

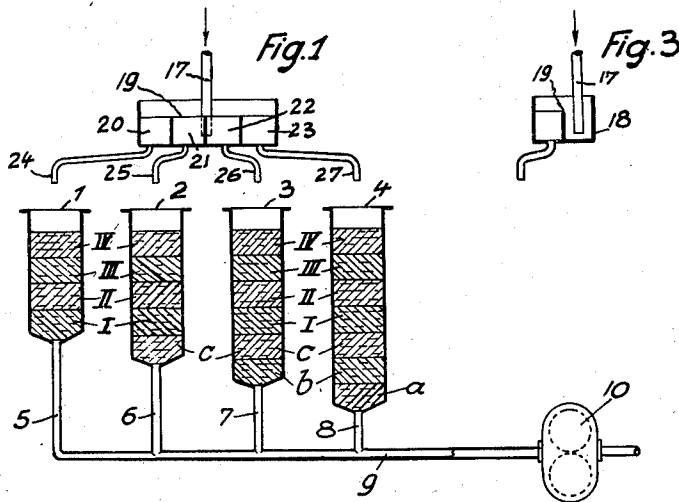
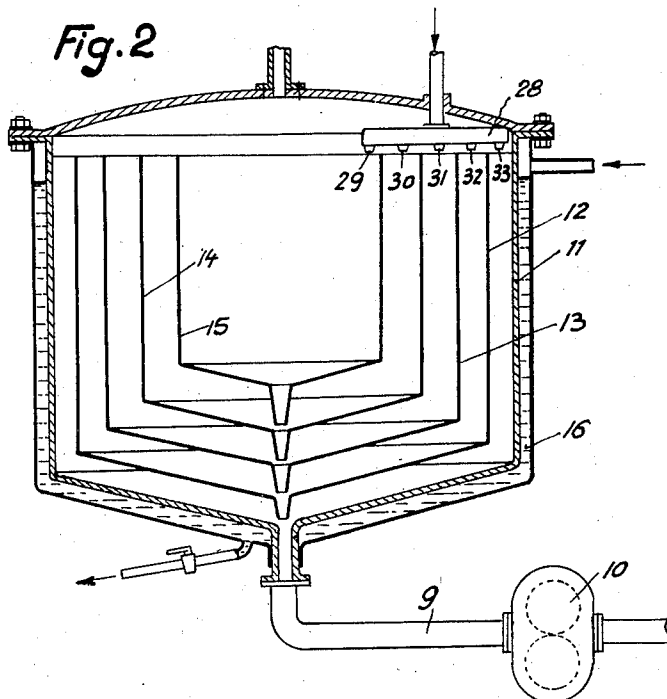
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MIXING SYSTEM

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MIXING SYSTEM

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This invention relates to a process of mixing liquids and to an apparatus for carrying out this process.

It is the object of the invention to facilitate the mixing of liquids which occur or become available at different times or places. More particularly the invention is concerned with the mixing of batches of liquids successively produced in a continuous process, for making up for small differences in the composition of the successive batches occurring in the continuous chemical or other treatment, or for adjusting the properties or composition of the liquid by adding certain quantities of the same or another liquid or liquids effecting the desired properties or composition.

A special object of the invention is to mix different quantities of liquids, more particularly thick or viscid substances, mixtures, colloidal solutions and the like with a minimum consumption of energy compared to the power consumption required in the conventional large mixing vessels.

According to this invention, the liquids or batches occurring at different times or places are split up into equal portions and the single portions are delivered into upright communicating vessels or reservoirs arranged at different levels in a staggered arrangement in such a manner that all portions of one batch of liquid take up the same level in the vessels while being at different distances from the bottoms or discharge openings of the vessels. After the different batches have been filled in, the liquid is continuously or intermittently tapped off from the bottoms of the vessels while fresh portions of the different batches of liquid are fed to the top of the vessels continuously or intermittently.

The invention will be better understood by reference to the following detailed description in connection with the accompanying drawing, showing by way of example and schematically two embodiments of my invention, viz—

Figure 1 is a section through one embodiment of my invention.

Figure 2 is a longitudinal section through a preferred modification of my novel apparatus.

Figure 3 is a lateral section of the distributing device of the apparatus shown in Figure 1.

Referring now to the drawing in greater detail, and first to Figure 1 it will be seen that four upright containers or vessels 1, 2, 3, 4 are provided, having cylindrical shapes and uniform cross sections. The bottoms of the four containers are, however, at different levels so that each of the

containers 2, 3 and 4 has a capacity exceeding by the same amount the capacity of the preceding container. The level difference between the bottoms of two succeeding containers is so dimensioned that the difference in volume corresponds approximately to the volume of the respective portion of the batches filled in in the mixing process.

The discharge holes arranged at the bottoms of the containers are connected with the horizontal central pipe 9, by connecting pipes 5, 6, 7, 8. The central pipe 9 may alternately be arranged inclined or in any suitable position. Inserted in this central pipe is a feed pump 10 of any suitable description, for instance, in the form of a gear pump.

