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APPARATUS FOR CONTINUOUS CENTRIFUGAL SEPARATION

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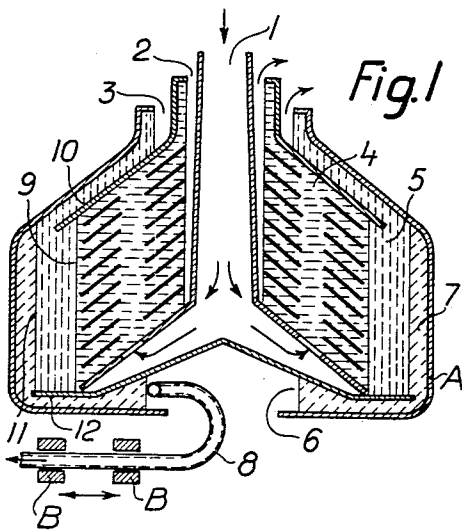


Fig. 1

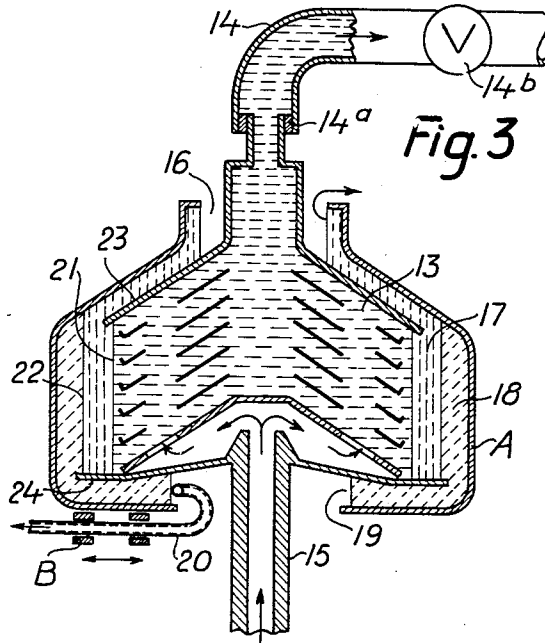


Fig. 3

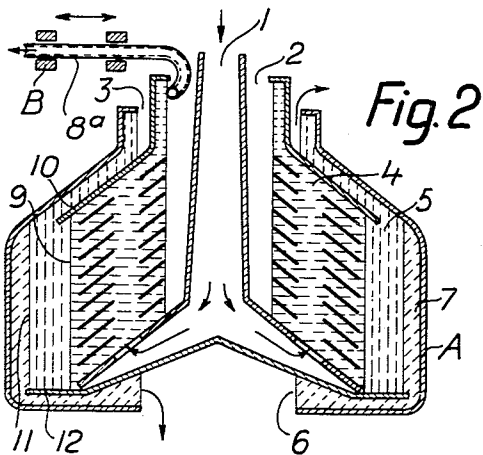


Fig. 2

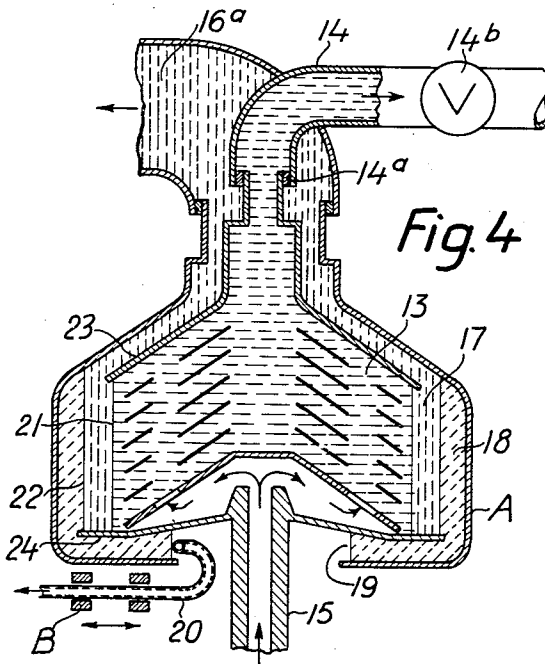


Fig. 4

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APPARATUS FOR CONTINUOUS CENTRIFUGAL SEPARATION

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2 Claims. (Cl. 233-19)

This invention relates to the continuous centrifugal separation of liquid mixtures, and more particularly to an improved centrifugal apparatus for continuously separating such mixtures into three components, each of which is separately discharged from the centrifuging operation.

