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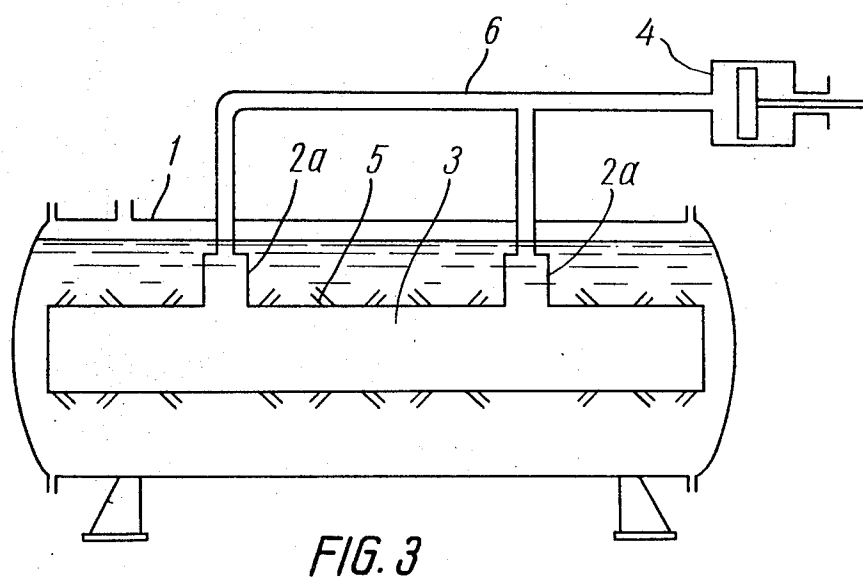
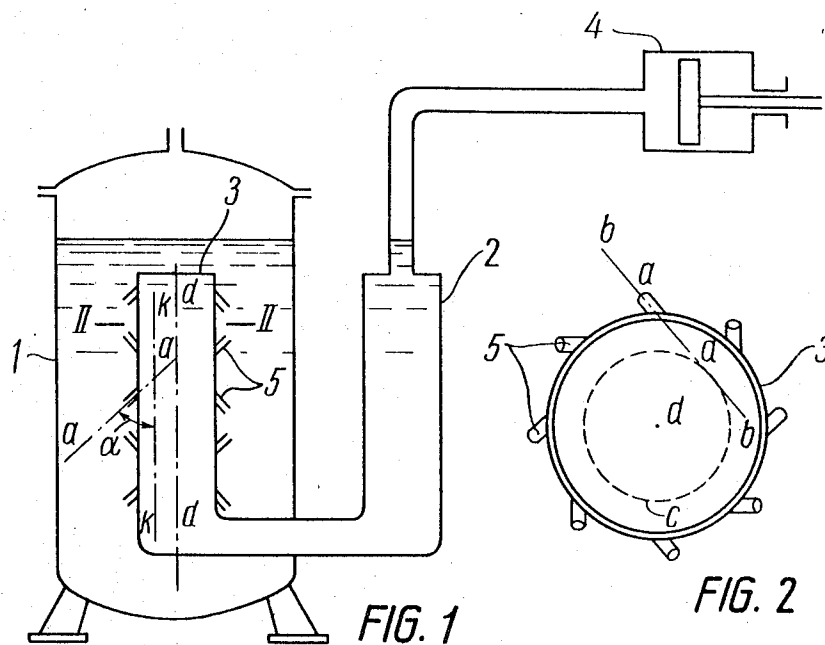
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3,531,093

