

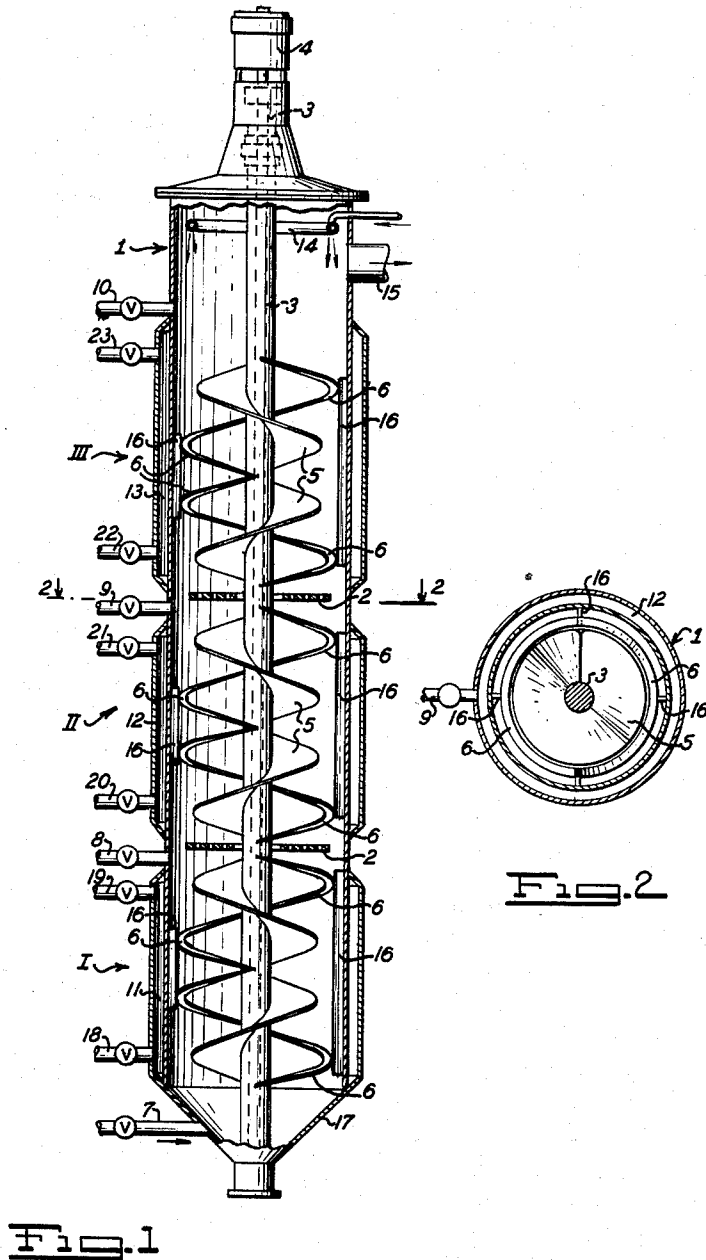
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REACTION COLUMN FOR THE CONTINUOUS TREATMENT OF LIQUIDS

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REACTION COLUMN FOR THE CONTINUOUS TREATMENT OF LIQUIDS

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This invention relates to an improved reaction column for the continuous treatment of liquids and particularly of fats and oils.

In the treatment of oils and fats, as, for example, in the de-acidification of vegetable and animal oils and fats, the oils which contain the fatty acids must be uniformly and intimately mixed together with a caustic alkali, so that the particles of the caustic solution come in contact with the particles of the fatty acid. If the contacting is not effected completely uniformly, a local excess of the caustic solution will occur, which will saponify the neutral oil, causing losses of the same. On the other hand, if the mixing of the components is too intensive, an undesirable emulsion will form. Oils which are emulsified in this manner cannot be completely recovered, resulting in considerable loss. Furthermore, the emulsion oils obtained are of poor quality and command a price far below that of neutral oil.

