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(54) **An icecream maker**

(57) In an icecream maker comprised of a freezing tank (24) provided with a heating system for pasteurising its contents and of a storage container (4) which can be cooled and heated, the storage container (4) is connected via at least one connecting line (14) to the freezing tank (24).

In order to construct such an icecream maker to properly pasteurise the icecream mix and also preclude changes in the flavour of the icecream mix due to overheating or prolonged thermal loads, at least the storage container is arranged in a heating and cooling chamber.

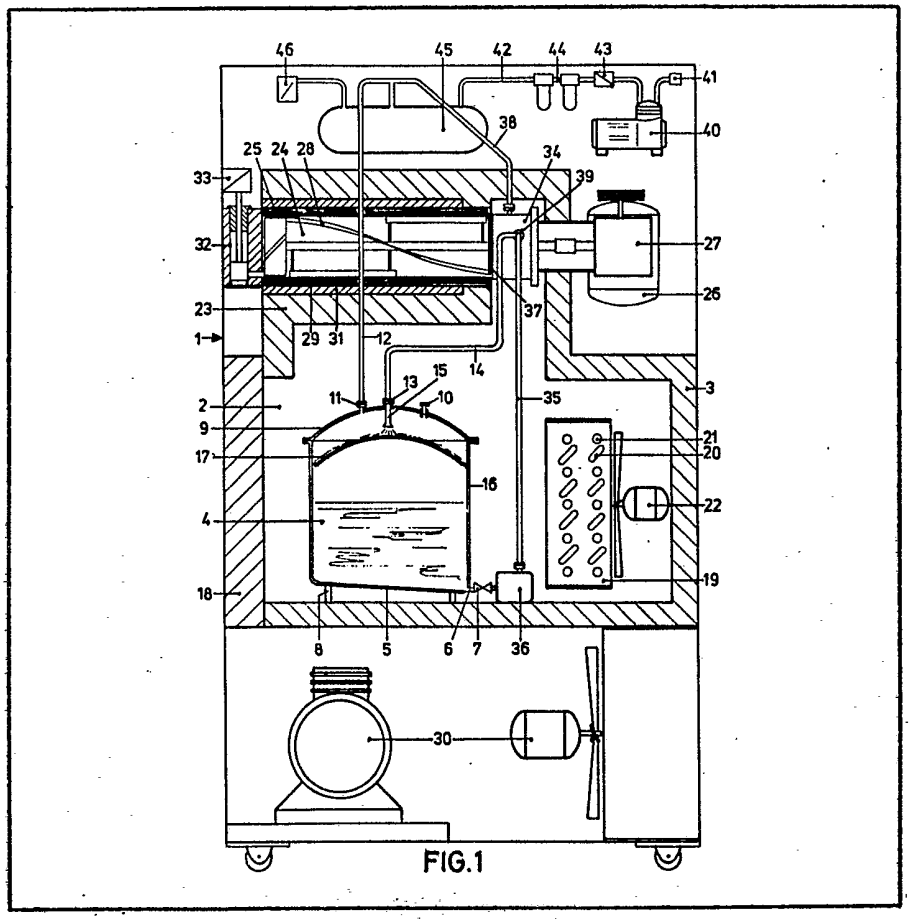

FIG.1

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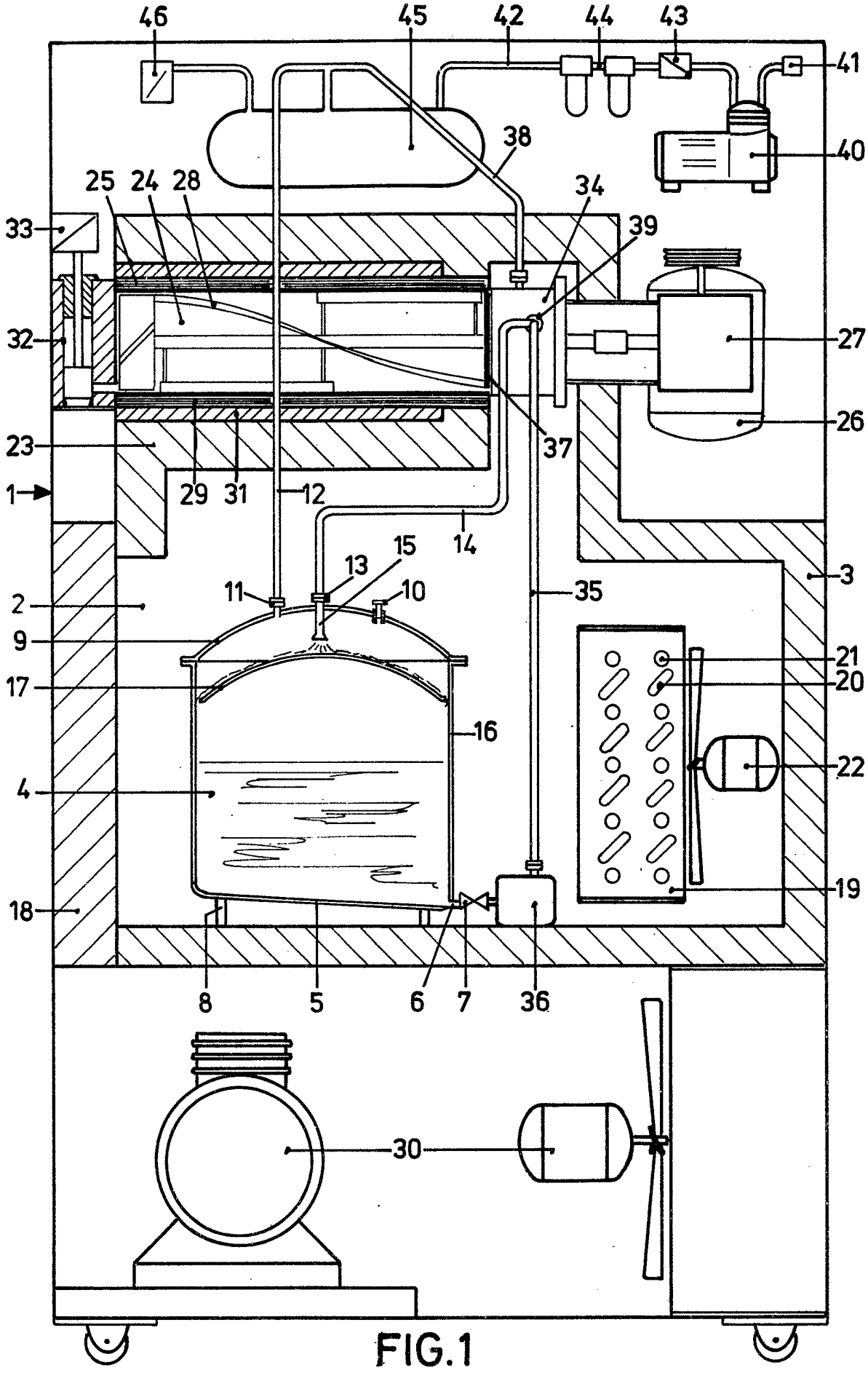
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FIG.1