DEVICE FOR PULSATING MIXING OF LIQUID REAGENTS
AND LIQUID-AND-SOLID REAGENTS

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2 Sheets-Sheet 1



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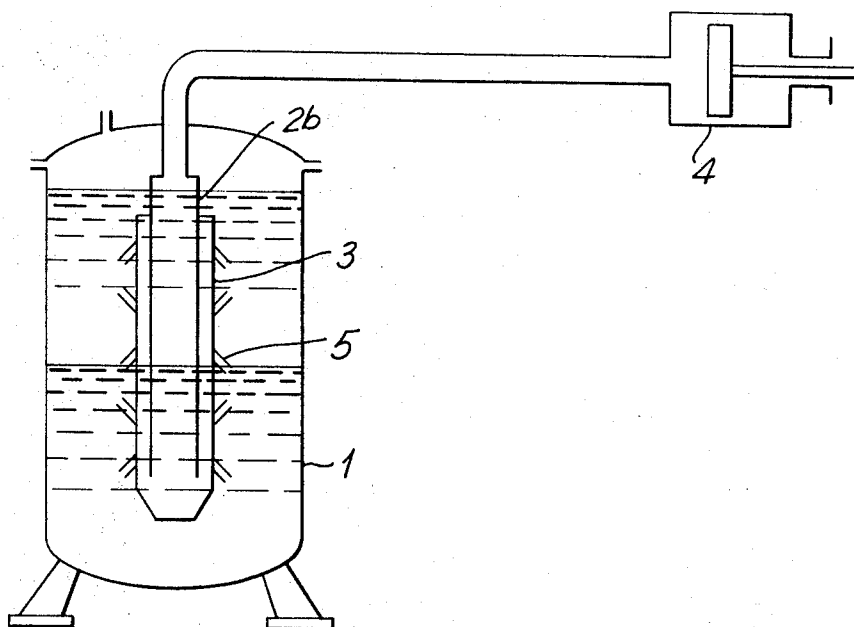
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FIG. 4



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DEVICE FOR PULSATING MIXING OF LIQUID REAGENTS AND LIQUID-AND-SOLID REAGENTS

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2 Claims

ABSTRACT OF THE DISCLOSURE

Device for pulsating mixing of liquid reagents or liquid-and-solid reagents which can or cannot be soluted one in the other and which have different or almost the same specific weights. The device has at least two intercommunicating vessels one of which is mounted in a reservoir for reagents to be mixed and the other is connected to a pulsator. A plurality of nozzles are disposed on the vessel mounted in the reservoir, which provide communication between that vessel and the reservoir to mix their contents when the pulsator is actuated.

The present invention relates to devices for mixing liquid reagents and liquid-and-solid reagents, and more particularly to devices for the pulsating mixing of liquid reagents and liquid-and-solid reagents which are soluble or insoluble in each other and which have different or similar specific weights. This invention may be employed in mixing-settling extractors and chemical reaction vessels for the chemical and oil processing branches of industry, and it will find particularly wide application in processing toxic, corrosive, explosive and radioactive products.

There are known in the art devices for the pulsating mixing of liquid reagents, comprising at least two intercommunicating vessels, one of which is intended for being placed within a mixing reservoir and is provided with a nozzle, while the other is connected to a pulsator.

In the known device the two intercommunicating vessels are formed as a pulsating chamber, terminating with an ejection nozzle, and a suction ejector chamber, installed vertically in the reservoir. This structure for the device ensures only localized mixing, since mixing is effected in the suction chamber of the ejector or additionally at the place of location of the nozzle. Besides, the simultaneous mutual dispersion of two liquids is impossible, since uniform mixing is ensured at best in only 50 percent of the total liquid volume.

An object of the present invention is the provision of such a device for the pulsating mixing of liquid reagents and liquid-and-solid reagents which ensures uniform mixing of the reagents throughout the whole volume, and if necessary, the simultaneous mutual dispersion of the two liquids.

In accordance with the above said and other objects, in the device for the pulsating mixing of liquid reagents and liquid-and-solid reagents, according to the invention, the axes of the nozzles are oriented tangentially to imaginary surfaces of rotation, having a common axis for unidirectional rotary motion of the liquid in the vessel around this axis, the axes of the nozzles being disposed at an acute angle to a line parallel to said axis and intersecting the axis of the nozzle.

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Such a disposition of the nozzles allows the elimination of dead or stagnant liquid zones in the reservoir. To ensure better mutual dispersion of the liquids being handled, it is expedient that some of the nozzles be inclined in one direction relative to the line parallel to the axis of the surface of rotation, while the others be inclined in the opposite direction.

The employment of the device according to this invention ensures the simultaneous and intensive mixing of the reagents throughout the whole volume of the reservoirs. The time, necessary for mixing is reduced to $\frac{1}{6}$ — $\frac{1}{7}$ of that of the conventionally known devices.

The invention is further described by way of example with reference to the accompanying drawings, wherein:

FIG. 1 is a diagram of the device for pulsating mixing of reagents, according to the invention;

FIG. 2 is a section, taken along the line II—II of FIG. 1;

FIG. 3 shows another embodiment of the device according to the invention; and

FIG. 4 shows still another embodiment of the same.

The device for the pulsating mixing of liquid reagents and liquid-and-solid reagents comprises a reservoir 1 (FIG. 1), which is filled with the reagents, and two intercommunicating vessels 2 and 3, by means of which mixing of the reagents is effected.

