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(54) **FLEXIBLE INTERLOCKING TILE SYSTEM**

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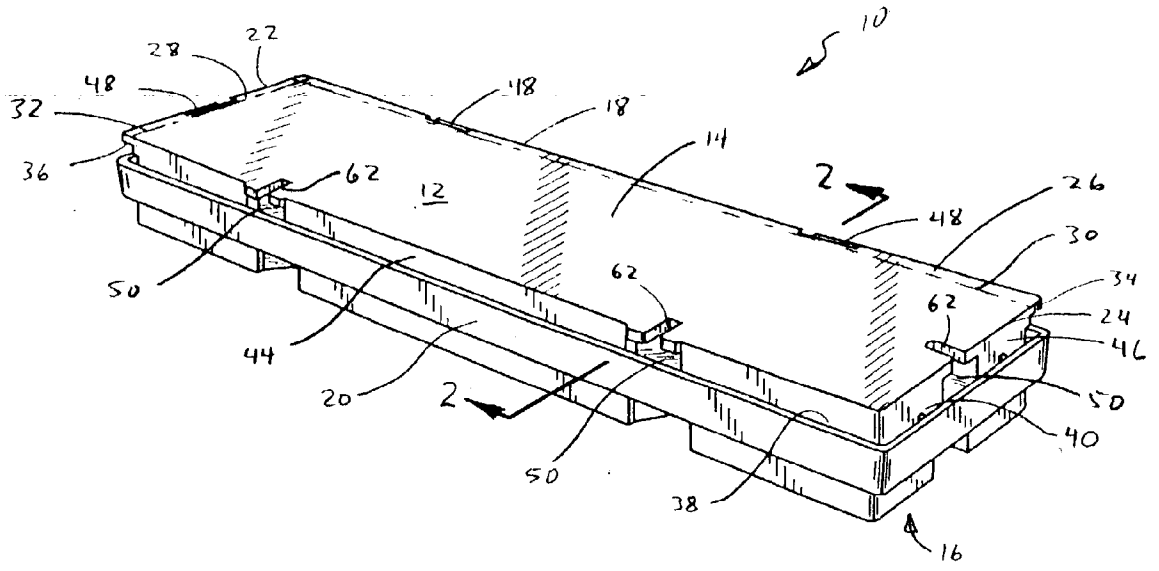
(57) **ABSTRACT**

A floor tile system for placing on an ice surface includes a plurality of flexibly interconnected tiles. Each tile includes a tile body that is integrally formed of thermally insulative material, including upstanding supports having a height selected to provide a temperature gradient between the ice surface and the top surface of the tile sufficient to substantially prevent condensation on the top surface when surrounded by typical ice rink ambient conditions of temperature and humidity.