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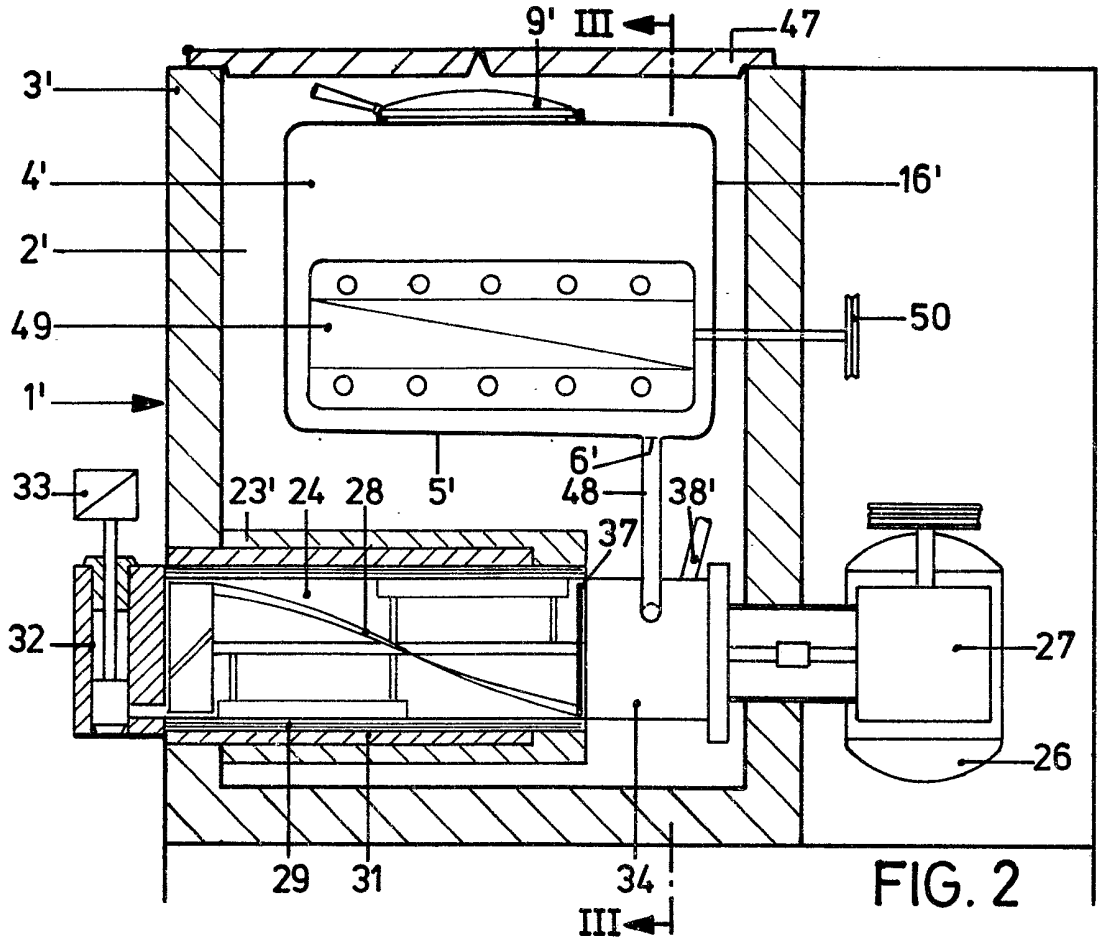
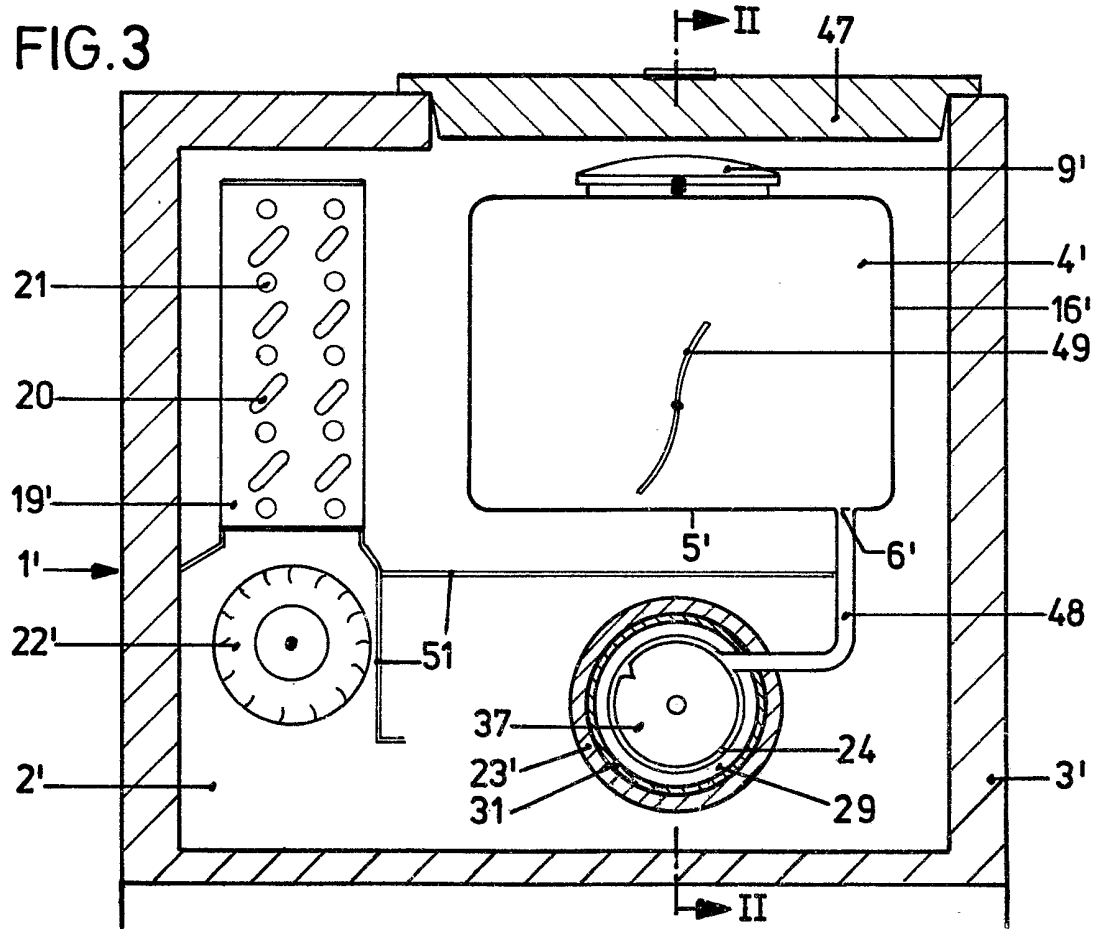


