ABSTRACT

A system for recycling energy from ice remnants. The system includes a container. The container includes a receptacle configured to receive ice remnants. An ice capturing and melting device below the receptacle is configured to capture and melt ice in the ice remnants while allowing fluid in the ice remnants to pass therethrough thereby forming a cooled recycled liquid at a bottom of the container. A discharge port located proximate the bottom of the container is configured to direct the cooled recycled liquid to at least one heat source of a facility and cool the heat source.
FIG. 3A
SYSTEM AND METHOD FOR RECYCLING ENERGY FROM ICE REMNANTS

FIELD OF THE INVENTION

[0001] This invention relates to a system and method for recovering energy from ice remnants.

BACKGROUND OF THE INVENTION

[0002] Potentially recoverable costs may be lost when ice and/or cold fluids are discarded in situations such as: the unconsumed portion of a beverage from a food service facility (FSF), ice and slushy water at a skating facility, or cold fluids and/or ice from any type of facility containing materials which are at a temperature below the local ambient.

[0003] For example, in discarded beverage remnants from a FSF, there may be value associated with: the potable water, the food energy value of sugar and other ingredients, the energy consumed to bring the beverage and associated ice to serving temperature, and the energy associated with concentrating carbon dioxide and carbonating the beverage. For discarded ice remnants from a skating facility or similar type facility that uses ice and/or a mixture of ice and fluid, there is value associated with the water and energy consumed to form the ice.

BRIEF SUMMARY OF THE INVENTION

[0004] This invention features a system for recycling energy from ice remnants. The system comprises a container including a receptacle configured to receive discarded ice remnants from a facility, an ice capturing and melting device below the receptacle configured to capture and melt ice in the ice remnants while allowing fluid in the ice remnants to pass therethrough thereby forming a cooled recycled liquid at a bottom of the container, and a discharge port located proximate the bottom of the container configured to direct the cooled recycled liquid to at least one heat source of the facility and cool the heat source.

[0005] In one embodiment, the ice remnants may include discarded beverage remnants, discarded ice, and/or a mixture of discarded ice and a fluid. The facility may include a food service facility and/or a skating facility. The ice capturing and melting device may include a plurality of screens. The plurality of screens may include screens with different mesh sizes each configured to trap ice in the ice remnants having different sizes. The screens may be configured to be progressively layered with screens having different sizes. A gas collection device coupled downstream from the at least one heat source may be configured to remove and collect gas from the cooled recycled liquid. The system may include an output port configured to direct the energy product to a predetermined temperature. The final output fluid may be configured as an energy product including dissolved ingredients of nutritional value in the ice remnants. The system may include a line configured to deliver the energy product to a garden at the facility. The energy product may be configured to attract desired birds and/or desired insects to the garden to draw customers to the facility. The energy product may be configured to be used for manufacturing a feed product for animals. The container may include at least one gas intake port configured to receive hot/humid gas and direct the gas through the ice capturing and melting device to assist in the melting of the ice to form the cooled recycled liquid. The container may include at least one gas intake port configured to receive a hot/humid gas and direct the gas through the ice capturing and melting device to form a cooled de-humidified gas in the container. The container may include at least one gas output port configured to direct the cooled de-humidified gas to the facility and/or a different facility. The at least one gas output port may be configured to direct the cooled de-humidified gas to a HVAC system of the facility and/or a different facility. The container may include a plurality of receptacles. The system may include a plurality of containers. The system may include a plurality of receptacles located at different locations of the facility coupled to each other and configured to deliver the ice remnants to the container. The system may include a plurality of receptacles located at different locations of the facility coupled to each other and configured to deliver the ice remnants to a plurality of containers. The cooled recycled liquid may be directed to a different facility to cool at least one heat source at the different facility.

[0006] This invention also features a system for recycling energy from ice remnants, the system comprises a container including a receptacle configured to receive ice remnants, an ice capturing and melting device below the receptacle configured to capture and melt ice in the ice remnants while allowing fluid in the ice remnants to pass therethrough thereby forming a cooled recycled liquid at a bottom of the container, at least one gas intake port configured to receive a hot/humid gas and direct the hot/humid gas towards the ice capturing and melting device to assist in the melting of the ice to form the cooled recycled liquid and configured to create a de-humidified gas in the container, a discharge port located proximate the bottom of the container configured to direct the cooled recycled liquid to at least one heat source of a facility and cool the heat source, and at least one gas output configured to direct the cooled de-humidified gas to the facility.

