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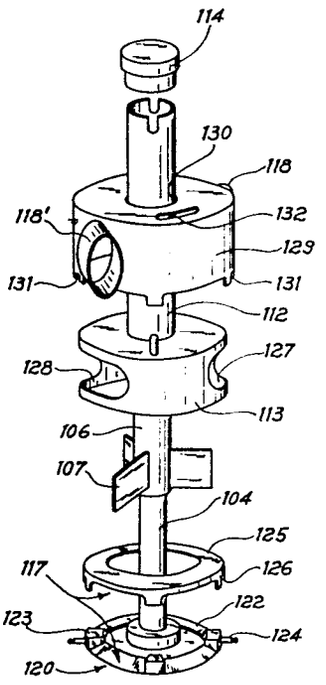
(54) Stirring and homogenizing device for allmentary mixtures.

(57) The invention concerns a device for stirring and homogenizing alimentary mixtures, particularly appropriate to be used in combination with pasteurizers of liquid mixtures for ice-cream.

The main object of the invention is to provide a device which does not absorb air into the mixture during stirring.

Said object is achieved by means of a stirring device characterized in that it comprises a centrifugal pump capable of sucking the mixture from a container (2; 102) tank and pumping it again into the container itself, said pump having a rotating impeller (6, 7; 106, 107) above the container bottom and covered by an at least partially removable jacket (13; 113).



EP 0 182 275 A2

This invention concerns a stirring and homogenizing device for alimentary mixtures, particularly adapted to be used in combination with pasteurizers, specially of liquid mixtures for ice-cream.

The known pasteurizers of liquid mixtures for ice-cream generally comprise a container or tank for containing and thermally treating the mixture, inside of which a stirring device must keep the mixture in movement in order to improve the thermal exchange between the mixture and the cooled or heated tank walls. Further, said stirring device must perform mixing of different liquid and solid ingredients forming the mixture, which can thus be directly prepared in the pasteurization container.

The known stirring devices generally comprise a rotary shaft vertically protruding from the bottom of the pasteurization container and housed in a tubular box sealingly fixed to the tank bottom, said shaft and box extending upwards beyond the highest level of the mixture, as well as stirring means consisting of a tubular element provided with one or more stirring blades, positioned coaxially to the rotary shaft and tubular box, outside the latter and mechanically connected to the shaft upwardly to said box.

These known devices have a basical drawback in that the rotation of said tubular element bearing the stirring blades creates a vortex which sucks air from the outside and conglobes it into the mixture. The consequence of said drawback is that during the pasteurization stage the mixture volume considerably increases and therefore the

user cannot take full advantage of the container capacity if he does not want to run the risk that the mixture overflow from the container itself.

An object of this invention is therefore to provide a mixture stirring device which eliminates the aforesaid drawback of the known devices.

Another object of the invention is to provide a device which may be used to perform further treatments of the mixture, besides that of stirring and mixing the mixture ingredients, such as for example a homogenization treatment, a treatment for crushing the solid ingredients in the mixture, etc.

Still another object of the invention is to provide a device which allows a wide adjustment range as far as intensity of stirring, mixing, homogenization degree, etc. are concerned.

Said objects are achieved by means of a stirring and homogenizing device for alimentary mixtures, characterized in that it comprises a centrifugal pump capable of sucking the mixture from a container and pumping it again into the same container, said pump comprising a rotating impeller above the tank bottom and covered by an at least partially removable jacket.

In particular, said impeller is clutched onto a rotary shaft vertically protruding from the tank bottom and said jacket has axial or radial-axial passages for sucking the mixture and radial passages for delivering said mixture.

Further characteristics and advantages of the device according to the invention will be now described in detail

with reference to the accompanying drawings, wherein:

- figure 1 is an "exploded" view of the device according to a first embodiment with its components in position of reciprocal presentation;
- figure 2 is a cross sectional view of the device with its components in position of reciprocal engagement;
- figure 3 and 4 are top views of the device, when oriented with reference to the container side walls according to different directions;
- figure 5 is an "exploded" view of another embodiment of the invention;
- figure 6 is a cross-sectional view of the embodiment of figure 5 with its components in position of reciprocal engagement;
- figure 7 is a top view of a pasteurization container with the embodiment of figures 5 and 6;
- figure 8 is a side view with parts in cross-section of a cock for controlling the mixture mixing and discharging operations when operated together with the device according to this embodiment of the invention.