FIG. 2

FIG. 3



SPECIFICATION

An ice cream maker

The invention relates to an icecream maker including a freezing tank provided with a heating system for pasteurising its contents and a storage container for icecream mix which is connected by at least one supply line to the freezing tank.

On such icecream maker, known from German Patent No. 2 313 715 (corresponding to British Patent No. 1 428 310), has a freezing tank in the form of a cylindrical housing which is surrounded by a heating jacket equipped with heating elements, as well as a cooling jacket equipped with cooling ducts. The heating system is dimensioned and controlled, in such a manner that the inside wall of the freezing tank is brought to a temperature which causes the icecream mix in the freezing tank to partially evaporate. This vapour rises via a refill pipe into a storage container arranged above the freezing tank and heats the contents of the former to a temperature of 70 to 80°C (corresponding to 343 to 353°K), which is sufficient for pasteurisation. An appropriate thermostatic control ensures that the inside walls of the freezing tank do not assume a temperature which lies much above 100°C (373°K), in order to prevent the icecream mix from sticking to the inside wall of the freezing tank.

This icecream maker has been extraordinarily successful in practice and, in particular, has achieved extremely good bacteriological results, that is, the icecream has always been bacteriologically satisfactory. However, heating the contents of the storage container, arranged above the freezing tank, by means of steam generated in the freezing tank leads to the heating-up process, that is the pasteurisation process, for pasteurising the contents of the storage chamber, having to take a very long time, for example, one and a half hours. This relatively long time was extended still further by the fact that, as mentioned, the temperature of the heat-transmitting inner wall of the freezing tank was not allowed to exceed certain temperatures, lying not very far above the vaporisation point of water, in order to prevent the icecream mix from sticking. Since, in addition, as a result of this slow heating up, the icecream mix also remains for a relatively long period in temperature ranges of between 35 and 45°C (corresponding to 308 to 318°K), in which germs will multiply particularly rapidly, the icecream mix had to be maintained for an especially long time at the temperature of pasteurisation.

