In a long hot water mat, straight parts (4a) of a hot water pipe (4) are laid lengthwise in a long mat body (2) and U-shaped turning parts (4b) of the hot water pipe are placed at locations near the opposite ends (2b) of the mat body (2). Slits (7) are formed at regular intervals in the lower surface of the mat body (2) so that the slits cross the mat body (2) in directions crossing the straight parts (4a) of the hot water pipe (4). The hot water mat having a heat dissipating sheet (6) thereon can be rolled from an end of the mat body (2), with the heat dissipating sheet being placed inward, due to the slits (7) so that the mat can be easily moved using an elevator or can be easily moved into a room while avoiding a reduction in the size of the mat.
Fig. 5

Fig. 6
ROLLED FLOOR HEATING MAT USING HYDRO

TECHNICAL FIELD

[0001] The present invention relates, in general, to a long folding hot water mat for floor heating which is laid on the floor of a room and heats the room from the floor.

BACKGROUND ART

[0002] Hot water mats for floor heating are designed to be used so that one or more mats having a predetermined size can be laid according to the size of the floor surface of a room.

[0003] A conventional hot water mat is problematic in that, when the hot water mat is moved to a building site or moved into a room after being produced in a factory, the mat may not enter an elevator or the room because the size of the mat is too big to pass through the narrow entrance of the elevator or the doorway leading to the room.

[0004] Therefore, to solve the problems experienced in the movement of the hot water mat, a folding hot water mat that is designed to be moved without difficulty has been proposed and used in the related art.

[0005] For example, a hot water mat disclosed in patent document 1 (Japanese patent Laid-open Publication No. 2000-65365) is configured so that slits are formed in the lower surface of the hot water mat in parallel to width support bars that are embedded in the hot water mat, and the mat can be folded at the slits.

[0006] However, this mat is problematic in that the width support bars made of wood cannot be folded so that the reduction in the size of the folded mat is limited.

[0007] To solve the problem, a hot water mat, in which two hot water mats are connected to each other in a direction of the length of the width support bars so that the two mats can be folded at the connected junction, is proposed in patent document 2 (Japanese patent Laid-open Publication No. 2010-38390).

[0008] However, the hot water mat disclosed in patent document 2 is problematic in that, although the two hot water mats are laid side by side and are connected to each other so that the two mats can be folded at the connected junction, it is impossible to reduce the size of the two hot water mats in the direction of the length of the width support bars of each mat in the same manner as in patent document 1 in which one mat is folded.

[0009] Further, even in a hot water mat having no width support bar, folding slits are formed in parallel to a hot water pipe as disclosed in patent document 3 (Japanese patent Laid-open Publication No. 2010-216727).

[0010] As described above, in the conventional hot water mats, the reduction in the size of the folded mat is limited so that when the floor is a large-sized floor, it is required to lay several hot water mats, for example, four mats 1, on the floor as shown in FIG. 11. In FIG. 11, reference numeral 2 denotes a mat body, 2a denotes width support bars, 3 denotes a piping groove, and 4 denotes a hot water pipe.

[0011] However, when the four hot water mats 1 are laid on the floor as described above, the number of U-shaped turning parts 4b of the hot water pipe 4 is increased and this results in an increase in pressure loss. Further, it is required to couple the hot water pipes 4 to each other at the junctions between the hot water mats 1 and this increases work time and may cause leakage of water, and increases the number of coupling elements, such as joint couplings.

[0012] In an effort to solve the problems, a technique, in which two hot water mats instead of the four hot water mats 1 of FIG. 11 are used to cover the floor, may be proposed. To realize this technique, each of the two hot water mats used in the technique may be configured as a long mat in which the width of each long mat remains the same as in each of the four hot water mats 1, but the length of each long mat is increased to become equal to the sum of the lengths of two hot water mats 1. After producing the long hot water mats, two long mats may be laid on the floor side by side so as to cover the floor, as shown in FIG. 12.