With reference to figures 1 to 4, a the device 1 according to the invention is shown as positioned inside a mixture container 2 of a pasteurizer.

From the bottom wall of said container a rotary shaft 3 vertically protrudes, housed in a tubular liner 4 which is sealingly fixed to said container bottom wall. Both the liner 4 and shaft 3 have upper free ends coming out from the mixture, even when the latter reaches the highest level inside the container 2.

The top end of shaft 3 freely protrudes from liner 4 and has a vertical groove 5 or similar connection means.

Coaxial with the shaft 3 and liner 4, a tube 6 is provided in its lower section with a series of radial blades 7, the horizontal bottom edges of which are substantially flush with the bottom wall of container 2. The tube 6 can be connected to the shaft 3 for instance by means of a horizontal small pin 8 positioned in the upper section of the tube itself and suitable for being introduced into said vertical groove 5 of shaft 3.

The tube 6 is kept coaxial to shaft 3 by means of a bushing 9 made of antifriction plastics material and a cap 10 (see fig. 2). The bushing 9 is integral to the tube 6, placed in correspondence with its bottom end and fills the annular space existing between the liner 4 and the tube 6; the cap 10 is inserted into the top end of tube 6 and has in its lower face an axial hole 11 suitable for receiving the top end of shaft 3.

Coaxially to the tube 6, a further tubular element 12 is inserted, said element 12 being provided, in its bottom section, with a jacket 13 so shaped and sized to completely contain the blades 7. The top end of said tubular element 12 comes out from the highest level of the mixture for such an extent as sufficient to allow a manual grasping and is closed by a cap 14. The jacket 13 is fixed to the bottom wall of container 2 for instance by means of a bayonet clutching comprising pins 15 protruding from the container bottom wall and corresponding grooves 16 provided in the bottom edge of said jacket 13. The jacket

13, moreover, has upper axial passages 17 and a couple of radial holes diametrically opposite and communicating with corresponding ducts 18 which protrude in a direction tangent to the side surface of the jacket and are oriented toward opposite directions.

The group of blades 7 and jacket 13 forms a centrifugal pump capable of sucking the mixture from the container 2 through the holes 17 and pumping it again into the same container through the ducts 18. In this way, the mixture jets coming from the ducts 18 generate a movement in the mixture mass within the container. Furthermore, the mixture sucked by the pump undergoes a treatment which improves mixing of ingredients.

One of the main features of the device according to the invention is that the mixture jets coming from the ducts 18 generate a circulation of the mixture itself inside the container, which is a function of the pump rotation speed as well as of the orientation of the ducts themselves with respect to the container side walls. In fact, as shown in figures 3 and 4, according to the orientation of the ducts 18, different mixture circulation paths are created inside the container. For example, by orienting the ducts according to a direction substantially tangent to the container side walls, a regular circulation of the whole mixture is obtained, which can be more appropriate to improve a thermal exchange between the mixture and the container walls, while by orienting the ducts according to a direction perpendicular to the side walls of the tank, a turbulent movement of the mixture around the pump is

produced, which can be more suitable for the dilution and mixing of the solid ingredients with the liquid ones.

The possibility of varying the directions of the pump delivery ducts, as well as the rotation speed of the impeller allows to choose within a wide range of values the stirring intensity and the circulation speed of the mixture, which allows to treat mixtures of different compositions and density. Another possibility to control the stirring intensity can be obtained by providing means which can be actuated from the outside and are capable of partializing the sucking passages 17 of the pump. By varying the amount of mixture treated by the pump in the time unit, it is actually possible to vary the intensity of the jets coming from ducts 18 and therefore the stirring rate.

Another feature of the device is to allow it to be used also for performing a homogenizing treatment of the mixture. For this purpose it is sufficient to foresee a jacket 13 provided with axial holes for sucking the mixture and a series of delivering radial holes having a very small diameter, capable of breaking the fat molecules present in the mixture. This particular embodiment allows for example to obtain cream by homogenizing butter.