When refining fatty oils with alkali, a soap is formed which is subsequently separated from the oil. The separation is often carried out in a centrifuge. In order to ensure satisfactory separating of the soap from the oil, it is desirable to counteract the tendency of the soap to form an emulsion, which is generally done by adding an electrolyte. Salt water, for example, is thus added to the oil prior to the centrifuging. However, as the centrifuges presently used permit only a separation of the soap-containing oil into two components (oil and soap), only so much electrolyte must be added that it keeps dissolved in the soap. In other words, there must be no graining out which, as is well known, separates the soap phase into two components, that is, neat soap and spent lye. The spent lye would form a third fluid component which would have to be discharged through a third outlet. This third component makes the handling of the centrifuge during the separation considerably more difficult, because two boundary levels are formed, namely, one between the spent lye and the soap and one between the soap and the oil. These boundary levels easily move under the influence of changes, such as changes in pressure, temperature, and specific gravity of the various components. Such displacements would jeopardize the satisfactory result of the separation, and the separated oil would contain soap.

By the practice of the present invention, it is possible to discharge a spent lye formed by graining-out of the soap. The spent lye, which is obtained when a large quantity of salt, for example (usually in the form of salt water of high concentration) is added to the soap-containing oil, will assume a position at the outermost part of the centrifugal rotor. The soap will form the middle layer and the oil the innermost layer. The present invention is not, however, limited to the separation of an alkali-treated soap-containing oil, but is applicable to the separation of any liquid mixture into three fluid or flowable components, each of which is discharged through a separate outlet.

The invention is characterized in that, of the two boundary levels formed between the three components, at least one level is adjusted in radial direction during the separation by discharging one of the three liquid components from the separator by means of a device which regulates the pressure of the component in its discharge channel in the centrifugal rotor. This device may be in the form of a paring element adjustable radially in the centrifuge, or a hermetically closed discharge pipe which can be throttled. The throttling may be effected by means of a valve which keeps a constant pressure in the pipe in front of the valve, or by a throttling valve when the flow of liquid in the pipe is constant. It has also proved very advantageous to adjust the second of

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the two boundary levels radially during the separation by discharging at least one of the two other liquid components from the separator by means of a device which regulates the pressure of the component in its discharge channel in the centrifugal rotor. The third component may also be discharged from the separator in the same way as the two other components. This affords further adjustability with regard to the boundary levels. In connection with regulated discharge of the latter two components, the same kind of devices may be used as described above with reference to the first component.

A centrifugal separator made according to the invention is provided with three outlets, one for each separated component, and is characterized mainly in that at least one of the outlets is regulatable by means of a device which regulates the pressure of the component in its discharge channel in the centrifuge rotor. It is desirable that at least one of the two other outlets also be regulatable by means of a device which regulates the pressure of the component in its discharge channel in the centrifuge rotor. The outlet or outlets not provided with a regulating device may either be open or in air-tight communication with a closed discharge pipe. Also, the inlet to the centrifuge rotor may be open or hermetically closed.

One embodiment of the separator, which is particularly suited for separating soap-containing oil in which the soap has been grained out so that a free spent lye has been formed, is characterized in that the outlet for the heaviest component (spent lye) is regulatable by means of a paring device and the outlet for the lightest component (oil) is regulatable by being hermetically connected to a closed pipe having a valve which keeps a constant pressure in the pipe in front of the valve; or the closed pipe may have a throttling valve when the flow of liquid in the pipe is constant. The outlet for the third component (soap) is in air-tight communication with a closed pipe for unrestricted discharge.