[0007] This invention also features a method for recycling energy from ice remnants, the method including: receiving ice remnants from a facility, providing an ice capturing and melting device configured capture and melt ice in the ice remnants while allowing fluid in the ice remnants to pass therethrough thereby forming a cooled recycled liquid, and directing the cooled recycled liquid to at least one heat source of the facility and cool the heat source.

[0008] In one embodiment, the method may include the step of collecting gas from the cooled recycled liquid. The method may include the step of receiving hot/humid gas and directing the hot/humid gas through the ice capturing and melting device to assist in the melting of the ice to form the cooled recycled liquid. The method may include the step of directing hot/humid gas through the ice capturing and melting device to form a cooled de-humidified gas. The method may include the step of directing the de-humidified gas to the facility and/or a different facility. The method may include the step of directing the cooled de-humidified gas to an HVAC system of the facility and/or a different facility. The method may include the step of gradually warming the cooled recycled liquid such that any dissolved carbon dioxide therein gases out to form a liquid energy product. The method may include the step of capturing the carbon dioxide. The method may include the step of directing the carbon dioxide to a greenhouse to facilitate photosynthesis simulation. The method may include the step of directing the liquid energy product to a predetermined location at the facility. The method may include the step of directing the energy product
to a garden to attract desired birds and/or desired insects to the
garden and to draw customers to the facility. The method may
include the step of using the energy product to manufacture
feed products for animals. The energy product may include
one or more of dissolved sugars, flavorings, and ingredients
originally present in the ice remnants.

[0009] This invention also features a method for recovering
an energy product from beverage remnants, the method
including: receiving beverage remnants from a facility, pro-
viding an ice capturing and melting device configured to
capture and melt ice in the beverage remnants while allowing
fluid in the beverage remnants to pass therethrough thereby
forming a cooled recycled liquid, and gradually warming the
cooled recycled liquid such that any dissolved carbon dioxide
therein gases out and forms a liquid energy product.

[0010] In one embodiment, the method may include the
step of directing the energy product to a predetermined loca-
tion. The method may include the step of directing the energy
product to a garden. The method may include the step of
capturing the carbon dioxide. The method may include the
step of directing the carbon dioxide to a greenhouse to facili-
tate photosynthesis stimulation. The method may include the
step of using the energy product to manufacture a food prod-
uct for animals. The method may include the step of using the
energy product to attract desired birds and/or insects to draw
customers to the facility.

[0011] This invention also features a method for recovering
energy from ice remnants, the method including: receiving
ice remnants from a facility, providing an ice capturing and
melting device configured capture and melt ice in the ice
remnants while allowing fluid in the ice remnants to pass
therethrough thereby forming a cooled recycled liquid,
receiving hot/humid gas and directing the hot/humid gas
through the ice capturing and melting device to assist in the
melting of the ice and to form a cooled dehumidified gas,
directing the cooled recycled liquid to at least one heat source
of a facility and cool the heat source, and directing the cooled
dehumidified gas to the facility.

BRIEF DESCRIPTION OF THE SEVERAL
VIEWS OF THE DRAWINGS

[0012] Other objects, features and advantages will occur to
to those skilled in the art from the following description of a
preferred embodiment and the accompanying drawings, in
which:

[0013] FIG. 1 is a schematic block diagram of one embodi-
ment of the system and method for recovering energy from ice
remnants of this invention;

[0014] FIG. 2 is a schematic block diagram of another embodi-
ment of the system and method for recovering energy
from ice remnants in accordance with this invention;

[0015] FIG. 3A is a schematic block diagram showing
another embodiment of the system and method for recovering
energy from ice remnants in accordance with this invention;

[0016] FIG. 3B is a schematic block diagram showing yet
another embodiment of the system for recovering energy
from ice remnants in accordance with this invention; and

[0017] FIG. 4 depicts schematic diagrams showing
examples of mesh sizes of the ice capturing and melting
device shown in FIGS. 1-3B.

