Claims

1. A closure for a container, the closure comprising:

an engagement portion to sealingly engage an opening region of a container; and

a crown portion including an inner surface adjacent to an inner region of the container and an outer surface opposed to the inner surface, the crown portion attached to or integral with the engagement portion and adapted to form a recess which extends into the inner region of the container to facilitate heat transfer to or from contents of the container;

wherein an overcap is provided to facilitate engagement with the opening region of the container and the overcap includes an access aperture so that the crown portion is accessible without removing the overcap.

2. The closure in accordance with claim 1 wherein the crown portion is a resilient material.

3. The closure in accordance with claim 2 wherein the crown portion is a membrane.

4. The closure in accordance with claim 1 wherein the crown portion is a substantially rigid material.

5. The closure in accordance with any one of claims 1 to 4 wherein the crown portion includes one or more projections increasing a surface area for facilitating heat transfer between the contents and the crown portion.

6. The closure in accordance with any one of claims 1 to 5 wherein the crown portion is adapted to be punctured for access to the contents of the container.

7. The closure in accordance with claim 6 wherein the crown portion includes a weakened portion to facilitate controlled puncturing.

8. The closure in accordance with any one of claims 1 to 7 further including a tamper evident device operatively connected to the overcap.

9. The closure in accordance with any one of claims 1 to 8 wherein the closure is operatively attached to the container.

10. A method of heating or cooling the contents of a container, the method including the step of:

providing a bottle including an operatively attached closure in accordance

with any one of claims 1 to 8; and

inserting the bottle into a dock which includes a temperature-controlled probe for insertion into the recess or invaginating the crown portion.

11. The method of heating or cooling the contents of a container in accordance with claim 10 wherein the method includes the step of inserting the temperature controlled probe into the recess or invaginating the crown portion.

12. A container for holding liquid, the container defining an inner region inside which liquid is adapted to be held, the container including one or more walls for facilitating heating or cooling of the liquid therethrough, the one or more walls being adapted for invagination by a temperature control probe such that the temperature control probe extends into the container without directly contacting contents of the inner region of the container;

wherein the one or more walls include a window of a resilient window material, the resilient window material adapted for invagination by the temperature control probe.

13. The container in accordance with claim 12 wherein the window is a crown forming the invagination.

14. The container in accordance with claim12 or 13 wherein the material is substantially rigid and formed into a closed hole substantially corresponding in shape to the temperature control probe.

15. The container in accordance with any one of claims 12 to 14 wherein the window is an aperture or an opening which is adapted to be closed by a closure in accordance with any one of claims 1 to 8.

16. The container in accordance with any one of claims 12 to 14 adapted to contain milk.

17. The container in accordance with any one of claims 12 to 16 adapted to contain blood.

18. An apparatus for controlling temperature of liquid within a container, the apparatus comprising:

one or more temperature control probes;

a temperature controller operatively connected to the one or more temperature control probes, the temperature controller adapted for controlling temperature in the one or more temperature control probes wherein the one or more temperature control probes are adapted to invaginate or be otherwise inserted into a wall, or window, or crown of a closure according to any one of claims 1 to 8 or a container in accordance with any one of claims 12 to 17 for heat transfer through the wall or window or crown.

19. The apparatus in accordance with claim 18 wherein a dock is provided which is adapted to receive the container.

20. The apparatus in accordance with claim 18 or 19 wherein the dock includes a dock base and the one or more temperature control probes extends upwardly from the dock base.

21. The apparatus in accordance with any one of claims 18 to 20 wherein a temperature sensor is provided to sense an initial temperature of a liquid in the container prior to control of the temperature of the liquid.

22. The apparatus in accordance with any one of claims 18 to 21 wherein the temperature sensor is selected from the group consisting of a thermocouple, a thermistor, an infrared thermometer, and a solid state temperature sensor.

23. The apparatus in accordance with any one of claims 18 to 22 wherein a user input terminal is provided to receive user inputs including those selected from the group consisting of final desired temperature of the liquid, a specific heat capacity of the liquid, a mass of the liquid in the container, and a maximum permissible liquid temperature.

24. The apparatus in accordance with claim 23 wherein a processor is provided which is adapted to calculate an output energy based on user inputs to the user input terminal.

25. The apparatus in accordance with any one of claims 18 to 24 which includes a mass sensor to sense the mass of the liquid in the container.

26. The apparatus in accordance with any one of claims 18 to 24 further including a power source.

27. A method of controlling temperature of a liquid in a container adapted to receive a temperature control probe, the method including the steps of:
providing a temperature control probe to the container via an invagination in a

wall of the container;

and

generating the amount of energy required in the temperature control probe to raise the temperature of the liquid to the desired temperature.