[0013] However, when the technique of the hot water mat 1 used in the long mats of FIG. 12, the long mats are problematic in that the number of straight parts 4a of the zigzag-shaped hot water pipe 4 is increased and the length of the straight parts 4a of the pipe 4 becomes short as illustrated in FIG. 12, thereby increasing the production cost. Another problem of the long mats resides in that the number of U-shaped turning parts 4b is increased and this causes an increase in the pressure loss of the hot water pipe 4. In FIG. 12 and FIG. 13, reference numeral 7 denotes folding slits that are formed in the lower surface of the mat body 2 in parallel to the straight parts 4a of the hot water pipe 4.

DISCLOSURE

Technical Problem

[0014] Accordingly, the present invention has been made keeping in mind the above problems occurring in the related art, and is intended to provide a hot water mat which is configured as a long mat by reducing the width of the mat and by increasing the length of the mat, with straight parts of a hot water pipe being laid in the directions of the length of the mat and with a reduced number of U-shaped turning parts of the pipe being used, so that a large-sized floor surface can be covered with a minimum number of mats, and which can be rolled so that the size of the mat can be reduced thus allowing the mat to be moved using an elevator or to be moved into a room in a rolled state.

Technical Solution

[0015] To accomplish the above-mentioned object, the invention disclosed in claim 1 provides a long folding hot water mat for floor heating, including:

[0016] a. a long flat panel-shaped mat body;
[0017] b. a piping groove for a hot water pipe, the piping groove including straight groove parts formed lengthwise on an upper surface of the mat body, and U-shaped turning groove parts alternately connecting ends of neighboring straight groove parts to each other, so that the piping groove forms a zigzag shape;
[0018] c. a hot water pipe laid in the piping groove and dissipating heat using hot water flowing in the hot water pipe;
[0019] d. a heat dissipating sheet attached to the front surface of the mat body having the hot water pipe, thereby integrating the hot water pipe with the mat body into a single body; and
[0020] e. folding slits formed at regular intervals in a lower surface of the mat body in directions perpendicular to straight parts of the hot water pipe.
[0021] Further, the invention disclosed in claim 2 provides the long folding hot water mat for floor heating as set forth in claim 1, wherein the slits formed in the lower surface of the mat body have a V-shaped, I-shaped or U-shaped cross-section.

[0022] Further, the invention disclosed in claim 3 provides the long folding hot water mat for floor heating as set forth in claim 1, wherein the slits are formed to reach a predetermined depth into a thickness of the mat body.

[0023] Further, the invention disclosed in claim 4 provides the long folding hot water mat for floor heating as set forth in claim 1, wherein the slits are formed to a depth that cuts through an entire thickness of the mat body.

[0024] Further, the invention disclosed in claim 5 provides the long folding hot water mat for floor heating as set forth in claim 1, wherein the slits are formed in one mat body in a manner of a combination of slits that are formed to reach a predetermined depth and slits that are formed to a depth cutting through an entire thickness of the mat body.

[0025] Further, the invention disclosed in claim 6 provides the long folding hot water mat for floor heating as set forth in claim 1, wherein the mat body is made of a foam body.

[0026] Further, the invention disclosed in claim 7 provides the long folding hot water mat for floor heating as set forth in claim 1, wherein the heat dissipating sheet attached to the upper surface of the mat body is made of a thin aluminum sheet.

[0027] Further, the invention disclosed in claim 8 provides the long folding hot water mat for floor heating as set forth in claim 1, wherein the piping groove formed in the mat body and the hot water pipe laid in the piping groove are formed for one system or for plural systems in one mat body.

[0028] Further, the invention disclosed in claim 9 provides the long folding hot water mat for floor heating as set forth in claim 1, wherein the hot water mat can be rolled from a lengthwise end thereof, with the heat dissipating sheet being placed inward, due to the slits.

[0029] Further, the invention disclosed in claim 10 provides the long folding hot water mat for floor heating as set forth in any one of claims 1 to 9, wherein width support bars are inserted into the mat body at locations between the slits so that the width support bars are in parallel to the slits, the width support bars having a thickness equal to a thickness of the mat body, with pipe seat grooves having a U-shaped cross-section being formed on a surface of each of the width support bars at locations at which the hot water pipe crosses each of the width support bars.