The embodiments of the centrifugal separator falling within the scope of the invention may vary considerably. Thus, with separators having two or three regulated outlets, all the devices regulating the pressure of the components may be of the same kind, for example, paring devices. However, only a few embodiments, chosen by way of example, are illustrated in the accompanying drawings, in which Figs. 1, 2, 3 and 4 are vertical sectional views of four different embodiments of the invention.

The separator shown in Fig. 1 comprises a rotatable centrifugal bowl or locus A having an open inlet 1 for the feed, an outlet 2 for the innermost or lightest component 4, and an outlet 3 for the component 5 of intermediate specific gravity. The outlets 2 and 3 are preferably provided with exchangeable regulating discs (not shown) so that the radii of these outlets can be adjusted. The bowl also has an outlet 6 for the outermost or heaviest component 7. The latter component is discharged by a paring tube 8 movable radially of the bowl in stationary bearings B. The position of the level or boundary 9 between the two inner components 4 and 5 is limited in the outward direction by the outer edge of the top disc 10. The regulating discs (not shown) in the outlets 2 and 3 are of such radii that the boundary level 9 is maintained at or a little inside the outer edge of the disc 10. The paring tube 8, being adjustable radially of the bowl during operation, is moved to such a position that only a clean component 7 is discharged. In other words, the boundary level 11 between the two outer components 5 and 7 is maintained at or a little inside the outer edge of the disc 12.

It is not necessary, however, to pare out the outermost component 7. One of the two others may be pared out instead. As shown in Fig. 2, a paring tube 8a is provided for the innermost component 4, and the outlet 6 for the

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outermost component is open. The parts of Fig. 2 have the same reference numbers as corresponding parts of Fig. 1.

The two embodiments according to Figs. 1 and 2 do not allow adjustment of the boundary level 9 during operation. Fig. 3 shows an embodiment which allows adjustment of the two boundary levels during operation and which differs from the two previous embodiments in that the outlet for the innermost component 13 is hermetically connected by a seal 14a to a stationary closed outlet pipe 14 in which there is a valve 14b of the kind previously specified. An airtight inlet is provided in the spindle 15 of the centrifuge rotor. The outlet 16 for the middle component 17 is open, and the outermost component 18 is discharged from the outlet 19 by a paring tube 20. The positions of the boundary levels 21 and 22 are fixed by the outer edges of the discs 23 and 24, respectively. The boundary level 22 is adjusted to a position somewhat inside the outer edge of the disc 24 by means of the paring tube 20; which is preferably maintained in the position found suitable. Variations in the positions of the boundary levels appearing during the operation are neutralized by adjusting the valve 14b in the discharge pipe 14, thereby varying the pressure against which the lightest component 13 discharges. The position of the paring tube 20 may be changed during the operation, if necessary.

The embodiment shown in Fig. 4 differs from that shown in Fig. 3 only in that the outlet 16a is in the form of a hermetically closed pipe. It may also be provided with a valve 14b of the kind previously mentioned. The embodiment of Fig. 4 is specially suited for separation

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of a soap-containing oil in which the soap has been grained out, so that a free spent lye has been formed. In this case the outlet 16a should be unobstructed, that is, there should be no valve in it because, when the boundary levels are correctly adjusted, the separated soap will be discharged through this outlet. In view of the high viscosity of the soap, it is better to regulate the outlets 14 and 19 through which the more fluid components (the oil and the spent lye) discharge, and to leave the soap outlet 16a as free as possible.

I claim:

1. A centrifugal separator comprising a rotatable centrifugal bowl having three outlets, one for each of three separated components of different specific gravity, an adjustable paring device coacting with the outlet for the heaviest component for discharging said last component from the bowl, a stationary discharge pipe hermetically connected to the lightest component outlet, and a valve in said pipe for regulating the discharge through said last outlet.

2. A separator according to claim 1, comprising also a stationary pipe hermetically connected to the intermediate component outlet.

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