This long thermal treatment of the icecream mix at temperatures between 70 and 80°C in the storage container, and at temperatures of around 100°C, or just under in the freezing tank, however, led to changes in the flavour of the icecream mix (which, of course, is normally produced with a milk basis). This long thermal treatment leads to a certain caramelisation of the icecream mix, that is, to undesirable changes in flavour.

From German Offenlegungsschrift 20 32 003 and, and similarly from German Offenlegungsschrift 26 57 534, in each case an ice cream maker is known in which underneath the freezing tank a separate, that is transportable storage container is arranged in a releasable and interchangeable manner in a cooling chamber and is connected via a flexible connecting line to the freezing tank, on the other hand, and with another flexible connecting line to a source of compressed air. The designs of these known icecream makers are not concerned with bacteriological problems. Constructing the storage containers as separate, releasable and interchangeable storage containers is merely meant to make it possible to construct them as hermetically closed units so that the icecream mix is not contaminated bacteriologically during transport. None of the bacteriological problems occurring actually in the icecream maker and particularly during its operation are dealt with.

From German Offenlegungsschrift 21 39 917 (corresponding to British Patent 1 371 726) it is known to connect, with icecream makers comprising a freezing tank which is spatially separated from the storage container, both of these to one another by means of a forward-flow line and in return-flow line so that constant pumping is possible. The purpose of this is to prevent, on the other hand, the icecream mix present in the lines from warming up during a prolonged stand-still due to mix removal, and germs from multiplying as a result of this. On the other hand, this measure serves to make it possible to pasteurise also the contents of the lines during the pasteurisation process and, in addition, to manage, if necessary, with only one heating system for pasteurising the contents of the freezing tank and of the storage container and the two lines.

It is the object of the invention to improve an icecream maker in such a manner that, whilst making it possible to obtain faultless pasteurisation of the icecream mix, changes in the flavour of the icecream mix as a consequence of over-heating or of excessively prolonged heating are obviated.

According to the present invention there is provided an icecream maker, including a freezing tank provided with a heating system for pasteurising its contents, and a storage container for icecream mix which can be cooled and heated and which is connected via at least one supply line to the freezing tank, wherein at least the storage container is arranged in a heating and cooling chamber adapted to be selectively heated and cooled.

The measures according to the invention heat to be transferred particularly well over a large area so that the icecream mix is heated relatively rapidly. The measures according to the invention also enable an exceptionally even temperature distribution to take place so that no local over-heating occurs. The result of this is exceptionally rapid and even pasteurisation and, on the other hand, there is no significant deterioration in the

flavour of the icecream.

A particularly simple solution of the heating, on the one hand, and of the cooling, on the other hand, in the heating and cooling chamber is obtained if a heating and cooling unit is provided in the heating and cooling chamber. The above-mentioned transfer of heat in a particularly even manner and over a large area may be improved if an air circulating unit is provided in the heating and cooling chamber, Since the heat transfer during heating, on the one hand, and during cooling, on the other hand, takes place primarily by means of convection, an air circulating unit brings considerable advantages.

If, the freezing tank is arranged wholly in the heating and cooling chamber, the same advantages also apply to the freezing tank. If it is arranged only partially, for example with its inlet chamber only, in the heating and cooling chamber, a separate heater must be provided also at the freezing tank for pasteurisation purposes. However, since it is only used for heating the contents of the freezing tank, heating can take place at a lower temperature level so that here, too, changes in the flavour of the icecream mix are obviated.

The storage container may be arranged in the heating and cooling chamber in a releasable and interchageable manner, and in this case, is preferably connected to the freezing tank by means of flexible lines.

The storage container may be connected to the freezing tank via a forward-flow line and a return flow line and via at least one interposed supply pump. In this case, it is not necessary to pump the icecream mix first into the freezing tank and to draw it off again via the return-flow line; the short circuit can also be installed directly at the point of entry of the forward-flow line into the freezing tank since with this arrangement, of course, the lines run through the heating and cooling chamber and the icecream mix present in them is thus heated and cooled directly.