Advantageous Effects

[0030] As described above, the hot water mat of the present invention is configured to form a long shape, in which the straight parts of the hot water pipe are laid lengthwise and the U-shaped turning parts of the pipe are laid at locations near the opposite ends of the mat.

[0031] Accordingly, the number of the straight parts of the pipe and the number of the U-shaped turning parts of the pipe can be remarkably reduced in comparison with the hot water mat of FIG. 12 so that the present invention can remarkably reduce the production cost and pressure loss.

[0032] Further, due to the long straight parts of the hot water pipe, the length of the heat dissipating tape that is attached to each of the straight parts of the pipe and has the reversed O-shaped cross-section can be increased, so that the coefficient of heat conduction from the hot water pipe to the heat dissipating sheet can be increased, thereby providing a hot water mat having high efficiency.

[0033] Further, in the hot water mat, the slits are formed in directions perpendicular to the direction of the length of the mat so that the hot water mat can be rolled from an end thereof, with the heat dissipating sheet being placed inward, thereby reducing the size of the mat. Accordingly, when a large-sized hot water mat having a width of 2.5 m and a length of 10~15 m is rolled, the diameter of the rolled mat can be limited to a range of 60 cm~80 cm, so that the rolled mat can be easily moved using an elevator and can be easily moved into a room without difficulty.

[0034] Further, the width support bars are inserted in parallel to the slits so that the width support bars do not disturb the process of rolling the hot water mat.

DESCRIPTION OF DRAWINGS

[0035] FIG. 1 is a plan view of a hot water mat related to the present invention;

[0036] FIG. 2 is a sectional view taken along line A-A';

[0037] FIG. 3 is a sectional view taken along line B-B';

[0038] FIG. 4 is a view illustrating the laying of the hot water mat of the present invention;

[0039] FIG. 5 is a view illustrating a state in which the hot water mat of the present invention is rolled;

[0040] FIG. 6(A) to FIG. 6(D) are views illustrating the shape of slits;

[0041] FIG. 7 is a plan view illustrating the hot water mat in which width support bars are embedded;

[0042] FIG. 8 is a sectional view taken along line C-C';

[0043] FIG. 9 is a sectional view taken along line D-D';

[0044] FIG. 10 is a view illustrating an embodiment in which width support bars are alternately inserted into the hot water mat from opposite sides so that the support bars reach respective intermediate positions and form a staggered arrangement;

[0045] FIG. 11 is a view illustrating the laying of a conventional hot water mat in a large-sized room;

[0046] FIG. 12 is a view illustrating a long hot water mat having conventional piping and slits; and

[0047] FIG. 13 is a sectional view taken along line E'-E'.

MODE FOR INVENTION

[0048] A hot water mat of the present invention is laid on the floor of a room and heats the floor using heat from hot water of 60°C~80°C that circulates through a hot water pipe laid in a mat body, thereby heating the room.

[0049] The mat body is made of a foam resin plate, in which a piping groove is formed on a surface of the foam resin plate and the hot water pipe that is made of a resin material is laid in the piping groove.

[0050] After laying the hot water pipe in the mat body, a heat dissipating sheet made of a thin aluminum sheet is attached to the surface of the mat body. The heat dissipating sheet evenly distributes the heat from the hot water that circulates through the hot water pipe over the whole surface of the hot water mat, thereby realizing uniformity of the temperature of the floor.

[0051] Further, a heat transfer tape that has a reversed O-shaped cross-section and is made of a thin aluminum sheet is attached to the lower part of each straight part of the hot water pipe. The heat transfer tape transfers heat of the peripheral surface of the lower part of the hot water pipe that is laid
in the piping groove to the heat dissipating sheet, thereby improving heat efficiency. Here, the present invention may provide a hot water mat that has no heat transfer tape. Therefore, the present invention may be adapted to a hot water mat having the heat transfer tape or to a hot water mat having no heat transfer tape.

Further, the present invention may be adapted to hot water mats that have no width support bars or have width support bars capable of supporting a floor material, such as a flooring. When the hot water mat uses the width support bars, the width support bars cross straight parts of the hot water pipe so that pipe seat grooves having a U-shaped cross-section are formed in each of the width support bars at locations at which the straight parts of the hot water pipe cross the width support bar.