DETAILED DESCRIPTION OF THE INVENTION

[0018] Aside from the preferred embodiment or embodi-
ments disclosed below, this invention is capable of other
embodiments and of being practiced or being carried out in
several ways. Thus, it is to be understood that the invention is
not limited to its application to the details of construction and
the arrangements of components set forth in the following
description or illustrated in the drawings. If only one embodi-
ment is described herein, the claims hereof are not to be
limited to that embodiment. Moreover, the claims hereof are
not to be read restrictively unless there is clear and convincing
evidence manifesting a certain exclusion, restriction, or dis-
claimer.

[0019] There is shown in FIG. 1 one embodiment of system
10 and the method thereof for recovering energy from ice
remnants 12. Ice remnants 12 may be unconsumed cooled
beverage remnants having some form of ice therein discarded
from a facility, such as a FSF facility or any similar type
facility which serves cooled beverages. In this example, ice
remnants 12 may include one or more of: water, carbonated
water, ice, flavorings, sugar, alcohol, or any similar type
ingredient of a cooled beverage served at a facility, known to
those skilled in the art. Ice remnants 12 may also include
discarded ice and/or a mixture of discarded ice and a fluid
discarded from a facility associated with ice remnants, e.g., a
skating facility or similar type facility. System 10 recovers
a majority, or at times, all of the costs associated with ice
remnants 12 discussed in the Background section above.

[0020] System 10 includes container 14 for holding
recycled liquid 64 from ice remnants 12. Container 14 may
be made of plastic, metal, or similar type material. Container
14 includes receptacle 16 configured to receive ice remnants
as they are discarded from a facility receptacle. Receptacle
16 then directs ice remnants 12 through opening 17 and into
ice capturing and melting device 29, as shown by arrows 18.
Receptacle 16 is may be shaped as a funnel as shown, or may
have any shape known to those skilled in the art that acts to
direct ice remnants 12 discarded by a facility through opening
17 and into ice capturing and melting device 29.

[0021] Although as shown in FIG. 1 there is a single recep-
tacle 14 with opening 17, in another example, system 10',
FIG. 2, includes container 14' which includes a plurality of
receptacles 16 each configured to direct ice remnants 12 to ice
capturing and melting device 29. In another design, system
10", FIG. 3A, may include a plurality of receptacles 16 con-
figured to receive ice remnants 12 and direct the ice remnants
12 to receptacle 16 of container 14 by line 19. In yet another
design, system 10", FIG. 3B, may include a plurality of recep-
tacles 16 connected via line 21 which directs the ice remnants
12 to a plurality of containers 14.

[0022] Container 14, FIGS. 1-3B, preferably includes ice
capturing and melting device 29. In one example, ice captur-
ing and melting device 29 includes at least one screen 30
which traps the ice, e.g., ice cubes/ice cubes, in ice remnants
12 in mesh openings 31 in screen 30. The melted liquid from the
ice is collected as recycled liquid 64. The melted ice from
screen 30 brings the temperature of recycled liquid 64 at bottom
66 of container 14 to about 32°F.

[0023] In another design, ice capturing and melting device
29 may include a plurality of screens, e.g., plurality of screens
32. In this example of progressively smaller mesh openings,
e.g., exemplary screen(s) 34, 36, and 38, FIG. 4. The upper
most screen, e.g., screen(s) 34, FIGS. 1 and 4, preferably have
mesh openings 40, FIG. 4, just smaller than the ice cubes/
flakes in ice remnants 12. Screen(s) 36, FIGS. 1 and 4, just below screen(s) 34, preferably have mesh openings 42, FIG. 4, that are slightly smaller than the mesh opening of the upper most screen(s). The lower most screen(s), e.g., screen(s) 38, FIGS. 1 and 4, preferably have mesh openings 44, FIG. 4, that are slightly smaller than mesh openings of screen(s) 36. The pattern of progressively smaller mesh openings for the screens of ice melting and capturing device 29 continues until screen(s) 38, FIGS. 1 and 4, with the smallest mesh openings, e.g., mesh openings 44, FIG. 4, allow only the tiniest ice crystals to pass therethrough.