In order to improve the heat transfer in the storage container on its side, means may be provided in the storage container for causing the icecream mix returned to the container through the return flow line to flow down the inside of the container walls to form a film thereon. The means may comprise a distributing disc leading to the inside of the container walls.

The heat transfer on the outside of the storage containers is improved still further if a heating and cooling unit is provided inside the heating and cooling chamber.

Two embodiments of the invention will now be described by way of example, with reference to the accompanying drawings in which:

Figure 1 shows an icecream maker according to the invention, in vertical cross-section,

Figure 2 shows a partial vertical cross-section of a modified icecream maker according to the invention according to section line II—II in Figure 3, and

Figure 3 shows a partial vertical cross-section through the modified icecream maker according to the section line III—III in Figure 2.

In the embodiment according to Figure 1 there is shown an icecream maker for supplying portions of icecream having a housing 1 of a box-like shape. A heating and cooling chamber 2 which is surrounded by a thick wall of heat insulation 3 is arranged in the housing. The heating and cooling chamber 2 is used for accommodating one (or several) transportable storage containers 4 for an icecream mix with an air space round the containers. In the region of its floor 5 this storage container 4 has an outlet 6 which can be closed by means of a shut-off valve 7. The outlet 6 is located at the lowest point of the storage container 4 so that it is possible to empty it completely. This is quite easily possible by arranging the floor 5 in an appropriately inclined manner or by arranging the whole storage container 4 to be inclined. In addition, the floor 5 of the storage container 4 is resting freely on small supports 8 so that the floor, too, can have air circulating freely around it.

The top of the, as a rule, cylindrically constructed storage container 4 is closed tightly by means of a cover 9. In the cover 9 a vent valve 10 is located. The cover 9 also contains a coupling 11 for connecting a compressed air line 12 to the container 4. In addition, approximately in the centre of the cover 9 a further coupling 13 is located for connecting to the container 4 a flexible return flow-line 14 for icecream mix. On the inside of the cover 9 a return-flow connecting tube 15 is joined to this coupling 13 and ends a little above a distributing disc 17 which is curved so as to be inclined with respect to the walls 16 of the storage container 4.

At the front of the housing 1 a door 18 which is also heat insulated is installed through which the storage containers 4 can be inserted into and removed from the heating and cooling chamber 2.

In addition, in the heating and cooling chamber a cooling and heating unit 19 is arranged which is provided with both cooling elements 20 and heating elements 21. On one side of this cooling and heating unit 19 an air circulating unit 22 is arranged which consists in the usual manner of a fan driven by an electric motor. This air circulating unit 22 drives a cross-flow of air through the cooling and heating unit where it heats up at the heating elements 21 or cools off at the cooling elements 20, according to the respective mode of operation. This heated or cooled air then comes into direct contact with the storage container 4, to the walls 16 of which it transfers its heat or from the walls 16 of which it removes heat, The cooling elements 20 and the heating elements 21 are provided with sheet metal fins with good heat-conducting properties so that large heat-emitting surfaces are obtained.

In the upper region of the heating and cooling chamber 2, and thermally isolated from it to a large extent by an appropriate heat insulation 23, a freezing tank 24 is arranged which is constructed in the ususal manner. Accordingly, it

has an essentially cylindrical housing 25 in which an agitator and scraper 28 is arranged which can be driven by a drive motor 26 with an interposed gear system 27. On the outside of the cylindrical housing 25 there is a cooling jacket 29 provided with cooling ducts which is connected to a refrigerating unit 30 arranged below the heating and cooling chamber 2 in the housing 1. In addition, this refrigerating unit 30 is also used to feed the cooling elements 20 in the cooling and heating unit 19.

The cooling jacket 29 is surrounded by a heating jacket 31 in which heating elements, not shown, are arranged.

