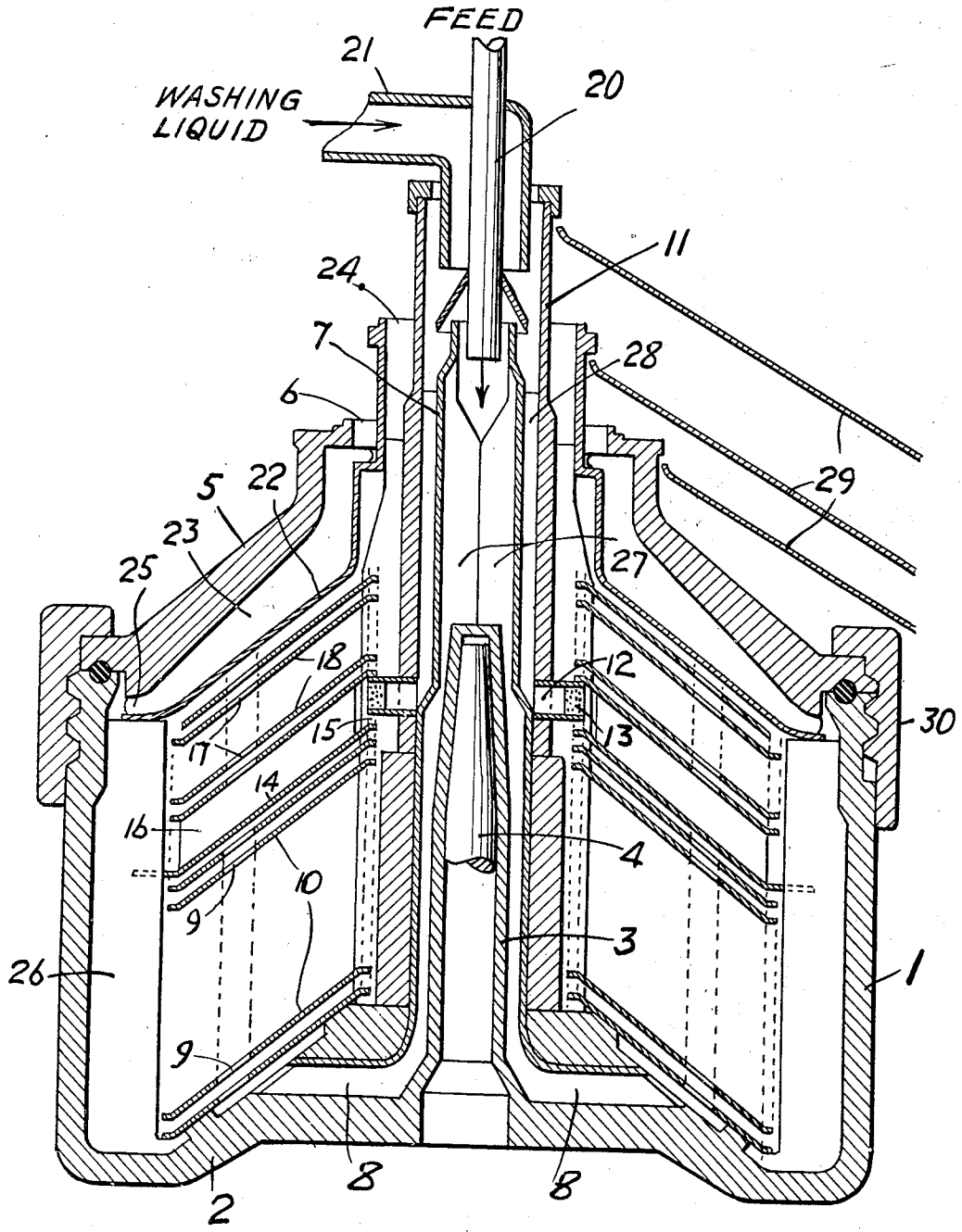
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MACHINE FOR PURIFYING LIQUIDS

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MACHINE FOR PURIFYING LIQUIDS

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12 Claims. (Cl. 233—14)

My invention relates to the removal of objectionable matter from liquids, and comprises a novel type of centrifugal separator adapted to effect this result with maximum efficiency. The invention is particularly adapted for removal of reaction products from vegetable and animal and other oils which have been chemically treated to neutralize deleterious constituents therein.

It is well known that in both gravity and centrifugal treatments it is relatively easy to remove a major portion of reaction products while it is relatively difficult to remove a small minor portion of these products. It is also well known that many of these products are easily soluble in water or other liquids having a greater specific gravity than the oil being treated and it is common practice to carry out first a gravity or centrifugal separation of most of the soap and then follow with a wash with a suitable liquid and cause a second independent gravity or centrifugal separation of the wash liquid and accompanying impurities.