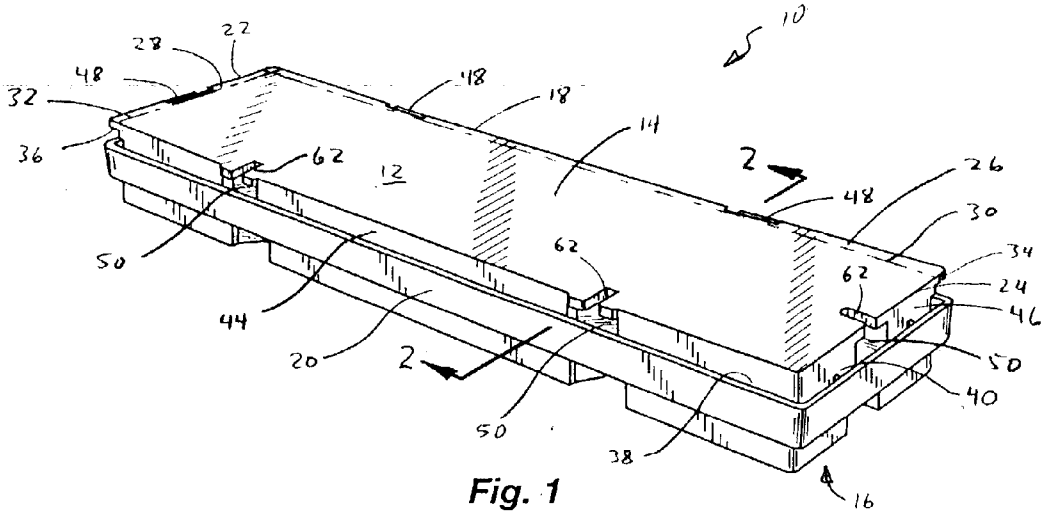


Fig. 1

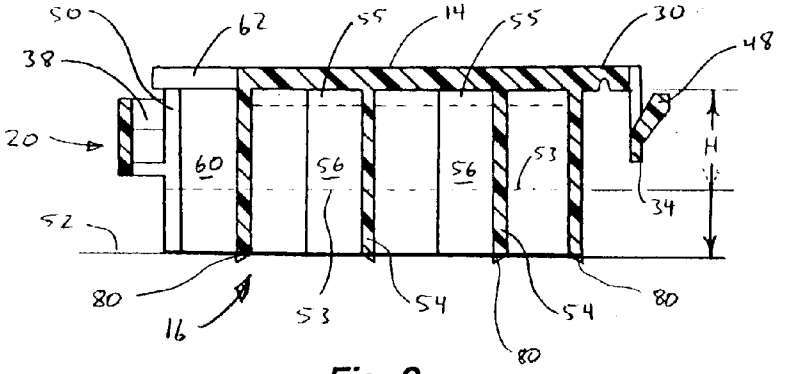


Fig. 2

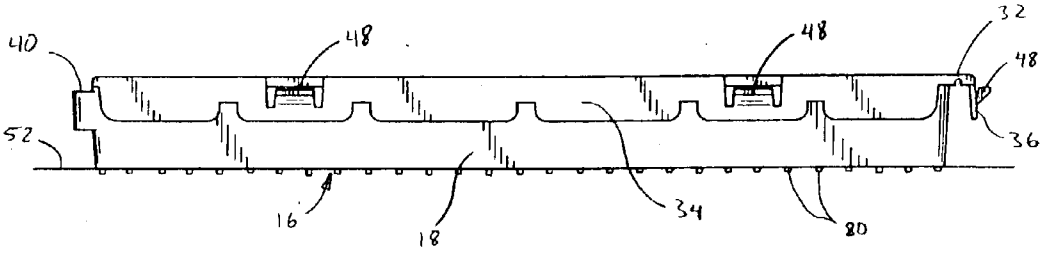


Fig. 3

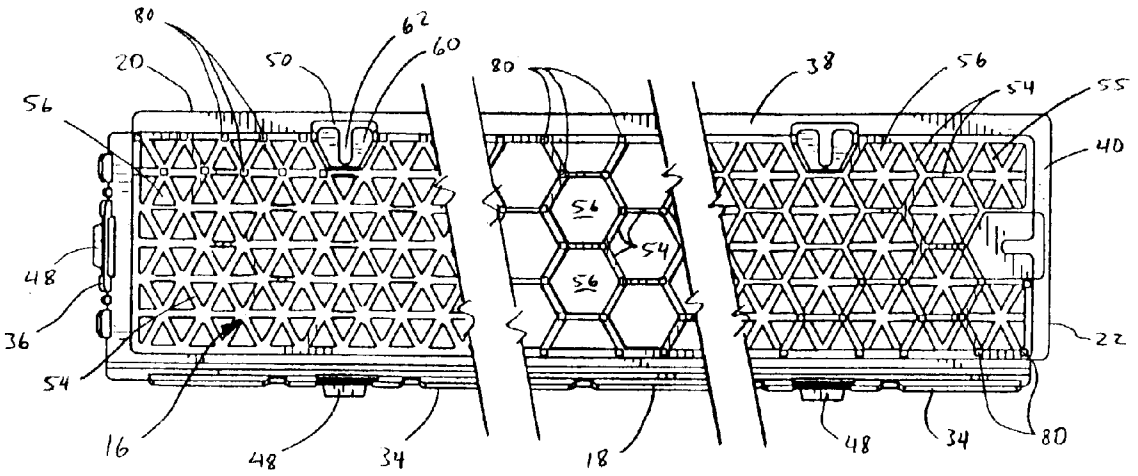

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Fig. 4

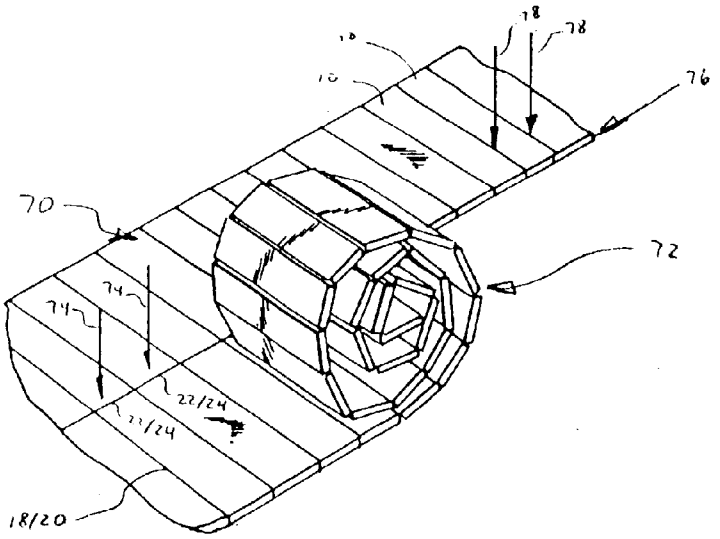
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Fig. 5

FLEXIBLE INTERLOCKING TILE SYSTEM

[0001] This application is a Continuation-in-Part of U.S. patent application Ser. No. 29/164,120, filed Jul. 16, 2002, the disclosure of which is incorporated herein by reference for the relevant teachings consistent herewith.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates generally to floor tile systems. More particularly, the present invention relates to an interlocking floor tile system configured to cover an ice surface.

[0004] 2. Related Art

[0005] There are many instances where it is desirable to install a temporary floor surface over an existing floor surface. For example, when a sports arena is used for a concert, convention, or other such event, it may be desirable to install a temporary floor surface over the athletic floor in order to protect the latter from damage due to hard-soled shoes, scaffolding and risers, sliding chairs, etc. A variety of temporary floor surfaces have been produced for such purposes. Some of these comprise a plurality of interlocking tiles, which are lightweight, and can be laid out relatively quickly, then removed after the event.