At one end, the front end, of the cylindrical housing 25, located adjacent the front wall of the housing 1, there is a discharge nozzle 32 through which by actuation of an actuating element 33 portions of icecream can be dispensed from the freezing tank 24. The other end of the cylindrical housing 25 is preceded by an inlet chamber 34 for the freezing tank 24, into which chamber a forward-flow line 35, consisting of flexible material , opens and which can be connected via an interposed feed pump 36 and the shut-off valve 7 to the outlet 6 of the storage container 4. At the point of transistion from the inlet chamber 34 into the cylindrical housing 25 of the freezing tank 24, that is into the freezing space proper, a barrier disc 37 is provided which is connected so to be rotationally fixed to the agitator and scraper 28. A compressed air line 38 also opens into the top of the inlet chamber 34. A freezing tank 24 constructed in this manner is generally known and represented and described especially in German Patent 2 313 715 (corresponding to UK Patent No. 1 428 310).

The forward-flow line 35 opens via an icecream mix level control 39 into the inlet chamber 34. When the level of the icecream mix in the inlet chamber 34 reaches the height of this level control 39 the icecream mix, conveyed by means of the pump 36, is short-circuited and runs back into the storage container 4 via the return-flow line 14.

As can be seen from Figure 1, the inlet chamber 34 is also located in the heating and cooling chamber 2 so that it is also heated or cooled from here.

The freezing tank 24, on the other hand, and the storage container 4, on the other hand, are supplied with compressed air by means of a motor-compressor 40 which sucks in air through a suction filter 41 and feeds the compressed air through a corresponding line 42 via a non-return valve 43 and a compressed-air dryer and steriliser 44 into a compressed-air tank 45. From this compressed-air tank 45 the compressed-air then reaches the freezing tank 24 via the line 38, and the storage container 4 via the compressed-air line 12. At the compressed-air tank 45 a pressure controller 46 is also provided in the usual manner.

The icecream mix in the whole machine is pasteurised in such a manner that, on the other hand, the contents of the freezing tank 24 are heated to the pasteurising temperature by heating the cylindrical housing 25 of the freezing tank 24 by means of the heating jacket 31. Simultaneously, by heating the heating elements 21 in the heating and cooling unit 19 appropriately whilst simultaneously operating the air circulating unit 22, the air in the heating and cooling chamber is heated up to a correspondingly high temperature of more than 80°C (353°K).

This air circulates around the walls 16 of the storage container 4 and transfers its heat to these walls. Simultaneously the supply pump 36 is operated which causes the icecream mix to be fed in a short circuit through the forward-flow line 35 and the return-flow line 14 since, due to the fact that no icecream portions are being removed from the discharge nozzle 32, no icecream is being fed into the freezing tank. The icecream mix flowing back is moved to the inside of the walls 16 by the distributing disc 17 and runs down these walls, which causes the icecream mix to be heated well and evenly. Since the inlet chamber 34, which is not surrounded by the heating jacket 31, is also arranged in the heating and cooling chamber 2 it, too, is heated in the same manner from the outside by means of the hot air.

The cooling or refrigerating operation takes place in such a manner that, on the one hand, the cooling jacket 29 of the freezing tank 24 is charged with refringerant by the refrigerating unit 30. Similarly, the cooling elements 20 of the cooling and heating unit 19 are charged so that the air moved by the air circulating unit 22 is cooled down considerably. This, in turn, cools the walls 16 of the storage container 4, on the one hand, and thus its contents and, on the other hand, also the forward-flow line 35 and the return-flow line 14, as well as the inlet chamber 34. In order to achieve here, too, a particularly good heat transfer during the cooling operation it is appropriate to allow the supply pump 36 to run constantly with corresponding excess delivery so that the contents of the storage container 4 are constantly circulated in such a manner that the excess return flow runs over the distributing disc 17 down the inside of the walls 16.

Since the construction and function of the illustrative embodiment according to Figures 2 and 3 are quite similar to those of that according to Figure 1, in Figures 2 and 3 structurally identical parts have been provided with the same reference number as in Figure 1 so that explanations can be dispensed with in this respect. Functionally identical but structurally somewhat different parts are designated by the same reference number, supplemented by a superscripted apostrophe (').

