of this is that the movement in axial direction is rendered more difficult. It has proved that if the drying is driven too far, a layer may be obtained which does not move at all. In order to avoid this, mechanical devices may be provided in the machine.

Fig. 1 shows a device of this kind, consisting of a member 40 which can be moved up and down. To the said member, elements 41 are fixed which work the inner side of the rotating layer of solids which is thereby prevented from becoming too heavy. I have found that it is generally possible with this simple device to keep such a plasticity of the solids in the inner part of the bowl that they can without difficulty be continuously discharged from the bowl.

Instead of an axially movable member it may in some cases be advantageous to have a fixed knife extending from the upper part the whole way down into the central chamber 28, by which knife the solid matters are continuously peeled off. It may also be necessary to adjust the elements 41 during operation to different working depths in the solid layer, and it may therefore be suitable to make them adjustable from the outside, for instance, by supports in the form of toothed rods. This arrangement may be used in connection with both fixed and axially movable elements. It is however possible that in the treatment of some liquids, solid matters are obtained for the transport of which more complicated arrangements are required. Arrangements for this purpose may be built according to a great many different principles. The member moving upwards and downwards may for instance be constructed as a paring device of about the same type as those used in cream separators. Such paring devices may be either disc-shaped or tube-shaped.

By making the device movable along the centre line of the bowl, the solid matters may be removed therefrom without having to move in the bowl in axial direction. It is further possible to arrange the paring device in co-operation with a container provided inside the said device, the peeled-off mass being collected in the container and then being discharged from the bowl in any suitable manner. It is possible to build a pump in the container, or to lift the container out of the bowl by mechanical means to empty and then to replace it. It is also possible to give the aforementioned elements such a shape that the chips formed in the peeling are thrown out of the chamber 28.

In the figure a bored channel 42 is shown in the central member 40, through which channel washing liquid can be introduced for washing out as far as possible the liquid sticking to the solids. When a heavy diluent, for instance trichlor ethylene, is used in connection with separation of an oil, containing wax, a bowl of the present type may be employed. It is then desirable that the wax should be as completely liberated from oil as possible, and this may be obtained by sprinkling on the surface of the wax oil-free trichlor ethylene, which is passed through the wax layer and thereby dissolves and removes part of the oil.

In the further description of the separator it will be assumed that the bowl is used in connection with the separation of wax. The separated wax enters the chamber 30 in which a discharge device 31 is arranged. The liquid liberated from wax is conducted through channels 32 to an upper chamber 33 in which a second discharge device 34 is arranged.

A serious inconvenience with previously used centrifuges for this purpose is the high power consumption which is due to heavy gases, for instance of trichlor ethylene, penetrating to the chamber surrounding the bowl. In the present centrifuge, such gases are prevented from leaving the bowl by a packing device, consisting of a chamber 35 filled with liquid and into which a stationary disc 36 projects. This arrangement has substantial advantages as compared with those previously used, in which both wax and oil are thrown out into collecting vessels of the same type as those used for open cream separators. Sealing liquid is fed to the chamber 35 through a pipe 43.

In the case of dry wax it may be difficult to discharge it through the paring device 31 illustrated, and step should therefore be taken to soften the wax. This may be effected by introducing a diluting liquid into the chamber 30 or to the separated wax before it reaches the chamber, which liquid should be of the same kind as the one used as additional liquid during the separation. The additional liquid may advantageously be supplied through the member 40. In order to get effective mixing it has proved advantageous to have a relatively small play 37 between the bottom of the chamber 30 and the lower side of the paring device 41. It may thereby in some cases be suitable to provide an axially movable disc in the bottom of the chamber, which disc participates in the rotation of the bowl and which is pressed on the stationary paring device by a suitable arrangement. With an arrangement of this type a very intimate mixing may be obtained. In order to prevent wax from overflowing from chamber 30 to chamber 33, or oil in the reverse direction in the case of unsuitable adjustment, it may be advantageous to provide an annular channel 38 between the two chambers which communicates with the atmosphere by openings 39. As it is desirable to work in ordinary atmosphere it may be advantageous to provide these openings 39 with automatic valves which intermittently let through the liquid leaking out this way.