[0006] Unfortunately, interlocking tile systems require a relatively significant amount of labor to install and remove. Less labor-intensive systems have also been developed, including carpeting or other roll-type materials. Unfortunately, these present certain drawbacks. The rolls can be very large, heavy and unwieldy, making installation and removal difficult. Additionally, if a portion of the roll becomes damaged, it is difficult if not impossible to repair the damage without discarding the entire roll. Moreover, roll-type coverings can be wrinkled under loads, presenting a potential tripping hazard.

[0007] Some of these problems are overcome by flexible interlocking tile systems that comprise a series of tiles that are interlocked with a hinge portion, thus allowing the tiles to be rolled up for storage in any size roll that is desired. With these systems, if one tile becomes damaged, it can simply be removed from the series of tiles, and replaced with an undamaged tile. These systems also substantially reduce the likelihood of wrinkles in a flexible surface, and thus reduce the potential for tripping.

[0008] Unfortunately, however, prior flexible interlocking tile systems present certain problems. For example, when they are used to cover an ice surface, the floor tiles cool down dramatically due to thermal conduction. This cooling of the top surface of the tile promotes the formation of condensation on the tops of the tiles, presenting a slippery and unsafe surface. While some interlocking tile systems have addressed the condensation problem, their solutions have been somewhat complicated. These prior systems frequently require multiple parts and insulating layers, thus increasing the cost and complexity of the system, and also presenting more elements that can break or malfunction.