Another particularly advantageous feature of the device according to the invention consists in that it is completely and very easily removable, so to facilitate the cleaning operations.

The device of figures 5 to 8 always operates within a container 102 of a pasteurizer, having a rotary shaft (not

shown) protruding form the container bottom and having a free end with a vertical groove. A tubular liner 104 partially covers the shaft and is connected to the bottom wall of container 102 by means of a plate 120 having a part 121 adapted to be inserted within a hole in the container bottom wall, and a part 122 lying above said container bottom wall and showing centering and positioning protrusions 123, as well as radially extending pins 124.

Coaxially above said protruding part 122, a covering ring 125 is positioned in such a manner to be centered on protrusions 123 and retained against rotations by insertion of fork-shaped elements 126 onto said pins 124. Said protruding part 122 and said covering ring 125 together define sucking parts 117 having a path which is first radially oriented and then axially oriented with reference to shaft 103.

The impeller blades 107 are arranged to rotate flush with said ring 125 and are mounted on a tube 106 which is coaxially mounted on said liner 104 and is connected with the shaft by means of a horizontal pin 108 positioned in the upper section of tube 106 and suitable to be introduced into said vertical groove of shaft. The tube 106 is kept coaxial with the shaft by means of one or more bushings in an antifriction plastics material.

Coaxially to the tube 106, a further tubular element 112 is inserted, said element being provided, in its bottom section, with a jacket 113 so shaped and sized to cover the blades 107 and form a pump or mixer scroll. The top

end of said tubular element 112 comes out from the highest level of the mixture for such an extent as sufficient to allow for a manual grasping thereof and is closed by a cup 114. Said jacket 113 further comprises two mixture outlet ports 127 and 128, the second of which has a circumferential extent which is at least twice the extent of the other port 127.

Coaxially above said jacket, a further cylindrical jacket 129 is placed, said jacket 129 comprising a hole 130 for the passage of said tubular element 112, a pair of tangentially extending ducts 118, 118′ having openings in correspondence with said ports 127 and 128, respectively fork-shaped protrusions 131 for rotationally fixing the jacket 129 to the pump base 122 by means of pins 124, as well as a groove 132 in its upper portion wherein a pin 133 protruding from the jacket 113 is inserted in order to limit the extent of a rotation of jacket 113, as manually controlled by the cap 114. This rotation shifts the ports 127 and 128 with reference to openings corresponding to ducts 118, 118′, so to gradually limit port 127 until completely closing the same, while port 128, due to its circumferential extension, remains always open. This allows to control the mixture circulation within the container 102 and, as it will be seen later on, to use the impeller 107 as a pump to evacuate the mixture from said container 102. The outer jacket 129 is fixed to the bottom plate 120 by suitable means allowing the whole device to be disassembled for cleaning purpose, for instance by resilient clips (not shown).

Figure 7 shows a top view of a pasteurizing container 102 inside of which the device 101 is mounted with its duct 118, opening toward the container and duct 118' connected, by means of a removable tube 134, to a special cock 135 as shown in figure 8. This cock has a control handle 136 adapted to be axially shifted in order to conventionally control by a rod 137 the position of a valve 138 which allows the mixture to be evacuated from a duct 139 protruding into the container 102 and connected with tube 134, to a discharge duct 140.

Upstream the valve 138, a bar 141 carries a double T-shaped element 142 (see the section at the left) having arc-shaped wing portions slidingly adapted to the inner wall of duct 139, in order to control the opening and closure of ports 143 provided for in the duct wall. The axial length of element 142 and the position thereof with reference to ports 143 are so designed that when the cock is closed (as shown in the drawing) said ports 143 can be partially limited by element 142, or completely opened, in order to assure always a mixture circulation within said tube 134 but to have a possibility of control the mixture flow rate, together with the abovestated control of the flow rate through port 127 and duct 118. When the cock is opened (and element 142 is retracted from the shown position) then said ports 143 can be wholly opened or closed, at will, according to the cock rotary position, in order to obtain respectively a discharge action together with a mixture circulation within the container 102, or a discharge pumping action alone.

This embodiment shows all the features and advantages of the previous one, and moreover allows sucking of mixture from a very low level into the container and pumping said mixture not only within the same container but also outwardly.