When starting the mixing process, a quarter of a batch of the liquid is first filled into the container 4 (a). Then one quarter (b) of a second liquid batch is filled into each of the vessels 4 and 3 and then, one quarter (c) of a third charge or batch is filled into each of the vessels 4, 3, 2. The next portion of liquid is then distributed, at four uniform portions (I), to all of the four vessels. The four portions I accordingly are at equal levels. In the same manner, the portions II, III, IV etc. of the further quantities of liquid are distributed over the four vessels. Now, when tapping the liquid from the vessels, the level of the liquid in the four communicating vessels sinks or falls practically uniformly so that four portions derived from four different batches in the vessels are mixed in the central pipe 9. For instance, the portions I, II, III and IV of the different batches are distributed over the four containers and thus mixed with each other. With further tapping, the portions II, III and IV of the vessels 4, 3 and 2 will be mixed with each other and with a portion of a fifth batch from the vessel 1. The mixed liquid now may be taken from the central duct or delivered further by compressed air acting upon the vessels or the mixing system or by a pump 10. The mixing process may be intensified by a filter arrangement behind the pump 10 or by any other suitable mechanical or chemical treatment.

It will be understood that my novel process is particularly advantageous when carried out continuously, since in this case only a single short starting period, i. e. filling in of the portions a, b, c, is required only, after which operation all of the liquid batches which occur or become available can be distributed over the four vessels.

A modified apparatus which is suitable for car-

rying out my novel process is shown in Figure 2. The apparatus in this instance consists of an exterior substantially cylindrical vessel 11 and cylindrical reservoirs or vessels 12, 13, 14, 15 positioned therein. The dimensions of these vessels are so chosen that the spaces between two level surfaces in the interior cylinder and in the annular spaces bounded by two cylinders each have the same filling capacity or volume. Advantageously, the discharge openings of the single vessels are coaxially arranged. These discharge openings may be provided with short tubular projections each of which terminates closely above the next lower discharge opening, as shown in Figure 2. In some instances I may provide the discharge tubes to extend through the lower discharge openings and to terminate approximately at the level of the discharge opening of the largest vessel, i. e. the lowest bottom.

The exterior vessel 11 may be formed as a strong-walled pressure vessel, and provided with a heating or cooling cover 16, as shown in Figure 2. The vessels 11, 12, 13, 14, 15 may alternatively be formed with a square, rectangular or polygonal cross section, provided that the filling capacity of the spaces between equal level surfaces is the same as hereinbefore described, in order to render it possible to mix equal portions of different liquids.

The modification shown in Figure 2 offers the advantage, compared to single separately positioned vessels, as per Figure 1, that only the exterior vessel 11 has to withstand the pressure of the liquid, while the interior cylinders 12, 13, 14, 15 may have very thin walls, since the pressure acts upon the walls from both sides so that these interior walls are not stressed by the pressure but merely serve to guide the liquid. The hydrostatic pressure and the additional pressure, if any, will stress the exterior wall only. Moreover, only a single heating or cooling device or heat insulating cover is required.

Where it is intended to mix with each other different proportions of the different liquids or batches, the cross sections of the vessels may be varied in the same proportion.

An automatic feeding device may be used to deliver the liquid proportionally to the vessels, consisting, for instance, of feed pumps, overfall-weirs or measuring nozzles corresponding in number to the number of vessels.

Figures 1 and 3 illustrate a distributing vessel with overfall-weirs, comprising a space 18 into which the liquid or liquids are delivered by a feed pipe 17. The liquid falls over the upper edge of the wall 19 into the four chambers 20, 21, 22, 23 and is thus delivered to the vessels 1, 2, 3, 4 through the pipes 24, 25, 26, 27. The quantities of liquid delivered into each of the chambers 20, 21, 22, 23 is proportional to the proportional length of the overfall edge 19 of the respective chamber. In order to distribute the liquid equally over the four chambers, the respective overfall edges should be equal in length.

Figure 2 shows a feeding device in the form of a distributing pipe 28 having a number of measuring nozzles 29, 30, 31, 32, 33 associated to the vessels 15, 14, 13, 12, 11, respectively, and effecting a uniform distribution or a distribution in any desired proportions by suitable choice of the passage cross sections.

My novel process and apparatus may be used in many industrial fields for mixing liquid or liquified substances, for instance, for mixing oil, liquid bitumen, solutions of cellulose or cellulose

derivatives, such as for example solutions of acetyl cellulose of the kind used for making varnishes or lacquers, artificial silk or foils, or mixtures of synthetic fatty acids.

