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DEVICE FOR MIXING AND HOMOGENIZING LIQUIDS

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Fig. 1

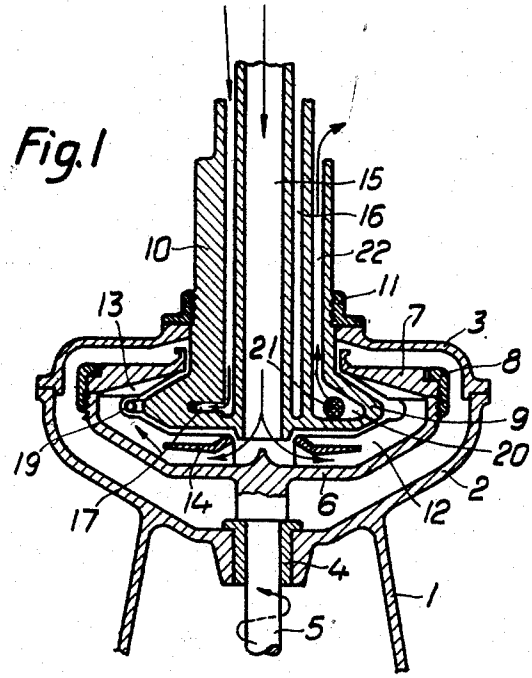
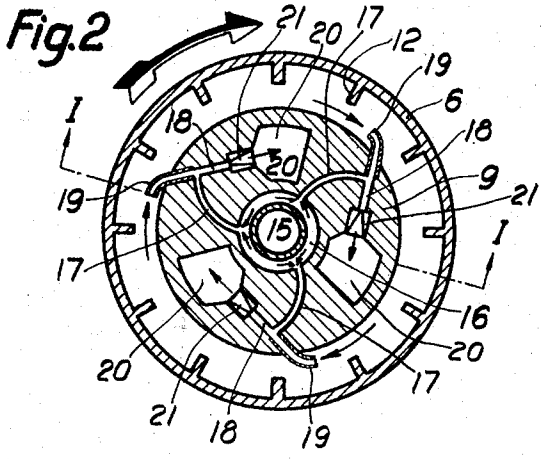


Fig. 2



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DEVICE FOR MIXING AND HOMOGENIZING LIQUIDS

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7 Claims. (Cl. 259—3)

1

This invention relates to the mixing and homogenizing of liquids.

It is known in the art of mixing and homogenizing liquids to make one of the liquids pass at high velocity through a pipe and make the other liquid, which is to be mixed with the first mentioned liquid, flow into this pipe. For this purpose an injection nozzle may be used in which the pressure energy of the first liquid is converted into energy of velocity and in which the pipes for the other liquid end. Owing to the reduced pressure and the high velocity of the main liquid, the other liquid will be entrained and finely distributed within the first liquid.

This invention is based generally on this known principle for mixing and homogenizing of liquids but differs therefrom with regard to the way in which the energy of velocity is produced, and has for its object the provision of an improved apparatus for this purpose.

According to the invention, the device comprises a rotatable housing enclosing a paring member for paring out and discharging, through a channel therein, a liquid fed into the housing and rotating with it. When the speed of the housing is sufficiently high, the liquid discharged by means of a paring member of this type has a velocity which is particularly suitable for mixing it with one or more other liquids fed, in accordance with the invention, into the channel of the paring member or the prolongation of the channel through another channel or channels. The channel for the other liquid or liquids which are to be mixed with the main liquid should preferably end in the channel for the latter liquid in such a manner that all the liquids are discharged in the direction and channel of the main liquid, and not vice versa. In order to obtain maximum atomization or homogenization, a separate homogenizing device may be provided in the discharge channel for the liquids, at a point where the velocity of the liquid is sufficiently high. This separae homogenizing device may be in the form of a chamber filled with balls or the like, as disclosed in Borck et al. Patent No. 2,583,206 dated January 22, 1952. According to one particular embodiment of this invention, the homogenizing device is placed in the paring member. The latter may consist of a circular disc in the circumference of which the opening or openings of the paring channel are located. The channels may also end in the rotatable housing in the form of tubes projecting from the paring member. In some cases it may be preferable to use a paring disc of external

2

spiral shape consisting of a disc having one or more projections in which the openings of the paring channel or channels are located.

The advantage of a mixer of this type is the high velocity which is given to the main liquid. The velocity energy is composed of static pressure converted into energy of this type and of the kinetic energy of the rotating liquid. The mixer may also advantageously be built into a centrifugal separator and be used for homogenizing whole milk when the paring member is used to pare out skim-milk and to mix and homogenize cream with it, as disclosed in my co-pending application Serial No. 225,291, filed May 9, 1951 now Patent No. 2,612,356, dated September 30, 1952. In order to obtain the desired high velocity in the paring member, its channels should be constructed in a way which best satisfies this requirement.

For a better understanding of the invention, reference may be had to the accompanying drawing, in which

Fig. 1 is a vertical sectional view of a preferred form of a mixer and homogenizer, taken on the line 1—1 of Fig. 2, and

Fig. 2 is a horizontal sectional view of the device shown in Fig. 1, with the outer frame structure omitted.