When such a two step separation has been carried on in the past it has required the use of two centrifugal machines in series, or the storage of primarily separated liquid until after treatment of an entire batch and then the use of the same separator, perhaps with a different adjustment, for the removal of wash liquid with its contained impurities.

Specifically, the object of my invention is to provide a centrifugal bowl in which these primary and secondary purification steps may be effected in a single centrifugal operation and to that end provide a single centrifugal bowl in which the primary separation of a major portion of the impurities takes place first, followed by the dissemination of a washing liquid through the partially purified liquid and the separation of that wash liquid and its contained impurities therefrom so that both operations can be effected in a single pass.

The single figure of the accompanying drawing is a section, in a plane, passing through the axis, of a bowl adapted for practicing the described process. Certain structural features of the bowl are found in the patent issued to me April 4, 1922, No. 1,411,782, which provides means for independently feeding two separate liquids to two separate zones in a separating bowl; but the construction embodying the invention herein described differs essentially from that of my prior patent in respect to features particularly adapted for the practice of the described process. Certain other structural features of the bowl are also disclosed in an application filed of even date herewith by Alan E. Flowers, Serial No. 395,153 but my improved bowl differs from the Flowers bowl as well as from my own prior bowl, in essential particulars, but no claim is made herein covering any construction common to the Flowers bowl and my improved bowl.

The bowl shell 1 has a bottom 2 with a socket 3 fitting the driving and supporting spindle 4. The bowl has a top 5 secured to the shell 1 by a coupling ring 30. At the inner end of the bowl top is a discharge 6. In the center of the bowl are concentric tubes 7 and 11. The inner tube 7, carrying the oil and soap or other materials which are to be separated from the oil, encloses passages 8 that lead to the entrances to distributing holes 9 near the peripheries of the discs 10 in the lower portion of the bowl. The outer tube 11, carrying the wash liquid, communicates with a plurality of channels 12 feeding a chamber inside a pervious wall 13 of clay or other suitable material. Above the group of discs 10, separated therefrom by a blank disc 14 and having communication therefrom through passages 15 is a wash chamber 16 in communication through distributing holes 17 with an upper group of discs 18 similar to those in the lower group. The pervious wall 13 is located at the inner edge of this wash chamber.

Supported by suitable means are two concentric supply tubes 20 and 21, which extend down into the tubes 7 and 11 respectively.

In the upper part of the bowl a top disc 22 provides a division wall between the separating chamber of the bowl and the passage 23 leading to the discharge outlet 6. Passages also lead from the inner edges of the discs 18 upward inside the neck of the top disc 22 to the outlet 24 for the discharge of light oil.

Wings 25 between the bowl top 5 and the top disc 22 and wings 26 secured to the bowl shell and extending inward to near the outer edges of the discs, force the bowl contents to continue rotating at the same speed as the bowl. Wings 27 and 28 attached to the walls of the tubes 7 and 11 respectively, force the incoming liquids to assume a speed of rotation equal to that of the bowl. Covers 29 are supplied to provide chambers to catch the materials discharged from the bowl.

While the bowl is useful for the removal of reaction products from any liquids, among which are vegetable, animal and mineral oils and other substances, in which chemical or physical treatment has produced materials having a specific

gravity different from that of the liquid being treated and soluble in or combinable with some washing liquid, I will describe its use for only one class, vegetable oils, which, when separated from the vegetable matter in which they originated, contain objectionable acid materials that can be neutralized with alkalies and then form water soluble soaps.

In the operation of the bowl, alkali treated oil, containing soap, is fed to the bowl through tube 20, flows downward inside tube 7 and outward through channels 8 to the entrance of the distributing holes 9 in the discs 10, thence upward and distributes between the discs, where separation of a major portion of the soap takes place in the usual manner. The soapstock flows outward to the bowl periphery and is discharged through opening 6 in the bowl top 5. The partially purified oil flows inward toward the center of the bowl to, and then outward through, opening 15 directly beneath the channels 12.

Clean water, fed through the passages 12 to the chambers at their ends, passes through the porous wall 13 and is finely disseminated through the oil flowing outward from the opening 15. Here it combines with the residual soap in the oil and the mixture flows through the holes 17 to the spaces between the upper discs 18 where the soap and water are separated from the oil and flow toward the periphery of the bowl, where they mix with the previously separated soap, then upward around the edge of the top disc 22 and escape at 6, while the purified and washed oil flows inward between the discs 18 to their inner edges, thence upward inside the neck of the top disc and escapes at 24.