The reaction vessels conventionally used for this treatment of oils and fats comprise an enclosed container, into which the liquids could be fed, provided with an agitator at one end portion in the form of a propeller or blades. These conventional reaction containers, however, did not prove satisfactory, and a completely uniform mixture without emulsification is not obtained. With the agitator positioned near one end portion of the container, extensive liquid movement and agitation would occur near this end portion, but would progressively decrease in a direction away from the agitator. Thus, for example, with the agitator located near the bottom of the container, extensive movement of the liquid particles with respect to each other could only take place near the bottom, and these movements would constantly decrease upwardly in the liquid, so that the mixing effect strongly decreases from the bottom towards the top. Since, however, the oils and the caustic alkali solutions are relatively immiscible, it was necessary, in order to avoid losses due to the formation of local alkali excesses, to maintain the liquids in constant motion during their entire stay in the reactor in order to assure a mutual contact between the liquid particles.

One object of this invention is a novel reaction column which will allow the continuous neutralization of oils and fats, using caustic alkali solutions with a completely uniform contacting of the solutions without the danger of emulsion formation. This, and still further objects, will become apparent from the following description, read in conjunction with the drawing, which diagrammatically shows a vertical section of an embodiment of a reaction column in accordance with the invention.

The reaction column for the continuous treatment of liquid such as fats and oils in accordance with the invention comprises an elongated enclosed container, as, for example, a vertically extending cylindrical container. Means, such as inlet and outlet connections, are provided for introducing and withdrawing liquid from the container. A rotatable helix is positioned within the con-

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tainer and extends substantially axially throughout the entire length of the container. The rotatable helix is subdivided into adjacent portions of reversed pitch, and means, such as a conventional electric motor, are provided for rotating the helix, preferably at a relatively low speed of, for example, about 40 revolutions per minute. Additionally, it is preferable to provide baffle plates between the wall of the container and the helix. These baffle plates are preferably in the form of a stationary circular screw or helix. The container is also preferably longitudinally sub-divided by means of separating partitions, which may be perforated or spaced from the outer container wall.

Fig. 1 is a vertical section of the elongated, enclosed container or reaction column of this invention, and

Fig. 2 is a section taken on the line 2—2 of Fig. 1.

Referring to the embodiment shown in the drawing, 1 designates an enclosed, elongated, vertical, cylindrical container, which may be constructed pressure-resistant, so that treatment therein may be effected under elevated pressure in order to start the reaction or to increase the reaction velocity, etc. The container 1 is divided along its length into the sections I, II, and III by the baffle or partition plates 2. These baffle plates 2 are perforated and are spaced from the container wall. They serve the purpose of preventing unretarded free transfer of liquid from one section into the other.

A rotatable shaft 3 extends axially through the container and is driven by the motor, such as the electric motor 4, at a low speed of, for example, about 40 revolutions per minute. A helix screw 5 is connected to and extends around the shaft 3 throughout substantially the entire axial length of the container 1. The helix is subdivided over its length into adjacent portions of reversed pitch. Thus, as shown, the helix 5 in the Section 1 of the container 2, extends around the shaft 3 for 360° in one direction of pitch, and then reverses the direction of pitch and extends around the shaft for another 360°. The sequence is repeated in the sections II and III.

Due to the helix extending axially about the length of the container, and due to the alternate reversed pitch sections, the liquid mixture in the container can be maintained in any easy upward and downward motion until it discharges without any emulsion being formed.

Between the rotatable helix 5 and the inner wall of the container, guide plates in the form of a stationary helix 6 are positioned. The stationary helix 6 alternately reverses its pitch along its length in the same manner as the rotatable helix 5. This stationary helix still further promotes the movement of the liquid. The stationary helix 6 is preferably removably positioned in the container in order to facilitate cleaning of the same. Thus, for example, the stationary helix may be fastened to longitudinal ribs 16 extending along the container wall. The space produced in this manner between the stationary helix 6 and the container wall makes it possible for the solids which gradually move outwardly to drop down between the ribs along the container wall and to collect in the conical portion 17 at the lower end of the reactor. In this manner the deposition of solids on the stationary helix within the individual section is avoided to a substantial extent, which increases the time interval required between cleanings of the container.