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CLAIMS

1) A stirring and homogenizing device for alimentary mixtures, characterized in that it comprises a centrifugal pump (7, 13; 107, 113) capable of sucking the mixture from a container (2; 102) of the mixture and pumping it again into the same container, said pump including a rotating impeller (6, 7; 106, 107) placed above the container bottom wall and an at least partially removable jacket (13; 113).

2) A device according to claim 1, characterized in that said impeller (6, 7; 106, 107) is inserted on a rotary shaft (3) vertically protruding from said container bottom wall, and in that said jacket (13; 113) has axial or radial-axial passages (17; 117) for sucking the mixture and radial passages (18; 127, 128) for delivering the same mixture.

3) A device according to claim 2, characterized in that said shaft (3) upwardly extends beyond the highest level of the mixture in the container and is housed in a tubular liner (4; 104) sealingly fixed to said container bottom wall, coaxially and over said liner (4; 104) being inserted a tube (6; 106) mechanically connected to the top end of said shaft (3) and having in its bottom part a series of radial blades (7; 107) constituting said impeller.

4) A device according to claim 3, characterized in that said tube (6; 106) and said radial blades (7; 107) are completely surrounded by a tubular element (12, 13; 112, 113) fixed in a removable way to said container, said

tubular element comprising a top section (12; 112) of a smaller diameter adjacent to said tube (6; 106) and a bottom section (13; 113) of a larger diameter, forming said jacket.

5) A device according to claim 2, characterized in that said radial passages (18; 127, 128) in said jacket (13, 113) are in the form of a couple of diametrally opposite radial holes, said holes communicating with corresponding ducts (18; 118, 118') tangently protruding form said jacket (13; 113) and oriented according to opposite directions.

6) A device according to claim 4 and 5, characterized in that said tubular element (12, 13) can be fixed to the container according to different orientations.

7) A device according to claim 2, characterized in that said radial passages provided in said jacket (13; 113) are a series of radial holes having a so small diameter as suitable for breaking fat molecules within the mixture.

8) A device according to claim 2, characterized in that said jacket comprises means adapted to be controlled from the outside of said container and capable of partializing said axial passages (17) for mixture sucking.

9) A device according to claim 5, characterized in that said ducts (118, 118') are formed on a second jacket (129) surrounding said first jacket (113), into alignment with said radial passages (127, 128) therein, said first jacket (113) and said second jacket (129) being relatively rotatable in order to limit or to close at least one of the mixture outlet ports as defined by said passages (127,

128) and the holes of said ducts (118, 119).

10) A device according to claim 9, characterized in that said second jacket (129) is removably fixed (at 124, 131) to the container (102) and said first jacket is rotatable within the first jacket for a given angle as defined by rotation limiting means (132, 133).

11) A device according to claim 9 or 10, characterized in that one (128) of said radial passages has such a circumferential length to keep open the related port of duct (118') in all relative positions of said jackets (113, 129).

12) A device according to claim 11, characterized in that said constantly opened duct (118') is connected to a tube (134) and a cock (135) for controlling the discharge of mixture outside the container (102).

13) A device according to claim 12, characterized in that said tube (134) or cock (135) comprises ports (143) opening into said container (102) and adapted to be closed when said cock is in its mixture discharging position.