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

1. A centrifugal purifier for separating from a liquid impurities heavier than the liquid comprising a rotatable bowl, means therein dividing it into a primary separating chamber and a secondary chamber, said chambers being radially substantially coextensive and surrounding the axis of the bowl along different lengths thereof, a set of frustro-conical discs in the primary chamber, means to distribute the liquid to be purified within the spaces between said discs wherein the major part of the impurities are separated from the liquid containing residual impurities, a similar set of discs in the secondary chamber, there being communication between the two chambers through which the separated liquid containing residual impurities flows from the primary chamber into the secondary chamber, and means to feed a wash fluid into the secondary chamber, wherein the wash fluid combines with said residual impurities and a further purification of the liquid is effected by its separation therein from the combined wash liquid and residual impurities.

2. A centrifugal purifier for separating from a liquid impurities heavier than the liquid comprising a rotatable bowl, means therein dividing it into a primary separating chamber and a secondary chamber, said chambers being radially substantially coextensive and surrounding the axis of the bowl along different lengths thereof, a set of frustro-conical discs in the primary chamber, means to distribute the liquid to be purified within the spaces between said discs wherein the major part of the impurities are separated from the liquid containing residual impurities, there being communication between the two chambers through which the separated liquid containing residual impurities flows from the primary chamber into the secondary chamber, means to feed a wash fluid into the secondary chamber and a set of frustro-conical discs in the secondary chamber substantially radially coextensive with the discs in the primary chamber and within the spaces between which the wash fluid and the residual impurities combined therewith separate from the liquid to thereby effect the latter's more complete purification, said bowl having an outlet for the finally purified liquid and a common outlet for the impurities separated in the primary chamber and the wash fluid and residual impurities separated in the secondary chamber.

3. A centrifugal purifier for separating from a liquid impurities heavier than the liquid comprising a rotatable bowl, means therein dividing it into a primary separating chamber and a secondary chamber, a set of frustro-conical discs in the primary chamber, means to distribute the liquid to be purified within the spaces between said discs wherein the major part of the impurities are separated from the liquid containing residual impurities, there being communication between the two chambers through which the separated liquid containing residual impurities flows from the primary chamber into the secondary chamber, a feed tube for washing fluid, a porous wall through which the wash fluid enters the secondary chamber and is therein disseminated through the partially purified liquid flowing from the primary chamber to thereby combine with said residual impurities and be separated with said impurities from said liquid.

4. A centrifugal purifier for separating impurities from a liquid which comprises a rotatable bowl and means therein dividing it into a primary separating chamber and a secondary chamber, said chambers being radially substantially coextensive and surrounding the axis of the bowl along different lengths thereof, means affording communication between said chambers at the zones thereof nearest the axis, a feed conduit adapted to supply liquid to be purified to the primary chamber wherein occurs a primary separation from the liquid of the major part of the impurities, the partly purified liquid containing the residual impurities then flowing through said communicating means into the inner zone of the secondary chamber, a feed conduit adapted to supply a washing fluid to the zone of the secondary chamber nearest the axis and disseminate the same throughout the partly purified liquid flowing into said zone from the primary chamber and combine with said residual impurities, said liquid being separated in the secondary chamber from said washing fluid and residual impurities, the bowl having outlets for the finally purified liquid and for the washing liquid and all separated impurities.

5. A centrifugal purifier for separating impurities from a liquid which comprises a rotatable bowl, a frustro-conical disc dividing the bowl into a primary separating chamber and a secondary chamber, a frustro-conical disc dividing the secondary chamber into a wash compartment and a final separating compartment, piles of frustro-conical discs in the primary separating chamber and in the last named compartment, means affording communication between the primary separating chambers and the washing compartment at the zones thereof nearest the axis

of the bowl, a feed conduit for supplying impure liquid to the primary separating chamber, another feed conduit for supplying washing fluid to the zone of the washing compartment nearest the axis of the bowl, the bowl having outlets for the finally purified liquid and for the washing liquid and all separated impurities.

6. A centrifugal purifier for separating impurities from a liquid which comprises a rotatable bowl, a frustro-conical disc dividing the bowl into a primary separating chamber and a secondary chamber, a frustro-conical disc dividing the secondary chamber into a wash compartment and a final separating compartment, piles of frustro-conical discs in the primary separating chamber and in the last named compartment, means affording communication between the primary separating chambers and the washing compartment at the zones thereof nearest the axis of the bowl, a feed conduit for supplying impure liquid to the primary separating chamber, another feed conduit for supplying washing fluid to the zone of the washing compartment nearest the axis of the bowl, passages, relatively far from the axis, from the washing compartment to the final separating compartment, the bowl having outlets from the peripheries of all three compartments for discharge of washing fluid and impurities and an outlet from the final separating compartment for the finally purified liquid.