[0009] Additionally, ordinary loads on ice tile systems tend to damage the ice. A load such as from a small utility vehicle is likely to cause the underside of the tile to dig into and melt the ice, resulting in greater maintenance expense for the arena in refurbishing the ice surface, in addition to a low spot in the floor surface which can present a tripping hazard.

[0010] Finally, another problem with prior interlocking tile systems is the difficulty of disconnecting adjacent tiles from each other. Because the interlocking mechanisms of these prior tiles are preferably hidden from view, disconnecting adjacent tiles usually requires the use of some sort of special tool. Unfortunately, these tools are easily lost. Moreover, to quickly remove such a floor system may require many workers, each of whom must have one of these tools to be effective.

SUMMARY OF THE INVENTION

[0011] It has been recognized that it would be advantageous to develop a floor tile system that can be removably rolled out over an ice surface.

[0012] It would also be advantageous to develop a floor tile system for temporarily placing over an ice surface, which reduces damage to and melting of the ice, and also substantially prevents condensation from forming on the wearing surface of the floor tiles.

[0013] It would also be desirable to develop a floor tile system which includes an interlocking mechanism that can be manually disconnected by a user.

[0014] The invention advantageously provides a floor tile, comprising a tile body, having a top surface and a bottom support structure, a flexible hinge portion, and a receiving slot, configured to receive the flexible hinge portion of an adjacent floor tile. An interlocking mechanism is configured to interlock the flexible hinge portion of another tile within the receiving slot, so as to form a flexible interlocking tile system for covering an ice surface. The tile body is integrally formed of thermally insulative material, including upstanding supports with a height selected to provide a temperature gradient between the ice surface and the top surface sufficient to substantially prevent condensation on the top surface when surrounded by typical ice rink ambient conditions of temperature and humidity.

[0015] In accordance with a more detailed aspect of the present invention, the interlocking mechanism comprises interlocking tabs disposed in either the flexible hinge portion or the receiving slot, and the floor tile further includes a tab release recess, disposed in the bottom support structure and surrounding the interlocking slot, having a size sufficient to allow a user to insert a finger into the tab release recess to disengage the interlocking tabs of adjacent tiles.

[0016] Additional features and advantages of the invention will be apparent from the detailed description which follows, taken in conjunction with the accompanying drawings, which together illustrate, by way of example, features of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] **FIG. 1** is a perspective view of a floor tile in accordance with one embodiment of the present invention.

[0018] **FIG. 2** is a cross-sectional view of the floor tile of **FIG. 1**.

[0019] **FIG. 3** is a side view of the floor tile of **FIG. 1**.

[0020] **FIG. 4** is a split bottom view of the floor tile of **FIG. 1**, showing three different embodiments of the bottom support structure.

[0021] **FIG. 5** is a perspective view of the floor tile system in process of installation or removal.

DETAILED DESCRIPTION

[0022] Reference will now be made to the exemplary embodiments illustrated in the drawings, and specific language will be used herein to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended. Alterations and further modifications of the inventive features illustrated herein, and additional applications of the principles of the inventions as illustrated herein, which would occur to one skilled in the relevant art and having possession of this disclosure, are to be considered within the scope of the invention.

[0023] Viewing **FIGS. 1-4**, the present invention advantageously provides a floor tile **10** configured for interconnection with other similar floor tiles to form a flexible interlocking floor surface particularly suitable for placing over an ice surface. The tile **10** comprises a tile body **12**, having a top surface **14** and a bottom support structure **16**. The tile may take a variety of shapes. As shown in the figures, the tile is rectangularly shaped, with two long sides **18**, **20**, and two short sides **22**, **24**.

[0024] Disposed along the first long side **18** and first short side **22** are flexible hinge portions **26** and **28**. The first flexible hinge portion **26** is configured to bend along a bending axis, represented by line **30**, that is parallel to the first long side **18**. Likewise, the second flexible hinge portion **28** is configured to bend along a bending axis, represented by line **32**, that is parallel to the first short side **22**.