28. The method in accordance with claim 27 further wherein the method includes the following steps:

measuring an initial temperature of liquid in the container;

obtaining one or more of the following data:

i. the final desired temperature of the liquid in the container;

ii. a specific heat capacity of the liquid in the container;

iii. a mass of the liquid in the container;

iv. a heat loss correction factor; and

calculating an amount of energy required to heat or cool the liquid to the desired temperature as a function of the initial temperature and the data.

29. The method as claimed in claim 27 or 28, wherein one or more of the desired temperature of the liquid, specific heat capacity of the liquid, mass of the liquid, and heat loss correction factor are input by a user.

30. The method according to any one of claims 27 to 29 wherein the liquid is milk.

31. The method according to any one of claims 27 to 29 wherein the liquid is blood.

CLAIMS

1. A system for heating or cooling the contents of a container, the system comprising:

a container for holding a liquid;

a closure for the container, the closure comprising:

an engagement portion to sealingly engage an opening region of the container; and

a crown portion including an inner surface adjacent to an inner region of the container and an outer surface opposed to the inner surface, the crown portion attached to or integral with the engagement portion and having a recess or being adapted to form a recess which extends into the inner region of the container to facilitate heat transfer to or from contents of the container;

an overcap to facilitate engagement with the opening region of the container, the overcap including an access aperture so that the crown portion is accessible without removing the overcap; and

a dock adapted for receiving the container, the dock having:

a temperature control probe;

a temperature controller operatively connected to the temperature control probe, the temperature controller adapted for controlling temperature in the temperature control probe, the temperature control probe adapted to heat or cool the container via the surfaces of the recess in the crown of the closure on the container.

2. A system according to Claim 1, in which the crown portion is a resilient material.

3. A system according to Claim 2, in which the crown portion is a membrane.

4. A system according to any of Claims 1 to 3, in which the recess is formed by the temperature control probe.

5. A system according to Claim 1, in which the crown portion is a rigid material.

6. A system according to any preceding claim, in which the crown portion includes one or more projections increasing a surface area for facilitating heat transfer between the contents and the crown portion.

7. A system according to any preceding claim, in which the crown portion is adapted to be punctured for access to the contents of the container.

8. A system according to Claim 7, in which the crown portion includes a weakened portion to facilitate controlled puncturing.

9. A system according to any preceding claim, further including a tamper evident device operatively connected to the overcap.

10. A system according to any preceding claim, in which the closure is attached to the container.

11. A system according to any preceding claim, in which the dock includes a dock base and the temperature control probe extends upwardly from the dock base.

12. A system according to Claim 11, in which the dock includes two or more temperature control probes.

13. A system according to any preceding claim, in which a temperature sensor is provided to sense an initial temperature of a liquid in the container prior to control of the temperature of the liquid.

14. A system according to any preceding claim, in which the temperature sensor is selected from the group consisting of a thermocouple, a thermistor, an infrared thermometer, and a solid state temperature sensor.

15. A system according to any preceding claim, in which a user input terminal is provided to receive user inputs including those selected from the group consisting of final desired temperature of the liquid, a specific heat capacity of the liquid, a mass of the liquid in the container, and a maximum permissible liquid temperature.

16. A system according to Claim 15, in which a processor is provided which is adapted to calculate an output energy based on user inputs to the user input terminal.

17. A system according to any preceding claim which includes a mass sensor to sense the mass of the liquid in the container.

18. A system according to any preceding claim, further including a power source.

19. A method of heating or cooling the contents of a container, the method comprising:

adding a liquid to a container;

closing the container with a closure comprising:

an engagement portion to sealingly engage an opening region of the container;

a crown portion including an inner surface adjacent to an inner region of the container and an outer surface opposed to the inner surface, the crown portion attached to or integral with the engagement portion and having a recess or being adapted to form a recess which extends into the inner region of the container to facilitate heat transfer to or from contents of the container;

an overcap to facilitate engagement with the opening region of the container and the overcap including an access aperture so that the crown portion is accessible without removing the overcap;

mounting the container containing the liquid in a dock adapted to receive the container, the dock having:

a temperature control probe;

a temperature controller operatively connected to the temperature control probe, the temperature controller adapted for controlling temperature in the temperature control probe, the temperature control probe being adapted to heat or cool a container via the surfaces of the recess in the crown of the closure on the container; and

heating or cooling the liquid in the bottle using the temperature controlled probe.

20. A method according to Claim 19, further including:

measuring an initial temperature of liquid in the container;

obtaining one or more of the following data:

i. the final desired temperature of the liquid in the container;

ii. a specific heat capacity of the liquid in the container;

iii. a mass of the liquid in the container;

iv. a heat loss correction factor; and

calculating an amount of energy required to heat or cool the liquid to the desired temperature as a function of the initial temperature and the data.

21. A method according to Claim 19 or 20, in which one or more of the desired temperature of the liquid, specific heat capacity of the liquid, mass of the liquid, and heat loss correction factor are input by a user.

22. A method according to any of Claims 19 to 21, in which the liquid is milk.

23. A method according to any of Claims 19 to 21, in which the liquid is blood.