7. A centrifugal purifier for separating from a liquid impurities heavier than the liquid comprising a rotatable bowl, means dividing the bowl into a primary separating chamber, and a chamber having a wash compartment and a final separating compartment, said chambers surrounding the areas of the bowl along different lengths thereof, the primary separating chamber and the final separating compartment being radially substantially coextensive, a set of frustro-conical discs in the primary separating chamber, a set of frustro-conical discs in the final separating compartment, both sets of discs being substantially radially coextensive, means to distribute the liquid to be purified within the spaces between the discs in the primary separating chamber, wherein the major part of the impurities is separated from the liquid containing residual impurities, there being communication between the primary separating chamber and the wash compartment, means to supply a wash fluid to the wash compartment, there being communication between the wash compartment and the final separating compartment in which latter are effected a further purification of the liquid and its separation from the combined wash liquid and residual impurities, the bowl having outlets for the purified liquid and for the wash fluid and all separated impurities.

8. A centrifugal purifier in accordance with claim 7 wherein the communication between the primary separating chamber and the wash compartment is in a zone near the axis and wherein the communication between the wash compartment and the final separating compartment is in a zone relatively distant from the axis.

9. A centrifugal purifier for separating from a liquid impurities heavier than the liquid comprising a rotatable bowl and two frustro-conical partitions therein dividing the bowl into three compartments, one above another, namely, a primary separating chamber, a wash compartment and a secondary separating compartment, said compartments all surrounding the axis of the bowl along different lengths thereof, means to feed the liquid to be purified to the primary separating chamber wherein the major part of the impurities is separated from the liquid containing residual impurities, there being communication between the zone of the primary separating chamber containing separated partially purified liquid and the wash compartment through which said partially purified liquid is adapted to flow from said chamber to said wash compartment, means to supply a wash fluid to the wash compartment and wherein it is disseminated through the partially purified liquid admitted thereto from the primary separating chamber, there being communication between the wash compartment and the final separating compartment wherein the liquid is separated from the wash fluid and residual impurities, the bowl having outlets for the purified liquid and for the wash fluid and all separated impurities.

10. A centrifugal purifier for separating from a liquid impurities heavier than the liquid comprising a rotatable bowl, means therein dividing it into a primary separating compartment, a wash compartment and a secondary separating compartment, a set of frustro-conical discs in each separating compartment, all said discs being similar and of substantially equal size, means, including a series of vertically aligned holes in the discs in the primary separating compartment, through which liquid to be purified is distributed to the spaces between said discs wherein the major part of the impurities are separated from the liquid containing residual impurities, means to conduct partially purified liquid to said wash compartment, and means to disseminate a washing fluid through the liquid in said wash compartment wherein the wash fluid combines with the residual impurities, there being vertically aligned holes in the discs of the secondary separating compartment, through which the mixture of partially purified liquid and wash liquid and impurities is distributed to the spaces between the discs in the secondary separating compartment, wherein further purification of the liquid is effected by separation therefrom of the wash fluid and residual impurities.

11. A centrifugal purifier for separating impurities from a liquid which comprises a rotatable bowl and means therein dividing it into a primary separating compartment, a secondary compartment and a wash compartment, said compartments surrounding the axis of the bowl along different lengths thereof and being radially substantially coextensive, means affording communication between the primary and wash compartments at the zones thereof nearest the axis, means affording communication between the wash compartment and the secondary separating compartment at a greater distance from the axis, a feed conduit adapted to supply liquid to be purified to the primary compartment wherein occurs a primary separation from the liquid of the major part of the impurities, the partly purified liquid containing the residual impurities then flowing through the communicating means into the wash compartment, a feed conduit adapted to supply a washing fluid to the zone of the wash compartment nearest the axis and disseminate the same throughout the partially purified liquid flowing thereinto from the primary compartment, the washing fluid therein combining with said residual impurities, the liquid being then conducted, through the communicating

means specified, to the secondary separating compartment wherein the liquid is separated from the washing fluid and residual impurities, the bowl having outlets for the finally purified liquid and for the washing fluid and all separated impurities.

12. A centrifugal purifier for separating from a liquid impurities heavier than the liquid comprising a rotatable bowl and two frustro-conical partitions therein dividing the bowl into three compartments, one above another, namely, a primary separating chamber, a wash compartment and a secondary separating compartment, said compartments all surrounding the axis of the bowl along different lengths thereof, means to feed the liquid to be purified to the primary separating chamber wherein the major part of the impurities is separated from the liquid containing residual impurities, there being communication, in a zone relatively near the axis, between the primary separating chamber and the wash compartment for the flow of partially purified liquid from said chamber to the wash compartment, means to supply a wash fluid to the wash compartment and wherein it is disseminated through the partially purified liquid admitted thereto from the primary separating chamber, there being communication, in a zone relatively distant from the axis, between the wash compartment and the final separating compartment wherein the liquid is separated from the wash fluid and residual impurities, the bowl having outlets for the purified liquid and for the wash fluid and all separated impurities.

SELDEN H. HALL.