[0025] The flexible hinge portions **26** and **28** each include a downwardly projecting member or rib **34**, **36**, which is configured to fit into a corresponding receiving slot **38** and **40** disposed along the second long side **20** and second short side **24**, respectively, of another similar tile **42**, shown in outline form in **FIG. 1**. The receiving slots **38**, **40** include sidewalls **44**, **46**. The downwardly projecting members **34**, **36** and the sidewalls **44**, **46** are configured to provide an interlocking mechanism, which interlocks the downwardly projecting member of the flexible hinge portion within the corresponding receiving slot.

[0026] In the embodiment shown in **FIGS. 1-3**, the interlocking mechanism comprises protruding resilient tabs **48**, disposed on the downwardly projecting members, and interlocking slots **50** disposed on the sidewalls. The interlocking slots are configured to receive the resilient tabs, which snap into the interlocking slots when the downwardly projecting member is pressed into the receiving slot.

[0027] It will be apparent that the interlocking mechanism could be otherwise configured. For example, the interlocking slots could be disposed on the downwardly projecting member, while the resilient tabs could be formed as part of the sidewall. Other methods of providing an interlocking mechanism between the hinge portion of one tile and the receiving slot of an adjacent tile could also be provided, so long as the system adequately connects the tiles, and allows the hinges to flex so as to form a flexible mat of interlocked tiles which can be rolled into a roll for storage.

[0028] The tile body **12** is integrally formed as a single piece of lightweight, thermally insulative material. Materials which may be suitable for the tile body include polyethylene, polypropylene, pvc, nylon, and other plastics, which may be injection molded into the desired configuration. The tile body **12** includes a bottom support structure **16**, which extends between the bottom of the tile and the top surface **14**, and is configured to support the tile on an ice surface **52**. The bottom support structure includes a plurality of upstanding or vertical supports, such as ribs **54**, which form a pattern of air pockets **56** between the surface of the ice **52** and an underside of the top surface **14**.

[0029] As noted above, condensation on the top surface of a floor temporarily placed over an ice surface presents potentially dangerous slip-and-fall conditions. As is well known, condensation forms on a surface when the temperature of the surface is below the dewpoint of the surrounding environment. Dewpoint is a function of relative humidity and barometric pressure. Referring to **FIG. 2**, to prevent condensation, the top surface **14** of the tile must be able to maintain a temperature above the dewpoint while the bottom surface is in contact with an ice surface (i.e. at or below 32° F.). To accomplish this, the upstanding supports **54** have a height H selected so as to provide a temperature gradient between the ice surface **52** and the top surface **14** of the tile sufficient to substantially prevent condensation on the top surface, particularly when surrounded by typical ice rink ambient conditions of temperature and humidity. Typical ice rink ambient conditions of air temperature and humidity are usually more than about 20° F. above freezing, and between about 20% and 80% relative humidity, with about 25° F. above freezing and at least about 30% relative humidity being fairly common.

[0030] To provide this temperature gradient, the material of the tile body **12**, and hence of the upstanding supports **54**, must be selected to have a coefficient of thermal conductivity which will maintain the top surface **14** at a temperature above the dewpoint when the bottom of the upright supports **54** are in contact with the ice. The inventors have found that for a tile height H of 1.25 in., the material of the upstanding supports must have a coeffecient of thermal conductivity greater than about 1.75 to prevent condensation in conditions of about 20° F. above freezing, and between about 20% and 50% relative humidity. It will be apparent that the actual material chosen may vary depending on the selected height of the floor tile. As shown by the dashed line **53** in **FIG. 2**, the height H of the tile above the ice surface may vary across a relatively wide range. The inventors presently prefer floor tiles having a height H of from about 0.75 in. to about 1.75 in. In one particular embodiment, the inventors have found that for a tile height H of 0.75 in., an air temperature above about 50° F., and about 30% relative humidity, upstanding supports configured as shown in **FIGS. 2 and 4** are sufficient to prevent condensation on the top surface.