The material to be treated may be introduced into the container through the inlet connection 7. At the upper portion of each of the individual sections there are provided the connections 8, 9, and 10, respectively, to which the material may be withdrawn, or through which additional substances may be added to the material in the container.

In certain cases it may be advisable to keep the ma-

terial undergoing treatment in the container in order to increase the reaction velocity, while in other cases a cooling of the material may prove necessary. In order to effect this heating or cooling, the heating or cooling jackets 11, 12, and 13 are provided. Heating or cooling media may be circulated through these jackets by means of the connections 18—23 provided, and, since an individual jacket with individual connections is provided for each section, each section may be individually heated or cooled.

If gas or vapor is introduced into the container during the treatment of a liquid or liquid mixture, or if gases or vapors form in the liquid or liquid mixture during the reaction, the formation of a certain amount of foam on the surface of the liquid cannot be avoided. This foam may have a very disturbing effect in both the reactor itself and in the subsequent treatment of the liquid, particularly, for example, in the case of centrifuging. In such cases it is advisable to break up the foam while it is still in the reactor, by spraying liquid on to the foam. For this purpose, a spray 14 is provided in the upper portion of the reactor. A suitable liquid for breaking the foam may feed into the spray 14 to spray on the surface of the liquid where the foam forms on the upper portion of the container.

Additionally, in order to be able to withdraw the gases or vapors which may possibly form during the treatment, the gas or vapor outlet connection 15 is provided in the upper portion of the container, which may be connected to a suitable gas and vapor outlet.

In order to assure feed under constant pressure for the following treatment stages, a float valve, having a direct or indirect control, may be installed in the container.

In operation, in, for example, the neutralization of animal and vegetable oils, the soap flakes forming during the treatment in the reaction column have a purifying action on the oil, since they promote the precipitation of accompanying substances and, at the same time, adsorb them. The soap flakes will neither be broken up, nor will the single-phase system be destroyed by the gentle treatment in the device in accordance with the invention. Further, catalysts may be added intermittently and uniformly mixed with the oil in the reaction column of the invention, which is of great importance, for example, in hydrogenation. In the same manner other substances, such as fuller's earth and/or gases or vapors may be brought into intimate contact with the oil.

While the invention has been described in detail with reference to the specific embodiment shown, various changes and modifications will become apparent to the artisan, which fall within the spirit of the invention and scope of the appended claims.

We claim:

1. Reaction column for the continuous treatment of liquids, such as fats and oils, comprising an elongated, enclosed container, means for introducing and withdraw-

ing liquid from said container, a rotatable helix extending substantially axially within said container and subdivided into adjacent portions of reversed pitch, and means for rotating said helix, and including positioned within the said container between the container wall and said rotatable helix a stationary helix, said stationary helix having the same axial length and a pitch, which is alternately reversed along its length in the same manner as the rotatable helix, said stationary helix being positioned so that its pitch is opposed to the corresponding section of the rotating helix.

2. Reaction column according to claim 1, in which said container is a vertically extending cylindrical container.

3. Reaction column according to claim 1, in which said stationary helix is removably positioned in said container.

4. Reaction column according to claim 3, in which said stationary helix is removably positioned in longitudinally extending ribs positioned along the inner wall of said container.

5. Reaction column according to claim 1, including spray means positioned in the upper portion of the container.

6. Reaction column according to claim 1, including means for removing vapor from the upper portion of said container.

7. Reaction column according to claim 1, in which said container is a pressure-resistant container.

8. Reaction column according to claim 1, in which said container is a substantially cylindrical, vertically extending container, sub-divided into adjacent sections along its length by liquid-permeable partition means.

9. Reaction column according to claim 8, in which a portion of said rotatable helix in each section extends for about 360° and then reverses pitch for about 360°.

10. Reaction column according to claim 9, including an inlet connection at the bottom portion of said container, and a conduit connection at the upper portion of each section.

11. Reaction column according to claim 1, in which said means for rotating said helix is means for rotating said helix at about 40 revolutions per minute.

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