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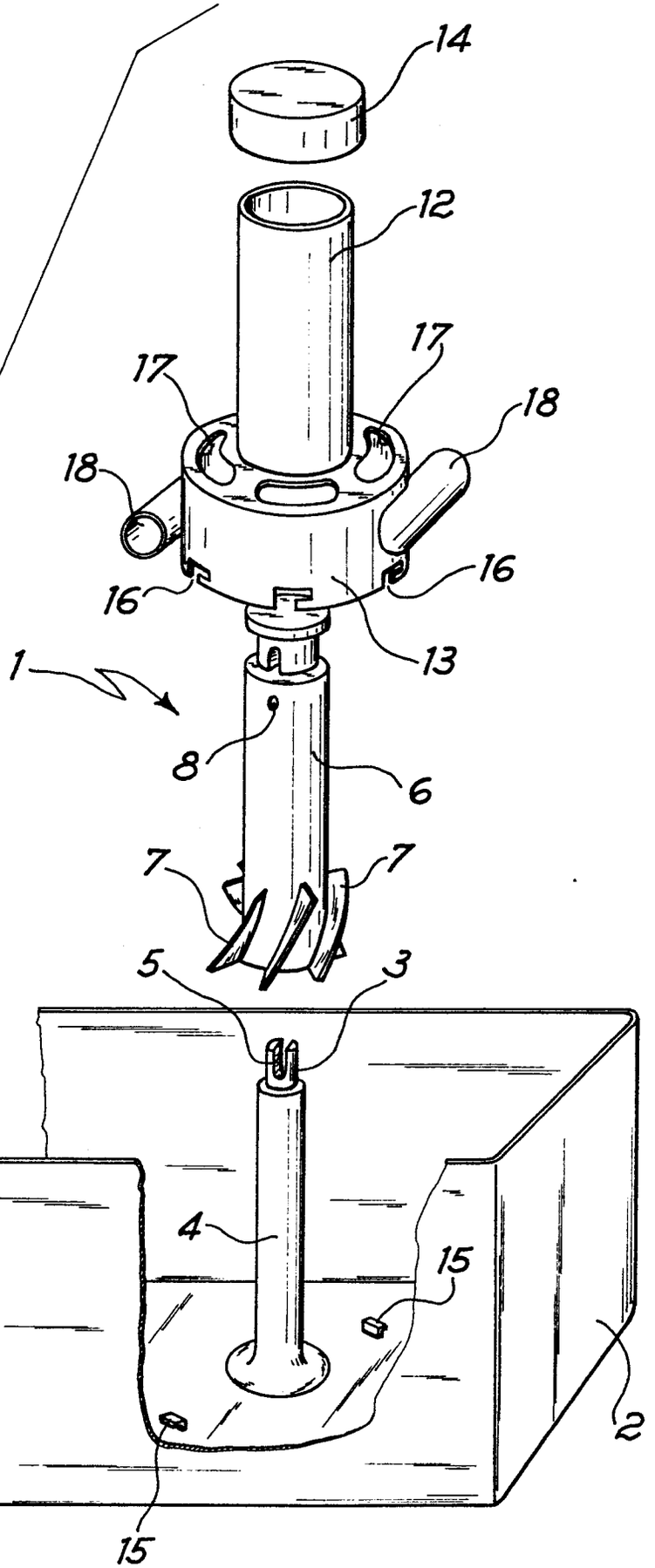