Slits that are formed in the lower surface of the hot water mat may be formed in such a way that the slits are formed to reach a depth that reaches a desired distance into the thickness of the mat body or to cut through the entire thickness of the mat body. Alternatively, the slits may be formed in a manner of a combination of the above-mentioned two types of slits. Further, as the pitch of the slits is reduced, the diameter of the rolled hot water mat can be reduced. However, the reduction in the pitch of the slits may cause a reduction in the strength of the mat body so that it is preferred that the pitch of the slits be determined to a range of 10-25 cm. Here, it is required to determine the pitch of the slits according to the size of the hot water mat.

The thickness of the mat body and the diameter of the hot water pipe are not limited in the present invention. However, the practical dimensions of the two elements are 12 mm as the thickness of the mat body and 10 mm as the diameter of the hot water pipe.

Embodiment 1

An embodiment, in which the present invention is adapted to a hot water mat having no width support bar, will be described in detail hereinbelow with reference to FIG. 1 to FIG. 6. In the drawings, reference numeral 1 denotes the whole of a hot water mat, and reference numeral 2 denotes a plate-shaped mat body that is made by forming using foam resin, in which the width of the mat body 2 is determined as W=2.5 m, and the length of the mat body 2 is determined as L=10 m.

On the surface of the mat body 2, a piping groove 3 having a U-shaped cross-section is formed. The piping groove 3 includes straight groove parts 3a that are formed lengthwise on the mat body 2, and U-shaped turning groove parts 3b that are formed at locations near the opposite ends 2b of the mat body 2 so that the turning groove parts 3b alternately connect the ends of the neighboring straight groove parts 3a to each other.

Further, the piping groove 3 of FIG. 1 is shown as a piping groove for one system. However, the piping groove may be formed so that it is used with two or more systems that are more practically used in the field.

Reference numeral 4 denotes a hot water pipe that is laid in the piping groove 3. In the hot water pipe 4, hot water that has been produced by a heat source (not shown) circulates after being supplied through conduits C, C and a header B, as shown in FIG. 4. Reference numeral 4a denotes straight parts of the hot water pipe 4, and reference numeral 4b denotes U-shaped turning parts of the hot water pipe 4. In FIG. 2 and FIG. 3, reference numeral 6 denotes a heat dissipating sheet that is attached to the mat body 2 so that the heat dissipating sheet can cover the whole of the surface of the mat body 2.

In FIG. 2, reference numeral 5 denotes a heat dissipating tape that is made of a thin aluminum sheet and is attached to each straight part 4a of the hot water pipe 4.

Reference numeral 7 denotes slits that are formed in the lower surface of the mat body 2 in a thickness direction of the mat body 2 so that the slits have a V-shaped cross-section. Here, the slits extend in width directions of the mat body 2 (the directions perpendicular to the straight parts 4a of the hot water pipe 4) in parallel to each other with a pitch of 20 cm, as shown in FIG. 3.

Further, the shape of the slits 7 may be an I-shape as shown in FIG. 6(A), a U-shape as shown in FIG. 6(B) or a shape that cuts the whole of the thickness of the mat body as shown in FIG. 6(C).

Alternatively, as shown in FIG. 6(D), the slits may be formed by the combination of the V-shaped, I-shaped or U-shaped slits 7 and the cut slits 7 of FIG. 6(C).

This combination of the shapes of the slits is caused by the fact that, when it is required to lay the mat bodies on a very long surface, the mat bodies may be formed as one mat body by connecting the mat bodies 2 to each other in the direction of the length. In the above state, the connected junction of the mat bodies 2 forms a slit 7 that cuts the whole of the thickness of the mat body 2.

Unlike an example of the use of the conventional hot water mat in which four mats are laid to cover the floor A of a large-sized room as shown in FIG. 11, the present invention can cover the floor A of the large-sized room by laying two hot water mats side by side on the floor A, as shown in FIG. 4. Of course, a room having a larger-sized floor may require three or more hot water mats.

