

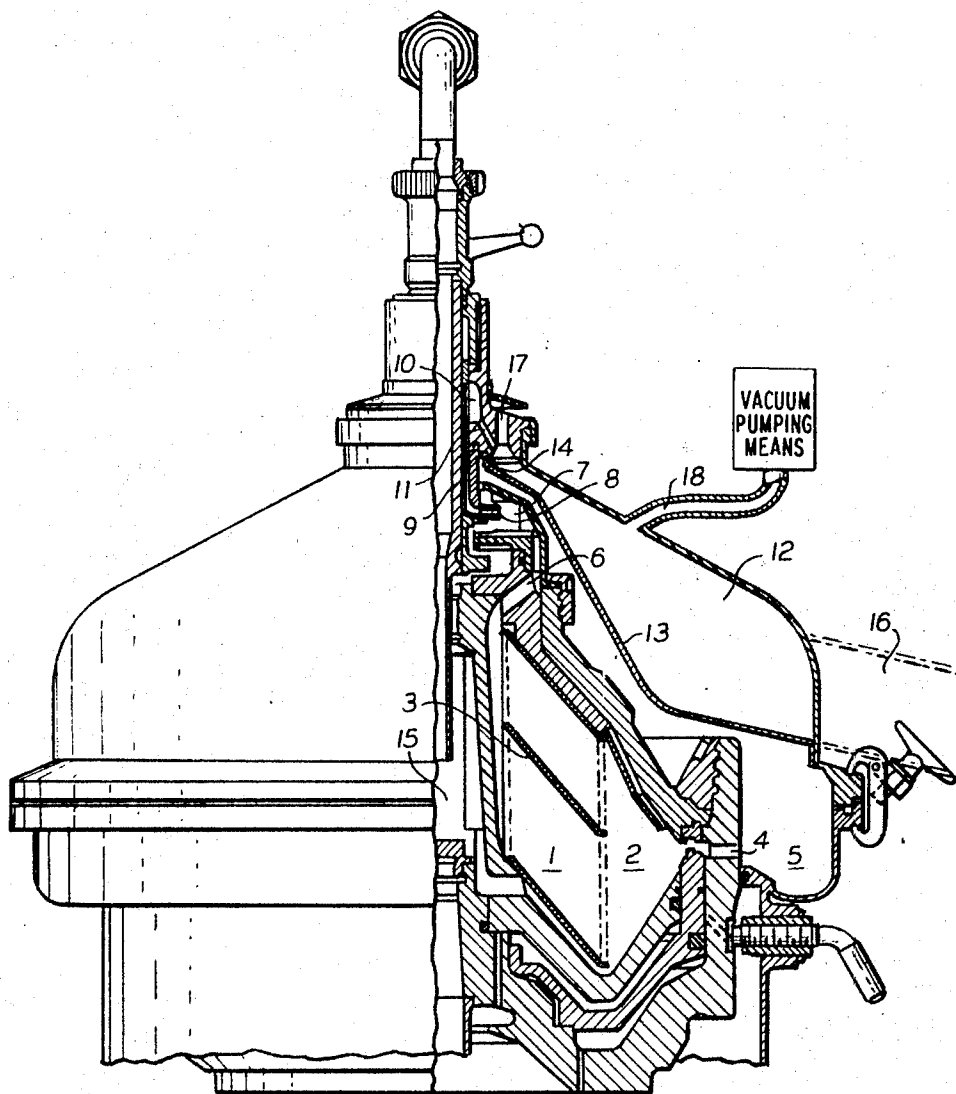
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CENTRIFUGES FOR THE SEPARATION OF LIQUID MIXTURES

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CENTRIFUGES FOR THE SEPARATION OF LIQUID MIXTURES

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3 Claims

ABSTRACT OF THE DISCLOSURE

This specification discloses a centrifugal apparatus and process carried out therein for the resolution of a liquid mixture which may or may not have solids admixed therewith. There is disclosed a centrifuge having a separating chamber and plate stack in a drum of conventional structure. The lighter component of the liquid flows toward the axis and passes out of the drum through a passageway near the axis. After leaving the drum, this lighter liquid passes through a skimming chamber having at least one skimming disc therein which acts to remove the lighter liquid under pressure to a chamber which communicates with a non-rotating receiver which is at a lower pressure than the liquid. Upon entering the lower pressure area, the component of the liquid having a lower boiling point and higher vapor pressure will flash off, thus purifying the liquid being recovered. The system is applicable to the separation particularly of oil-water mixtures, since the oil is the lighter phase, but the water will flash off upon sudden reduction in pressure, thereby permitting recovery of purified oil.

It is known that multi-component liquid systems, such as oil-water mixtures, can be resolved by centrifugation. Further, if such mixtures contain solids, these, too, can be separated by centrifugation. Centrifuges adapted to resolve such mixtures generally have a drum equipped with a plate stack and provided with an annular sludge chamber surrounding the plate stack, which receives any solids which might be contained in the liquid and which separates from the liquid as it passes through the drum. The liquid components leave the drum separately in the vicinity of the drum axis.

Liquid-liquid resolution has been disclosed to be accomplished by the prior art. For example, German Patent 492,404 discloses a separating drum having free liquid outlets. The two liquid components are driven by the rotating drum into separate receiving chambers which are disposed in the hood enveloping the drum and are provided with separate outlets.