The vessel 2 is connected to a piston-type pulsator 4 at the top portion thereof and is placed outside the reservoir 1, while the vessel 3 is provided with nozzles 5 and is placed within the reservoir.

Through the nozzles 5 the liquid reagents penetrate from the reservoir 1 into the intercommunicating vessels 3 and 2 and fill them.

Under the influence of pulses generated by pulsator 4, the liquid reagents are thrown into the reservoir 1 through the nozzles 5 from the vessels 2 and 3 during the pressure stroke thereof, said pressure being transmitted to the vessel 2. When the pressure is released the liquid from the reservoir 1 again penetrates into the vessels 3 and 2 through the nozzles 5. As a result intensive reagent mixing is provided not only in the reservoir 1, but also in the vessel 3 owing to the disposition of the nozzles 5, which ensures unidirectional rotary motion of the liquid in the vessel 3 and reservoir 1. The nozzles 5 are so disposed on the surface of the vessel 3 that their axes $a-a$ (FIG. 2) are oriented along tangents $b-b$ to imaginary surfaces of rotation C, having a common axis $d-d$, around which said unidirectional rotary motion of the liquid arises.

Since the vessel 3 is of a cylindrical shape, the axes $d-d$ of the rotation surfaces C coincide with the vertical axis of the vessel 3.

Besides, the axes $a-a$ of the nozzles 5 are disposed at an acute angle α (FIG. 1) to the line $k-k$, parallel to the axis $d-d$ and intersecting with the axis $a-a$ of the nozzle, some nozzles being inclined to one side upwards, while the others are inclined to the opposite side downwards in relation to the line $k-k$.

The orienting of the nozzles along said tangents only in one direction ensures rotational motion of the liquid, resulting in the elimination of stagnant or dead zones in the reservoir 1 and vessel 3, that is, the whole liquid successively passes through the zones of nozzle operation, while the nozzle inclination at a certain angle α upwards and downwards ensures intensive mixing and mutual dispersion of the rotating liquids. The angle of inclination α of the nozzles 5 is selected so as to be in the range of 30° — 70° depending on the reservoir height and on the specific weights of the reagents to be mixed.

The device for the pulsating mixing of liquid reagents and liquid and solid reagents may be constructed differ-

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ently, for example, the vessel 3 (FIG. 3) is horizontally placed within the reservoir 1 and is provided with two vessels 2a, communicating through a header 6 with the piston-type pulsator 4, the vessels 2a also being disposed within the reservoir 1. Also, a vessel 2b (FIG. 4) communicating with the pulsator 4, may be placed coaxially within the vessel 3 and in communication therewith in its bottom portion. In the devices shown in FIGS. 3 and 4, the nozzles 5 are disposed on the vessel surface in the same way as in the embodiment shown in FIGS. 1 and 2 and described hereinabove.

The mixing of two liquids having different specific weights, for example water and kerosene, is performed as follows.

The reservoir 1 (FIG. 4) is filled with water and kerosene, a sharp dividing line being immediately formed therebetween. The water and kerosene penetrate into the vessels 3 and 2b through the nozzles 5 and fill them. Then the pulsator 4 is switched on and during the first half of the pulsating cycle the liquids are forced out of the vessel 2b and thrown through the nozzles 5 of the vessel 3 into the reservoir. As the nozzles 5 are directed to opposite sides upwards and downwards, after being thrown out of the vessel 3 the kerosene is directed to and dispersed in the water and vice versa.

During the second half of the pulsating cycle the vessels 3 and 2b are filled with the liquid and a partially produced emulsion. During the following cycles final water and kerosene mixing occurs, and as the nozzles 5 are oriented tangentially in one and the same direction the emulsion acquires a rotary motion and is uniformly distributed throughout the whole reservoir.

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What is claimed is:

1. A device for pulsating mixing of liquid reagents; and liquid and solid reagents; comprising a reservoir for the reagents to be mixed; at least two intercommunicating vessels, at least one of said vessels being placed within said reservoir; a pulsator connected to the other of said vessels; a plurality of nozzles disposed on the vessel placed within said reservoir and having axes oriented along tangents to imaginary surfaces of rotation, having a common axis, to provide unidirectional rotary motion of the liquid in the vessel around said axis, the axes of said nozzles being disposed at an acute angle with respect to said common axis, said plurality of nozzles including a first group of nozzles inclined in one direction in relation to said axis, and a second group inclined in the opposite direction.

2. A device as claimed in claim 1 wherein the acute angle is in the range of 30-70°.

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