The mixer and homogenizer illustrated in the drawing comprises a frame 1, the upper part of which is in the form of a shell 2 having a cover 3. A vertical shaft 5 is rotatably disposed in a bearing 4 in the frame 1. The shaft 5 carries a housing 6 provided with a cover 7, which is secured to the housing 6 by an annular nut 8. In the housing 6 is a paring member comprising a paring disc 9 carried by a spindle 10, which in turn is supported on the frame 1 by means of an annular nut 11 screwed on the spindle 10 and secured to the cover 3 of the frame by bolts (not shown). In the housing 6 and on the lower side of the cover 7 are wings 12 and 13, respectively, directed radially inward and serving the purpose of making the liquid fed into the housing 6 partake in its rotation. The wings 12 support an annular flange 14, the function of which will be described presently. In the spindle 10 and the paring disc 9 is a central through-flow channel 15, ending at the bottom of the paring disc. This channel is surrounded concentrically by another channel 16, from which extend three smaller channels or ducts 17 in the paring disc. Each duct 17 ends in one of three channels 18 in the paring disc. The channels 18 extend as far as the circular periphery of the paring disc.

where they end in bent tubes 19 fixed to the paring disc. As shown in Fig. 2, the bent portion of each tube 19 extends opposite to the direction of rotation of the housing 6. The other ends of the channels 18 open each into a chamber 20 in the paring disc. An homogenizing device 21, which may consist of a chamber filled with balls or the like (as disclosed in the aforesaid Patent No. 2,583,206), is arranged between each chamber 20 and channel 18. The chambers 20 have a common outlet through the spindle 10 via the channel 22.

The construction described operates in the following manner. After the housing 6 has been put into rotation by means of a driving device (not shown) coupled to the shaft 5, a liquid which is to be mixed with another liquid is admitted through the channel 15, which forms a liquid inlet to the housing. The liquid is distributed on the lower side of the paring disc 9 into the channels formed by the annular flange 14, the wings 12, and the bottom wall of the housing, and is immediately put into rotation and led to the periphery of the paring disc. The arrows in the drawing indicate the direction in which the liquids move. The bent tubes 19 of the paring disc pare out the liquid to which, owing to the static pressure prevailing at the point of paring and the kinetic energy of the liquid, a considerable amount of energy is given. This makes it possible for the liquid to be mixed with the other liquid at high velocity in the channels 18, which should be suitably shaped for the purpose, and then to flow with only a small loss of energy into the homogenizing member 21 and thence into the chamber 20. The other liquid which is to be mixed with the first is at the same time admitted through the channel 16 and the ducts 17, communicating with the channels 18. The second liquid is finely distributed into the first or main liquid and follows it to the homogenizing member 21 and chamber 20. The ducts 17 end in such a way in the channels 18 that such flow is made possible, and the pared-out liquid is prevented from flowing out through the ducts 17. Thus, each channel 18, in the region where it is joined by the duct 17, may be reduced in through-flow area so as to effect an increase in velocity and a reduction in pressure of the main liquid, whereby the action is similar to that of an injection nozzle. When the liquids are brought together in the channel 18, an intimate mixing is obtained and, to a certain degree, homogenizing of the liquids is brought about, which is further improved in the homogenizing member 21. The mixed and homogenized liquid is discharged from the chamber 20 through the channel 22.

From the above, it will be understood that the homogenizing devices 21 are not necessary for the mixing of the liquids but are provided only for the purpose of improving the mixing. The homogenizing devices 21 may be arranged outside the paring disc 9 at a point beyond the channel 22 reckoned in the direction of flow. Neither is it necessary for the ducts 17 to lie in the paring disc 9 itself, but they may very well be positioned beyond the channel 22 if care is taken that the liquid flowing through channel 22 has still a sufficiently high velocity to effect a mixing with the other liquid when it is made to converge with it. Instead of a paring disc having projecting tubes 19, a circular paring disc without such tubes may be used, although the energy produced with the same diameter of the inlet openings will then be a little lower. Instead of tubes projecting from the paring disc, a paring disc provided with peripherally spiral-shaped projections in which the channels 18 end, may be used, as disclosed in the aforesaid Brecourt et al. Patent No. 2,230,210.

I claim:

1. A liquid mixing device comprising a rotatable housing having a liquid inlet and adapted to rotate a body of liquid fed through the inlet, a paring member in the housing operable on said liquid body to pare and discharge liquid therefrom, the paring member having a channel for passage of the pared liquid at high velocity, and a liquid supply duct terminating in said channel at a region spaced from its entrance end and where the throughflow area of the channel does not exceed the throughflow area at said entrance end of the channel for supplying to the channel a liquid to be mixed with said first liquid while said first liquid is at high velocity.

2. A device according to claim 1, in which said channel and duct form an injection nozzle in which said first liquid entrains the second liquid in the direction and channel of the first liquid.

3. A device according to claim 1, comprising also an homogenizing device disposed in said channel beyond the point of its intersection with said duct, reckoned in the direction of liquid flow in the channel.

4. A device according to claim 1, in which said duct is in the paring member.

5. A device according to claim 1, comprising also an homogenizing device disposed in the paring member and located in said channel beyond the point of its intersection with said duct, reckoned in the direction of liquid flow in the channel.

6. A device according to claim 1, in which the paring member comprises a paring disc having a circular circumference, said channels having inlet openings in said circumference of the disc.

7. A device according to claim 1, in which the paring member comprises a paring disc having a circular circumference and a tube forming an extension projecting beyond said circumference and defining an inlet to said channel.

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