Fig.1

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Fig. 2

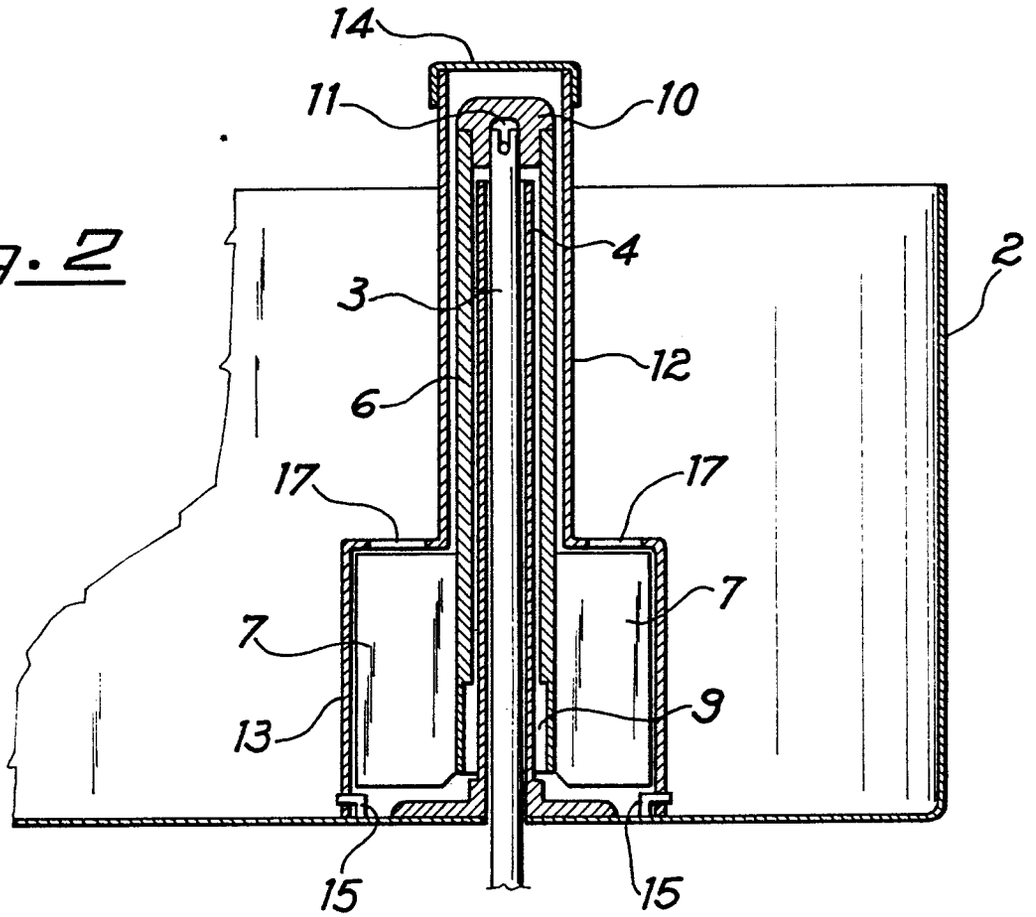

Fig. 3

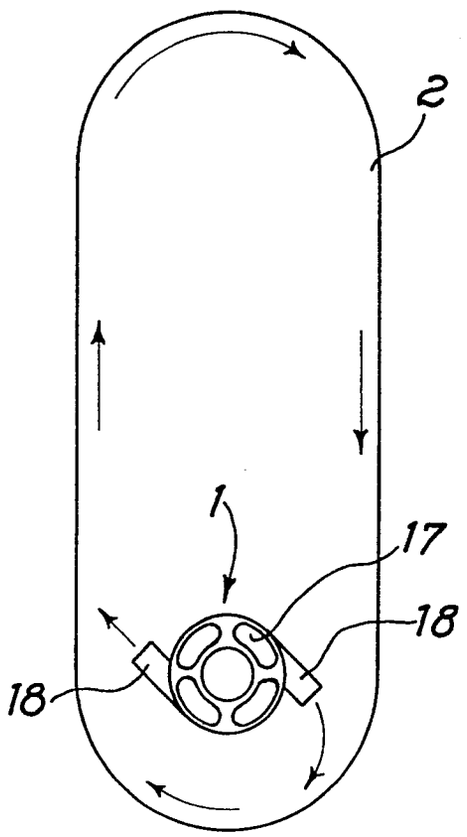