[0024] One exemplary operation of system 10 is now discussed with reference to FIG. 1. In this example, system 10 is preferably includes a plurality of screens 32. As discussed above, this is not a necessary limitation of this invention, as system 10 need only include at least one screen 30. To begin, ice remnants 12 descended at a facility are directed through opening 17 by receptacle 16 to ice capturing and melting device 29. The liquid portion of ice remnants 12 flows through screens 32 and is collected as recycled liquid 64 at bottom 66 of container 14. The ice cubes/flakes in ice remnants 12 are trapped by the mesh openings of the various layers of screens 32. The larger ice cubes/flakes are trapped by screens 34 with larger mesh openings 40, FIG. 4, where they melt. The melted liquid from the ice is collected as recycled liquid 64, as shown by arrow 50. Smaller ice cubes/ice flakes are trapped by mesh openings 42 of screens 36 where they melt. The melted liquid from the ice is collected as recycled liquid 64. Still smaller ice cubes/ice flakes are trapped by mesh openings 44 of screens 38 where they melt. The melted liquid from the ice is collected as recycled liquid 64. As the ice cubes/ice flakes trapped in screens 34 melt, they drop to screens 36 and melt again. As the ice cubes/ice flakes trapped in screens 36 melt, they drop to screens 38 and melt again. The melted ice cubes/flakes from screens 34-36 bring the temperature of cooled recycled liquid 64 at bottom 66 of container 14 to about 32° F.

[0025] As cooled recycled liquid 64 collects at bottom 66 of container 14, it is preferably drained via drainage pipe 68 with any suitable flow valve 70 connected to line 72. Cooled recycled liquid 64 may then be pumped to a network of lines and radiators (not shown) to spaces surrounding various heat sources 74 of the facility, e.g., ovens, dishwashers, griddles, and the like, of a FSF, or any heat source of any type of facility that needs to be cooled. Cooled recycled liquid 64 may also be pumped from the facility where it is generated to another facility to cool at least one heat source of the other facility. The result is the radiated infra-red heat from heat sources 74 is captured and blocked from warming the room. The chilled water in line 72 may also be used to pre-cool food stuffs and equipment in the kitchen of the FSF, or similar type equipment of any type of facility that needs cooling. Line 72 may proceed in stages, with the initial section containing the coldest recycled liquid 64 to be used to cool heat sources 74, e.g., for ovens, deep fat fryolators, and the like, of a FSF or any of the various heat sources for any type of facility. After absorbing the infra-red energy from these devices, the now warmer liquid, e.g., in line 76, may be used to cool other devices 78, e.g., wine cabinets, and the like, of a FSF, or the heat sources of any type of facility that needs to be cooled.

[0026] A gradual warming of the liquid passing from line 72 to line 80 downstream from device 78 causes any dissolved carbon dioxide in recycled liquid 64, e.g., from beverage remnants 12 associated with a FSF (beverage remnants), to gas out. The gas in line 80 is preferably captured and collected by gas collection device 82 by line 83. Gas collection device 82 preferably outputs the captured gas 84 via line 86. Captured gas 84 may then be used for greenhouse photosynthesis rate stimulation or for any type of process which needs carbon dioxide gas. The ultimate discharge from system 10 by line 80 is output fluid 88. In this example, output fluid 88 is preferably a close-to-room temperature fluid that may include dissolved sugars, flavors, and other similar ingredients that may have been originally in ice remnants 12. In other examples, output fluid 88 need not include dissolved sugars, flavors, and other similar ingredients that may have been originally in ice remnants 12. Output fluid 88 may be used on-site or transported to another facility. The commercial value of output fluid 84 includes, inter alia, a food for pollinating bees, a food stuff for a butterfly garden, a hummingbird habitat, and the like. Using fluid 88 in this manner may draw customers to the FSF or similar type facility. The sugar water ingredient in output fluid 88 may also be used as an ingredient for feed pellets/mashes for animals, and the like. System 10, 10" and 10" FIGS. 2-3C, may include similar features and may operate in a similar manner, as discussed above with reference to FIG. 1.