German Patent 676,499 discloses a separating drum which is provided with two skimmer disks. These stationary skimming disks extend with their peripheral portion into the ring of liquid rotating with the drum and pump the skimmed liquid under pressure through the closed outlets. Since the liquids do not emerge freely, no receiving chambers are required in the hood in this type of construction.

The purity of the liquid components being separated from one another in a centrifugal separator depends on, among other things, the position of the separating zone. If the specifically lighter liquid should contain only a small percentage of the specifically heavier liquid, the zone of separation must be located as far as possible from the drum axis, and vice versa. But even so, an absolute purity of the lighter component has not, as yet, been achieved.

Swedish Patent 133,520 discloses a centrifuge in which the receiving vessel for the lighter component is provided

with a connection for a vacuum pump for the purpose of removing from this liquid the remainder of the lower-boiling other liquid, which is liberated by evaporation when the pressure is reduced.

This prior art design has the disadvantage, however, that the chamber for receiving the liquid that is to be vacuum-treated has an open connection to the chamber for receiving the other liquid and to the inlet chamber of the drum, so that the vacuum produced by the pump acts in these chambers, too, and there produces the evaporation of the other liquid.

The vapors which thus develop in the chambers communicating with the receiver for the specifically lighter liquid have to pass through this receiver before they can enter the suction line of the pump. Thus, in the separation of oil-water mixtures, water vapor continuously flows from the drum inlet chamber and the water receiver through the oil receiver, thereby adversely affecting the removal of residual water from the oil.

In the case of skimmer disk separators, the residual water that is not separated from the oil in the centrifugal treatment remains in the oil, because the skimmer disk pumps the under pressure and no expansion occurs.

In the case of some substances, such as insulating oils, even traces of water can considerably lower the dielectric strength, that is, the quality of the oil.

It is therefore an object of this invention to provide a novel centrifuge apparatus capable of resolving liquid mixtures and, in the same operation, purifying the separated lighter liquid.

It is another object of this invention to provide a centrifugal process for the resolution and purification of a liquid mixture.

Other and additional objects of this invention will become apparent from a consideration of this entire specification, including the drawing and claims hereof.

In accord with and fulfilling these objects, one aspect of this invention resides in a centrifuge having a drum containing a separating chamber, a sludge chamber, and a plate stack, as in conventional centrifuges of this type. There is provided a lighter liquid outlet toward the axis of rotation from the separating chamber. A skimming chamber, having at least one skimming disc, is provided, communicating with the skimming disc through a pressure release means.

As the liquid to be separated is fed to the rotating separating chamber, the lighter liquid migrates toward the axis and passes into the skimming chamber, where the skimming disc forces it under pressure out of the centrifuge into the non-rotating receiver. Since the skimming disc imparts pressure to the lighter liquid when such sprays into the receiver, it is subjected to a sudden pressure drop, thus causing rapid vaporization or flashing of any of the heavier liquid admixed therewith.

If desired, a vacuum pump may be operatively associated with the receiver to increase the pressure drop on the liquid as it enters thereinto.

This invention is particularly well adapted to use in the separation of oil-water mixtures which may contain solids in admixture therewith.

Understanding of this invention will be facilitated by reference to the drawing, which is a partial front elevation in section of a centrifuge according to this invention.

The embodiment of this invention as depicted in the drawing separates an oil-water-solids mixture at a temperature of about 80° C. Referring now to the drawing, the centrifuge comprises a drum having a separating chamber 1 wherein most of the solids and the water separates from the oil. These impurities collect in the sludge chamber 2 outside of the plate stack 3 and are periodically discharged through the ports 4 into the sludge receiver 5. The oil flows towards the axis of rotation and over-

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flows through passages 6 into the skimming chamber 7, from which it is removed under pressure by means of the skimmer disc 8. The outlet passages 9 of skimmer disc 8 empty into an annular chamber 10 which communicates through passages 11 with the stationary receiving chamber 12. The floor 13 of receiving chamber 12 is sealed off from the sludge receiver 5 by means of the seal 14. The sealing of receiving chamber 12 against the inlet chamber 15 of the drum is produced by the skimmer disc 8 which plunges into the liquid ring rotating with the drum.

The oil emerging from the passages 11 undergoes a sudden release from pressure and is simultaneously sprayed into received chamber 12, whereupon the residual water vaporizes, passes out through the upper portion of discharge pipe 16, which is not filled up with oil, and escapes from the purified oil receiving tank, which is not shown.

The receiving chamber 12 can communicate through one or more passages 17 with the outside air, so that a constant current of air is maintained which picks up the vaporized water. The receiving chamber 12 can also be provided with a connection 18 for a vacuum pump, for the purpose of intensifying the vaporizing effect.

What is claimed is:

1. A centrifuge adapted to the resolution of liquid mixtures comprising a drum having a separating chamber therein; a lighter-liquid outlet toward the axis of said centrifuge communicating with said separating chamber; a skimming chamber having a skimmer disc therein com-

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municating with said outlet; and a non-rotating receiver communicating with said skimmer disc through a pressure differential maintenance means, which is the combination of said skimmer disc, and an annular chamber communicating therewith which has a small opening communicating with said non-rotating receiver, which receiver is sealed from the chamber out and from any other product receivers.

2. A centrifuge as claimed in claim 1 wherein said receiver has orifices therein communicating with the ambient atmosphere.

3. A centrifuge as claimed in claim 1, having vacuum pumping means operatively associated with said receiver.

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