The main difference between the embodiment according to Figures 2 and 3 and the embodiment according to Figure 1 consists in that the storage container 4' — as is largely customary — is arranged outside the freezing tank 24 and cannot be taken out of the housing 1'. In this arrangement the top of the housing 1' is provided with housing cover 47 which is well heat-insulated and which

closes the heating and cooling chamber 2′ at this place, and after the removal of which the cover 9′ of the storage container 4′ is accessible.

In this embodiment, the freezing tank 24 is arranged completely in the heating and cooling chamber 2′ and is provided only in the area of the cylindrical housing 25 which is surrounded by the cooling jacket 29 and the heating jacket 31 with a relatively thin heat insulation layer 23′. This layer 23 prevents too rapid and too great temperature variations taking place in the interior of the freezing tank 24 during the cooling operation without significantly retarding the passage of heat during the pasteurising process by virtue of the heated air blown against the tank.

The icecream mix is fed from the outlet 6′ in the floor 5′ of the storage container 4′ to the inlet chamber 34 via a refilling line 48 which opens into the inlet chamber below its top so that in this way, too, the icecream level in the inlet chamber, and thus in the freezing tank 24, is controlled in the usual known manner. Since in this embodiment no supply pump and no corresponding repumping of the icecream mix is provided for, in the storage contaner 4′ and agitator 49 is provided which can be driven from the outside, via a pulley 50, by a drive system, not shown.

The cooling and heating unit 19′ is also again preceded by an air circulating unit 22′ which is associated with air guide vanes 51 in order to ensure that the air cooled or heated, respectively, in the cooling and heating unit 19 first circulates around the walls 16′ of the storage container 4′ including the cover 9′ and the floor 5′, and only then gets back to the air circulation unit 22′ in the circuit past the freezing tank 24.

Below the heating and cooling chamber 2′ a refrigerating unit will be provided in the housing 1′. In this case the compressed-air supply will also be arranged in the lower part of the housing 1′. In Figure 2 only the compressed-air line 38′, leading to the inlet chamber 34, is indicated.

It is, of course possible to provide a repumping system as described in the first embodiment in the embodiment according to Figures 2 and 3.

CLAIMS

1. An Icecream maker including a freezing tank provided with a heating system for pasteurising its contents, and a storage container for icecream mix which can be cooled and heated and which is connected via at least one supply line to the freezing tank, wherein at least the storage container is arranged in a heating and cooling chamber adapted to be selectively heated and cooled.

2. An Icecream maker according to Claim 1, wherein a heating and cooling unit is provided in the heating and cooling chamber.

3. An Icecream maker according to to Claim 1 or 2, wherein an air circulating unit is provided in the heating and cooling chamber.

4. An Icecream maker according to any one of Claims 1 to 3, wherein the freezing tank is arranged at least partially in the heating and cooling chamber.

5. An Icecream maker according to any one of Claim 1 to 4, wherein the storage container is arranged in a releasable and interchangeable manner in the heating and cooling chamber.

6. An Icecream maker according to Claim 5, wherein the storage container is connected to the freezing tank by means of flexible lines.

7. An Icecream maker according to any one of Claims 1 to 6, wherein the storage container is connected to the freezing tank via a forward-flow line and a return-flow line and via at least one interposed supply pump.

8. An Icecream maker according to Claim 7, wherein means are provided in the storage container for causing icecream mix returned to the container through the return-flow line to flow down the inside of the container wall to form a film.

9. An Icecream maker according to Claim 8 wherein a distributing disc leading to the inside of the container walls is provided in the storage container below the mouth of the return-flow line.

10. An Icecream maker according to any one of Claims 1 to 9, wherein a cooling and heating unit and/or an air circulation unit is associated with at least one air guide vane.

11. An Icecream maker substantially as described herein with reference to and as illustrated in Figure 1, or Figure 1 as modified by Figures 2 and 3, of the accompanying drawings.

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