[0031] It will also be apparent that the required height H of the floor tile, and hence also the required thermal conductivity, may vary depending upon the configuration of the upstanding supports. Because the air pockets **56** also provide thermal insulation, the thickness and spacing of the vertical ribs **54** will affect the temperature gradient provided by the

tile body. As shown in **FIG. 4**, the vertical ribs may be arranged to create air pockets of a variety of shapes. As shown on the left side of **FIG. 4**, the vertical ribs may be configured to create triangular air pockets. Alternatively, as shown in the center of **FIG. 4**, the vertical ribs may be configured to create hexagonal air pockets. As yet another alternative, shown on the right side of **FIG. 4**, the vertical ribs may be arranged to create hexagonal air pockets with horizontal cross ribs **55** disposed across the upper portion of each hexagon. These horizontal cross ribs can provide additional strength to the top surface of the tile. The vertical position of these horizontal cross ribs is shown in dashed lines in **FIG. 2**. The cross-section of **FIG. 2** is taken through a tab **48** and interlocking slot **50** of a tile having a hexagonal support configuration like that shown in the center of **FIG. 4**. It will be apparent that the air pockets may take other shapes also. Regardless of the shape, the configuration of the air pockets and the thermal conductivity and height of the vertical ribs are intended to provide the required thermal insulation.

[**0032**] Viewing **FIG. 4**, the bottom support structure **16** advantageously includes a tab release recess **60**, surrounding each interlocking slot **50**, having a size sufficient to allow a user to insert a finger into the tab release recess to disengage the two adjacent tiles. The tab release recess is accessible from the bottom of the tile, allowing a user to disconnect adjacent tiles when rolled up with only their bottom sides exposed, and without the need for any special tools. In the embodiment shown in **FIG. 5**, the tab release recess **60** comprises a portion of one hexagonal air pocket. A gap in the sidewall **44**, **46** of the receiving slot **38**, **40** adjacent to the interlocking slot **50** provides the release tab recess into which a user may insert their finger to push the interlocking tab **48** out of the interlocking slot.

[**0033**] Viewing **FIGS. 1, 2**, and **4**, as with prior interlocking tiles, an opening **62** is also provided in the top surface **14**, whereby the tab release recess is accessible with a tool, such as a flat bladed screwdriver or other tool, which may be inserted through the opening.

[**0034**] As shown in **FIGS. 2-4**, the floor tiles may also includes a plurality of gripping teeth **80**, downwardly extending from the bottom side of the bottom support structure **16**. These teeth are configured to dig into the ice surface **52** to help prevent sliding of individual floor tiles and of the entire installed floor tile system. In the embodiment shown, the gripping teeth comprise wedges that face in opposing directions relative to the narrow dimension of the tile. The provision of wedges oriented in opposing directions helps prevent the wedges from tending to push the tiles laterally.

[**0035**] The gripping teeth **80** may be located in a variety of configurations and spacings. As shown in **FIG. 4**, one configuration of the wedges is to locate them at selected intersections of vertical ribs **54**. With this approach, the particular arrangement of the gripping teeth will depend in part upon the shape and configuration of the vertical support structure **16**. Only a representative portion of the gripping teeth are shown in **FIG. 4**. In the left portion of the figure, the gripping teeth are shown at intersections of triangular vertices. In the center of the figure, the teeth are shown at all vertices of the hexagonal ribs with each other and with the side walls of the tile. At the right side of **FIG. 4**, the gripping teeth are shown at major vertices of the hexagonal ribs. With regard to the spacing of the teeth, a variety of spacings are possible. In one embodiment, the inventors have found that teeth having a spacing of about 4 or 5 teeth per linear inch as measured in two directions on the bottom of the tile (laterally and longitudinally) is a workable spacing. However, fewer or more teeth may be used.