Fig. 4

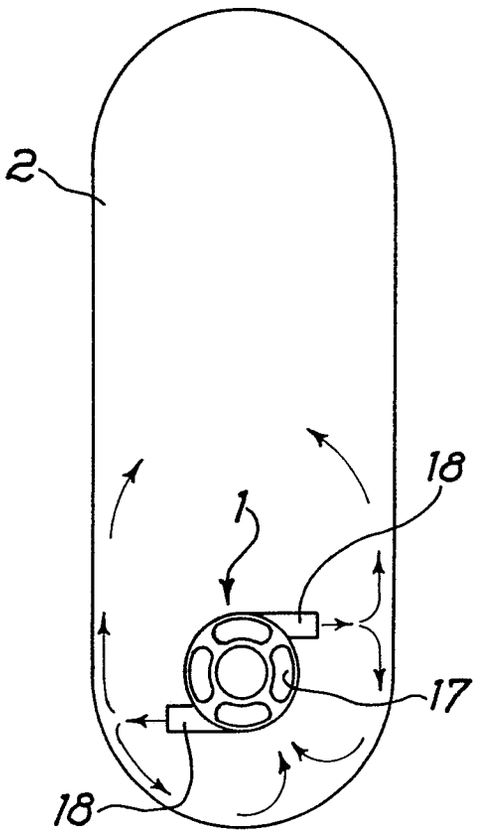

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Fig. 5

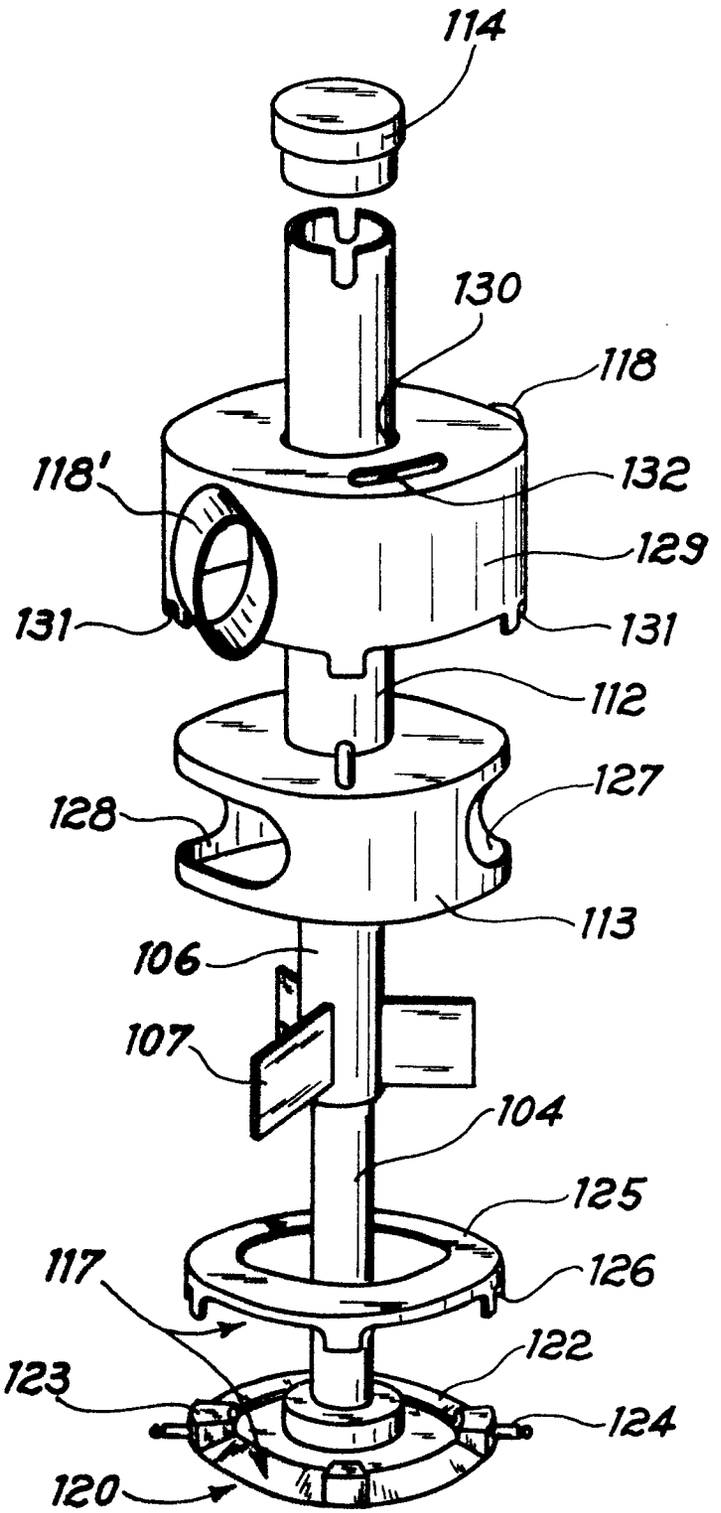