Further, to roll the hot water mat 1 so as to reduce the size of the mat, the mat 1 can be rolled from an end thereof in a state in which the heat dissipating sheet 6 is directed inward and the slits 7 are directed outward, as shown in FIG. 5. When the hot water mat 1 has been completely rolled, the diameter of the rolled mat 1 becomes 70 cm, and the length of the rolled mat 1 becomes 2.5 m, so that the rolled mat 1 having the above-mentioned dimensions can be easily moved using a conventional elevator and can be easily moved into a room without difficulty.

Embodiment 2

This embodiment 2 provides a hot water mat that is embedded with width support bars, as shown in FIG. 7 to FIG. 9.

The width support bars 10 are inserted into the mat body 2 in parallel to the slits 7.

Further, on the surface of each of the width support bars 10, pipe seat grooves 11 having a U-shaped cross-section are formed so as to seat the hot water pipe 4 therein, as shown in FIG. 9.

Further, in this embodiment, the width support bars 10 are embedded in such a way that one width support bar 10 is placed between neighboring two slits 7. However, it should be understood that the width support bars 10 may be placed by skipping over two or more slits 7.

When the width support bars 10 are installed in the mat body 2, the mat body 2 is divided into pieces by the width support bars 10. However, the pieces of the mat body 2 are
integrated into a single body by the heat dissipating sheet so that the mat body 2 does not remain in the divided state.

Further, to prevent the mat body 2 from being divided into pieces by the width support bars 10, it is preferred that the width support bars 10 are alternately inserted into the mat body 2 from opposite sides of the mat body so that the front ends 12 of the support bars 10 reach respective depths without completely crossing the mat body 2 and, accordingly, the mat body 2 can remain as a continuous body, as shown in FIG. 10.

In FIG. 7 to FIG. 11, the same reference numerals as in the embodiment 1 denote the same elements and further explanation is thus omitted to avoid repetitive explanation.

1. A long folding hot water mat for floor heating, comprising:
   a. a long flat panel-shaped mat body;
   b. a piping groove for a hot water pipe, the piping groove including straight groove parts formed lengthwise on an upper surface of the mat body, and U-shaped turning groove parts alternately connecting ends of neighboring straight groove parts to each other, so that the piping groove forms a zigzag shape;
   c. a hot water pipe laid in the piping groove and dissipating heat using hot water flowing in the hot water pipe;
   d. a heat dissipating sheet attached to the front surface of the mat body having the hot water pipe, thereby integrating the hot water pipe with the mat body into a single body; and
   e. folding slits formed at regular intervals in a lower surface of the mat body in directions perpendicular to straight parts of the hot water pipe.

2. The long folding hot water mat for floor heating as set forth in claim 1, wherein the slits formed in the lower surface of the mat body have a V-shaped, I-shaped or U-shaped cross-section.

3. The long folding hot water mat for floor heating as set forth in claim 1, wherein the slits are formed to reach a predetermined depth into a thickness of the mat body.

4. The long folding hot water mat for floor heating as set forth in claim 1, wherein the slits are formed to a depth that cuts through an entire thickness of the mat body.

5. The long folding hot water mat for floor heating as set forth in claim 1, wherein the slits are formed in one mat body in a manner of a combination of slits that are formed to reach a predetermined depth and slits that are formed to a depth cutting through an entire thickness of the mat body.

6. The long folding hot water mat for floor heating as set forth in claim 1, wherein the mat body is made of a foam body.

7. The long folding hot water mat for floor heating as set forth in claim 1, wherein the heat dissipating sheet attached to the upper surface of the mat body is made of a thin aluminum sheet.

8. The long folding hot water mat for floor heating as set forth in claim 1, wherein the piping groove formed in the mat body and the hot water pipe laid in the piping groove are formed for one system or for plural systems in one mat body.

9. The long folding hot water mat for floor heating as set forth in claim 1, wherein the hot water mat can be rolled from a lengthwise end thereof, with the heat dissipating sheet being placed inward, due to the slits.

10. The long folding hot water mat for floor heating as set forth in claim 1, wherein width support bars are inserted into the mat body at locations between the slits so that the width support bars are in parallel to the slits, the width support bars having a thickness equal to a thickness of the mat body, with pipe seat grooves having a U-shaped cross-section being formed on a surface of each of the width support bars at locations at which the hot water pipe crosses each of the width support bars.

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