I claim:

1. In a process of continuously mixing liquids, the steps which comprise distributing a batch of one liquid to a plurality of vessels having their bottoms positioned at different levels and being already filled with a liquid up to a certain level, then distributing a batch of a second liquid to the said vessels in the ratios selected in the distribution of the first named batch, and concurrently allowing the liquids to flow through discharge pipes connected to the bottoms of said vessels into a pipe line connecting said discharge pipe with each other, and continuing said distributing and discharging operations in the ratios selected for the second batch with further batches of liquids.

2. In an apparatus for mixing liquids, in combination, a plurality of reservoirs having their bottoms arranged at different levels in a stepped arrangement which have different capacities between the horizontal planes passing through all the reservoirs and their bottoms, pipes for connecting the said bottoms with each other and with the point to which the mixed liquids are to be delivered and means for successively distributing the component liquids of the mixture over said reservoirs in such a manner that each batch of component liquid takes up substantially the same level in all of said reservoirs.

3. In an apparatus for mixing liquids, in combination, a plurality of upright reservoirs of equal cross sections having their bottoms arranged at different levels in a uniformly stepped arrangement which have different capacities between the horizontal planes passing through all the reservoirs and their bottoms, pipes for connecting the said bottoms with each other and with the point to which the mixed liquids are to be delivered and means for successively distributing the component liquids of the mixture over said reservoirs in such a manner that each batch of component liquid takes up substantially the same level in all of said reservoirs.

4. In an apparatus for mixing liquids, in combination, a plurality of reservoirs concentrically positioned in a common exterior vessel which have different capacities between the horizontal planes passing through all the reservoirs and their bottoms and having their bottoms at different levels so that the bottom of the innermost reservoir is at the highest level, discharge openings in said bottoms substantially coaxially positioned with respect to a common vertical axis and means for distributing the component liquids of the mixture over said reservoirs including said exterior vessel in constant proportions for the liquids consecutively distributed.

5. In an apparatus for mixing liquids, in combination, a plurality of reservoirs concentrically positioned in a common exterior vessel which have different capacities between the horizontal planes passing through all the reservoirs and their bottoms and having their bottoms at different levels so that the bottom of the innermost reservoir is at the highest level, discharge pipes in said bottoms substantially coaxially positioned and terminating substantially at the level of the discharge opening of the next lower bottom, means for distributing the component liquids of the mixture over said reservoirs including said exterior

vessel in constant proportions for the liquids consecutively distributed.

6. In an apparatus for mixing liquids, in combination, a plurality of reservoirs concentrically positioned in a common exterior vessel which have different capacities between the horizontal planes passing through all the reservoirs and their bottoms and having their bottoms at different levels so that the bottom of the innermost reservoir is at the highest level, a discharge opening in the bottom of said exterior vessel, discharge pipes in said bottoms substantially coaxially positioned and terminating substantially at the level of the discharge opening in the bottom of said exterior vessel, means for distributing the component liquids of the mixture over said reservoirs including said exterior vessel in constant proportions for the liquids consecutively distributed.

7. In an apparatus for mixing liquids, in combination, a plurality of reservoirs concentrically positioned in a common exterior vessel which have different capacities between the horizontal planes passing through all the reservoirs and their bottoms and having their bottoms at different levels so that the bottom of the innermost reservoir is at the highest level, discharge openings in said bottoms substantially coaxially positioned with respect to a common vertical axis, means for distributing the component liquids of the mixture over said reservoirs including said exterior vessel in constant proportions for the liquids consecutively distributed, and a pressure pipe connected with the top of said reservoirs.

8. In an apparatus for mixing liquids, in combination, a plurality of reservoirs concentrically positioned in a common double-walled exterior vessel which have different capacities between the horizontal planes passing through all the reservoirs and their bottoms and having their bottoms at different levels so that the bottom of the

innermost reservoir is at the highest level, discharge openings in said bottoms substantially coaxially positioned with respect to a common vertical axis and means for distributing the component liquids of the mixture over said reservoirs including said exterior vessel in constant proportions for the liquids consecutively distributed.

9. In an apparatus for mixing liquids, in combination, a plurality of communicating reservoirs having discharge openings at different levels in a staggered arrangement which have different capacities between the horizontal planes passing through all the reservoirs and their bottoms and means for automatically distributing each component liquid of the mixture over said reservoirs with retention of the same distribution ratio for the different liquids.

10. In an apparatus for mixing liquids, in combination, a plurality of communicating reservoirs having discharge openings at different levels in a staggered arrangement which have different capacities between the horizontal planes passing through all the reservoirs and their bottoms and means comprising overfall weirs for automatically distributing each component liquid of the mixture over said reservoirs with retention of the same distribution ratio for the different liquids.

11. In an apparatus for mixing liquids, in combination, a plurality of communicating reservoirs having discharge openings at different levels in a staggered arrangement which have different capacities between the horizontal planes passing through all the reservoirs and their bottoms and means comprising calibrated measuring nozzles for automatically distributing each component liquid of the mixture over said reservoirs with retention of the same distribution ratio for the different liquids.

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