In a centrifuge of this type it is suitable to use regulating devices, which in principle are of the same type as those used in cream separators, for regulating the bowl so that wax and oil are discharged in the correct proportions; that is, as little oil as is practicable should be contained in the wax when it is removed from the drying space of the bowl. If the plugs 44 are taken out, the wax can be removed directly from the bowl, without having to use the paring device 31. This may be advantageous if the wax becomes very hard.

What I claim and desire to protect by Letters Patent is:

1. A centrifuge adapted for the separation of precipitated wax from an oil solution of higher specific gravity comprising a rotary bowl enclosing an annular outer zone extending to the periphery of the bowl, in which said separation is effected, and an inner central zone, surrounding the axis of the bowl, into which the separated wax is discharged and in which it accumulates, the bowl having at the upper end portion of said

inner central zone an outlet through which the severed wax is discharged, an axially positioned member extending into the central zone having a channel opening into the central zone below said outlet and through which diluent is adapted to be fed to render more flowable the separated wax in the central zone, and means carried by said member extending into said central zone below said outlet and adapted to mechanically sever wax from the mass of wax accumulated in and moving toward said outlet.

2. A centrifuge adapted for the separation of precipitated wax from an oil solution of higher specific gravity comprising a rotary bowl enclosing an annular outer zone extending to the periphery of the bowl, in which said separation is effected, and an inner central zone, surrounding the axis of the bowl, into which the separated wax is discharged and in which it accumulates, a distributor comprising an axial channel through which the mixture of wax and oil solution is fed and transverse branch channels from said axial channel leading outward to the inner lower part of the separating zone, and wings directly above the said transverse branch channels having upwardly extending grooves the lower ends of which are directly above and communicate with the discharge ends of said transverse channels, said grooves opening outward to the separating zone and having inner walls which extend upward and inward at a sharp angle to the bowl's axis and the upper ends of which extend into said zone of wax accumulation, enabling the wax separated in the distributor to slide along said walls into the zone of wax accumulation.

3. A centrifuge for the separation of precipitated wax from oil which comprises a rotary bowl having a separating chamber and a paring chamber rotating with the bowl and into which separated wax is adapted to flow, a stationary parer in the parer chamber for removing the wax flowing thereinto, the bowl having a discharge channel rotating with and adjacent one wall of the

rotating parer chamber, and means for closing and opening communication between said paring chamber and channel, the opening of said communication allowing wax to escape through said rotating channel without flowing through the parer.

4. A centrifuge in accordance with claim 2 in which the side walls of each groove extend at an angle to radii of the bowl.

5. A centrifuge adapted for the separation of precipitated wax from an oil solution of higher specific gravity comprising a rotary bowl enclosing an annular outer zone extending to the periphery of the bowl, in which said separation is effected, and an inner central zone, surrounding the axis of the bowl, into which the separated wax is discharged and in which it accumulates, the bowl having at the upper end portion of said inner central zone an outlet through which the separated wax is discharged, conveyor wings rotating with the bowl and extending into said inner central zone below said outlet, an axially positioned member extending into the central zone having a channel through which diluent heavier than the wax is adapted to be fed and which has a discharge which opens outward into the central wax zone near said outlet and inside the inner edges of said wings, and mechanical means extending into said central zone and located below and spaced from said outlet and extending radially beyond the diluent discharge opening but inside the inner edges of the wings and adapted to work the inner side of the rotating mass of wax accumulated in said central zone while it is moving toward said outlet, the diluent fed through said discharge to the wax zone being adapted to pass through the separated wax layer and dilute and dissolve oil therein and also soften the wax and thereby cooperate with said mechanical wax-working means to insure the free movement of the wax toward said outlet.

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