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Fig.6

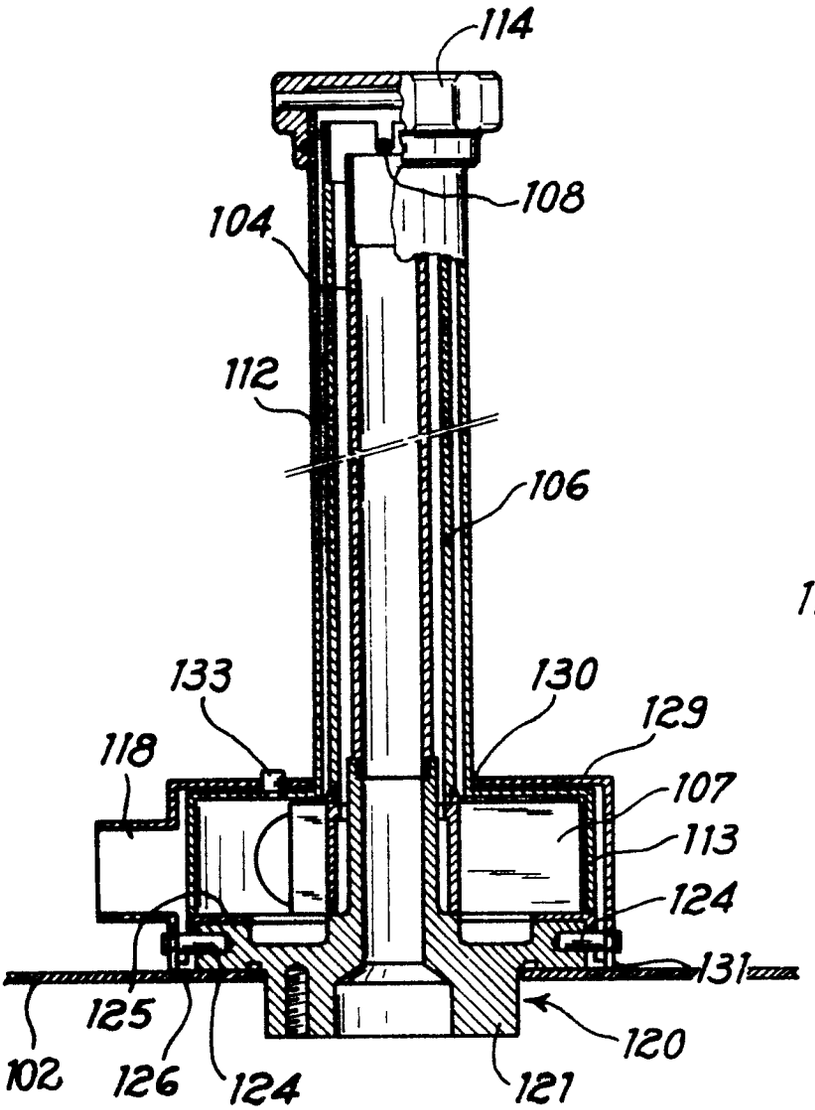

Fig.7

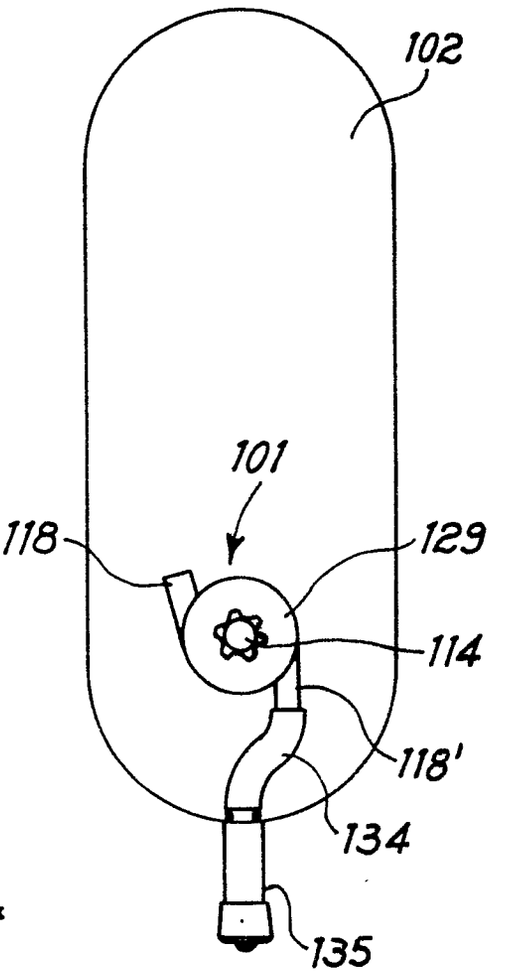

Fig.8