[0027] Container 14, FIG. 1, also includes duct 52 configured to receive hot/humid air 54 from the facility and direct the hot/humid air 54 to ice capturing and melting device 29 to assist in the melting the ice cubes/ice flakes trapped therein. Hot/humid air 54 is preferably pumped into duct 52 by an arrangement of fans, ducting, and the like (not shown) at various locations in the facility where the air is the warmest and most humid, e.g., ceilings, above sinks and cooking appliances, restrooms and the like of a facility, as shown by arrow 55. As hot/humid air 54 flows over screens 30 of ice capturing and melting device 29, the air becomes cooled and de-humidified and preferably may flow out ducts 56 as cooled/de-humidified air 58, as shown by arrows 60 and may be used to cool the facility. The cooled/de-humidified air 58 may be mixed with conventional HVAC systems 62 to cool tables, work spaces, and other various heat sources of the facility. Screen(s) 32 and/or screen(s) 34 and/or screen(s) 36 also preferably ensure that the large de-humidification power of the 32° F. air is completely harvested by the fluid of hot/humid air 54 and the resulting condensation drip only occurs within container 14. This is different than a typical vapor compression chiller which cannot continuously operate at 32° F. or below because of frost buildup on the heat exchange surfaces. System 10, 10", and 10" FIGS. 2-313 may operate in a similar manner.

[0028] Although specific features of the invention are shown in some drawings and not in others, this is for convenience only as each feature may be combined with any or all of the other features in accordance with the invention. The words “including”, “comprising”, “having”, and “with” as used herein are to be interpreted broadly and comprehensively and are not limited to any physical interconnection. Moreover, any embodiments disclosed in the subject application are not to be taken as the only possible embodiments.

[0029] In addition, any amendment presented during the prosecution of the patent application for this patent is not a disclaimer of any claim element presented in the application as filed: those skilled in the art cannot reasonably be expected to draft a claim that would literally encompass all possible equivalents, many equivalents will be unforeseeable at the time of the amendment and are beyond a fair interpretation of
what is to be surrendered (if anything), the rationale underlying the amendment may bear no more than a tangential relation to many equivalents, and/or there are many other reasons the applicant cannot be expected to describe certain insubstantial substitutes for any claim element amended.

Other embodiments will occur to those skilled in the art and are within the following claims.

What is claimed is:

1. A system for recycling energy from ice remnants, the system comprising:
   a) a container including:
   b) an ice capturing and melting device configured to capture and melt ice in the ice remnants while allowing fluid in the ice remnants to pass therethrough forming a cooled recycled liquid at a bottom of the container; and
   c) a discharge port located proximate the bottom of the container configured to direct the cooled recycled liquid to at least one heat source of the facility and cool the heat source.

2. The system of claim 1 in which the ice remnants include discarded beverage remnants.

3. The system of claim 1 in which the ice remnants include discarded ice.

4. The system of claim 1 in which the ice remnants include a mixture of discarded ice and a fluid.

5. The system of claim 1 in which the facility includes a food service facility.

6. The system of claim 1 in which the facility includes a skating facility.

7. The system of claim 1 in which the ice capturing and melting device includes a plurality of screens.

8. The system of claim 7 in which the plurality of screens includes screens with different mesh sizes each configured to trap ice in the ice remnants having different sizes.

9. The system of claim 8 in which the plurality of screens are configured to be progressively layered with screens having different sizes.

10. The system of claim 1 further including a gas collection device configured to remove and collect gas from the cooled recycled liquid.

11. The system of claim 1 further including an output port for downstream from the gas collection device configured to output a final output fluid.

12. The system of claim 11 in which the final output fluid is at a predetermined temperature.

13. The system of claim 12 in which the final output fluid is configured as an energy product including dissolved ingredients of nutritional value in the ice remnants.

14. The system of claim 13 further including a line configured to deliver the energy product to a garden at the facility.

15. The system of claim 14 in which the energy product is configured to attract desired birds and/or desired insects to the garden to draw customers to the facility.

16. The system of claim 13 in which the energy product is configured to be used for manufacturing a feed product for animals.

17. The system of claim 1 in which the container includes at least one gas intake port configured to receive hot/humid gas and direct the gas through the ice capturing and melting device to assist in the melting of the ice to form the cooled recycled liquid.

18. The system of claim 1 in which the container includes at least one gas intake port configured to receive a hot/humid gas and direct the gas through the ice capturing and melting device to form a cooled de-humidified gas in the container.

19. The system of claim 18 in which the container further includes at least one gas output port configured to direct the cooled de-humidified gas to the facility and/or a different facility.

20. The system of claim 19 in which the at least one gas output port is configured to direct the cooled de-humidified gas to a HVAC system of the facility and/or a different facility.