[**0036**] Referring to **FIG. 5**, the present invention advantageously creates a flexible mat **70** of interlocked tiles **10** which can be rolled into a roll **72** for storage. Because the tiles are releasably interconnectable along two sides, the user can choose how wide any individual roll will be. For example, when removing the tiles from a large floor surface, a worker can disconnect the short sides **22**, **24** of the tiles, indicated by arrows **74**, along a break line **76**, while leaving some selected number of tiles, such as **1**, **2**, or **6**, connected along their short sides. The roll **72** shown in **FIG. 5** is only one tile wide. The worker then begins rolling the connected tiles, starting from an edge of the floor, gradually releasing connected short edges **22**, **24**, along the break line **76** so as to create a roll that is **1**, **2**, or **6** tiles wide. If the roll **72** exceeds a certain maximum desired size (i.e. diameter) before reaching the opposite edge of the floor, the worker can simply disconnect the long edges **18**, **20** of the tile roll, indicated by arrows **78**, from the next row, thereby completely disconnecting the rolled portion from the rest of the floor. The worker then repeats the rolling process, disconnecting short edges and creating a new roll until reaching the opposite edge of the floor, after which the process is repeated until the entire flexible mat **70** is removed.

[**0037**] It is to be understood that the above-referenced arrangements are only illustrative of the application for the principles of the present invention. Numerous modifications and alternative arrangements can be devised without departing from the spirit and scope of the present invention while the present invention has been shown in the drawings and fully described above with particularity and detail in connection with what is presently deemed to be the most practical and preferred embodiments(s) of the invention, it will be apparent to those of ordinary skill in the art that numerous modifications can be made without departing from the principles and concepts of the invention as set forth in the claims.

What is claimed is:

1. A floor tile, comprising:

a) a tile body, having a top surface and a bottom support structure;

b) a flexible hinge portion, disposed along a first side of the tile body and configured to bend along a bending axis that is parallel to the first side; and

c) a receiving slot, disposed along a second side of the tile body, opposite the first side, configured to receive the flexible hinge portion of an adjacent floor tile; and

d) an interlocking mechanism, configured to interlock the flexible hinge portion of another tile within the receiving slot;

e) wherein the bottom support structure is configured to support the tile body on an ice surface, the tile body being integrally formed of thermally insulative material, and the bottom support structure comprising

upstanding supports of the insulative material, the upstanding supports having a height selected so as to provide a temperature gradient between the ice surface and the top surface sufficient to substantially prevent condensation on the top surface due to contact with the ice surface.

2. A floor tile in accordance with claim 1, wherein the tile includes four sides, the flexible hinge portion comprises two hinge parts disposed on two adjacent sides of the tile, each hinge part being configured to bend along a bending axis that is parallel to the respective side, and wherein the receiving slot is disposed on the remaining two adjacent sides, and

3. A floor tile in accordance with claim 1, wherein

a) the flexible hinge portion comprises a downwardly projecting member;

b) the receiving slot comprises a sidewall; and

c) the interlocking mechanism comprises:

a. protruding resilient tabs, disposed on one of the downwardly projecting member and the sidewall; and

b. slots, configured to receive the resilient tabs, disposed on the other of the downwardly projecting member and the sidewall.

4. A floor tile in accordance with claim 1, wherein the height of the upstanding supports is selected so as to substantially prevent condensation on the top surface in typical ice rink ambient conditions of temperature and humidity of more than about 20° F. above freezing, and between about 20% and 80% relative humidity.

5. A floor tile in accordance with claim 4, wherein the typical ice rink ambient conditions of temperature and humidity are about 25° F. above freezing and at least about 30% relative humidity.

6. A floor tile in accordance with claim 1, wherein the insulative material of the upstanding supports has a coefficient of thermal conductivity greater than about 1.75.

7. A floor tile in accordance with claim 1, wherein the upstanding supports have a height of from about ¾ inch to about 1-¾ inches.

8. A floor tile in accordance with claim 7, wherein the upstanding supports have a height of about 1.5 inches.

9. A floor tile in accordance with claim 1, further comprising a plurality of gripping teeth, downwardly extending from a bottom side of the bottom support structure, configured to dig into the ice surface to help prevent sliding of the floor tile.