21. The system of claim 1 in which the container includes a plurality of receptacles.

22. The system of claim 1 further including a plurality of containers.

23. The system of claim 1 further including a plurality of receptacles located at different locations of the facility coupled to each other and configured to deliver the ice remnants to the container.

24. The system of claim 23 further including a plurality of receptacles located at different locations of the facility coupled to each other and configured to deliver the ice remnants to a plurality of containers.

25. The system of claim 1 in which the cooled recycled liquid is directed to a different facility to cool at least one heat source at the different facility.

26. A system for recycling energy from ice remnants, the system comprising:

   a) a container including:
      b) an ice capturing and melting device configured to capture and melt ice in the ice remnants while allowing fluid in the ice remnants to pass therethrough forming a cooled recycled liquid at a bottom of the container;
      c) a discharge port located proximate the bottom of the container configured to direct the cooled recycled liquid to at least one heat source of the facility and cool the heat source;
      d) a discharge port located proximate the bottom of the container configured to direct the cooled recycled liquid to at least one heat source of a facility and cool the heat source; and
   
27. A method for recycling energy from ice remnants, the method comprising:

   receiving ice remnants from a facility;
   providing an ice capturing and melting device configured capture and melt ice in the ice remnants while allowing fluid in the ice remnants to pass therethrough thereby forming a cooled recycled liquid; and
   directing the cooled recycled liquid to at least one heat source of the facility and cool the heat source.

28. The method of claim 27 further including the step of collecting gas from the cooled recycled liquid.
29. The method of claim 27 further including the step of receiving hot/humid gas and directing the hot/humid gas through the ice capturing and melting device to assist in the melting of the ice to form the cooled recycled liquid.

30. The method of claim 27 further including the step of directing hot/humid gas through the ice capturing and melting device to form a cooled de-humidified gas.

31. The method of claim 30 further including the step of directing the de-humidified gas to the facility and/or a different facility.

32. The method of claim 31 further including the step of directing the cooled de-humidified gas to an HVAC system of the facility and/or a different facility.

33. The method of claim 27 further including the step of gradually warming the cooled recycled liquid such that any dissolved carbon dioxide therein gases out to form a liquid energy product.

34. The method of claim 33 further including the step of capturing the carbon dioxide.

35. The method of claim 33 further including the step of directing the carbon dioxide to a greenhouse to facilitate photosynthesis simulation.

36. The method of claim 33 further including the step of directing the liquid energy product to a predetermined location at the facility.

37. The method of claim 36 further including the step of directing the energy product to a garden to attract desired birds and/or desired insects to the garden and to draw customers to the facility.

38. The method of claim 27 further including the step of using the energy product to manufacture feed products for animals.

39. The method of claim 27 in which the energy product includes one or more of dissolved sugars, flavorings, and ingredients originally present in the ice remnants.

40. A method for recovering an energy product from beverage remnants, the method comprising:

- receiving beverage remnants from a facility;
- providing an ice capturing and melting device configured to capture and melt ice in the beverage remnants while allowing fluid in the beverage remnants to pass through thereby forming a cooled recycled liquid; and gradually warming the cooled recycled liquid such that any dissolved carbon dioxide therein gases out and forms a liquid energy product.

41. The method of claim 40 further including the step of directing the energy product to a predetermined location.

42. The method of claim 40 further including the step of directing the energy product to a garden.

43. The method of claim 40 further including the step of capturing the carbon dioxide.

44. The method of claim 43 further including the step of directing the carbon dioxide to a greenhouse to facilitate photosynthesis simulation.

45. The method of claim 40 further including the step of using the energy product to manufacture a food product for animals.

46. The method of claim 42 further including the step of using the energy product to attract desired birds and/or insects to draw customers to the facility.

47. A method for recycling energy from ice remnants, the method comprising:

- receiving ice remnants from a facility;
- providing an ice capturing and melting device configured capture and melt ice in the ice remnants while allowing fluid in the ice remnants to pass therethrough thereby forming a cooled recycled liquid;
- receiving hot/humid gas and directing the hot/humid gas through the ice capturing and melting device to assist in the melting of the ice and to form a cooled de-humidified gas;
- directing the cooled recycled liquid to at least one heat source of a facility and cool the heat source; and directing the cooled de-humidified gas to the facility.