10. A flexible interlocking tile system for placing over an ice surface, comprising:

a) a plurality of flexible interlocking tiles, each tile including:

a. a tile body, having a top surface and a bottom support structure;

b. a flexible hinge portion, disposed along a first side of the tile body, having an interlocking mechanism; and

c. a receiving slot, disposed along a second side of the tile body, opposite the first side, configured to receive the flexible hinge portion of an adjacent floor tile, and having an interlocking mechanism configured to interlock with the interlocking mechanism of the hinge portion; and

d. wherein the bottom support structure is configured to support the tile body on an ice surface, the tile body being integrally formed of thermally insulative material, and the bottom support structure comprising upstanding supports of the insulative material, the upstanding supports having a height selected so as to provide a temperature gradient between the ice surface and the top surface sufficient to substantially prevent condensation on the top surface when surrounded by ambient conditions of more than about 20° F. above freezing and between about 20% and 80% relative humidity; and

b) the flexible hinge portion of each of the plurality of interlocking tiles being removably received within the receiving slot of an adjacent tile, so as to form a flexible mat of interlocked tiles which can be rolled into a roll for storage.

11. A tile system in accordance with claim 10, wherein

a) the flexible hinge portion includes a downwardly projecting member, the flexible hinge portion being oriented parallel to the receiving slot and configured to bend along a bending axis that is parallel to the first side of the tile;

b) the receiving slot includes a sidewall; and

c) the interlocking mechanism comprises:

a. protruding resilient tabs, disposed on one of the downwardly projecting member and the sidewall; and

b. slots, configured to receive the resilient tabs, disposed on the other of the downwardly projecting member and the sidewall.

12. A tile system in accordance with claim 10, wherein the insulative material of the upstanding supports has a coefficient of thermal conductivity greater than about 1.75, and the upstanding supports have a height of from about ¾ inch to about 1-¾ inches.

13. A tile system in accordance with claim 10, wherein the upstanding supports of the bottom support structure comprise a plurality of vertical ribs forming a pattern of air pockets between the surface of the ice and an underside of the top surface.

14. A tile system in accordance with claim 13, wherein the air pockets are of shapes selected from the group consisting of triangular and hexagonal.

15. A tile system in accordance with claim 10, further comprising a plurality of gripping teeth, downwardly extending from a bottom side of the bottom support structure of at least some of the interlocking tiles, configured to dig into the ice surface to help prevent sliding of the tile system.

16. A floor tile, comprising:

a) a tile body, integrally formed of thermally insulative material, having

a. a first side,

b. a second side opposite the first side,

c. a top surface, and

d. a bottom support structure, configured to support the tile body on an ice surface, and comprising upstanding supports having a height selected so as to provide a temperature gradient between the ice surface and

the top surface sufficient to substantially prevent condensation on the top surface when surrounded by ambient conditions of more than about 20° F. above freezing and between about 20% and 80% relative humidity;

b) a flexible hinge portion, having a downwardly extending member with a resilient interlocking tab, disposed along the first side of the tile body and configured to bend along a bending axis that is parallel to the first side;

c) a receiving slot, disposed along the second side of the tile body, having a sidewall with an interlocking slot configured to receive the interlocking tab of the downwardly extending member of an adjacent floor tile so as to interlock two adjacent tiles together; and

d) a tab release recess, disposed in the bottom support structure and surrounding the interlocking slot, having a size sufficient to allow a user to insert a finger into the tab release recess to disengage the two adjacent tiles.

17. A floor tile in accordance with claim 16, wherein the tab release recess is accessible from below the top surface.

18. A floor tile in accordance with claim 16, further comprising an opening in the top surface, whereby the tab release recess is accessible by inserting a tool through the opening.

19. A floor tile in accordance with claim 16, wherein the upstanding supports of the bottom support structure comprise a plurality of vertical ribs forming a pattern of air pockets between the surface of the ice and an underside of the top surface.

20. A floor tile in accordance with claim 19, wherein the tab release recess comprises at least a portion of one air pocket.

21. A floor tile in accordance with claim 20, wherein the air pockets are of shapes selected from the group consisting of triangular and hexagonal.

22. A floor tile in accordance with claim 16, further comprising a plurality of gripping teeth, downwardly extending from a bottom side of the bottom support structure, configured to dig into the ice surface to help prevent sliding of the floor tile.

* * * * *