

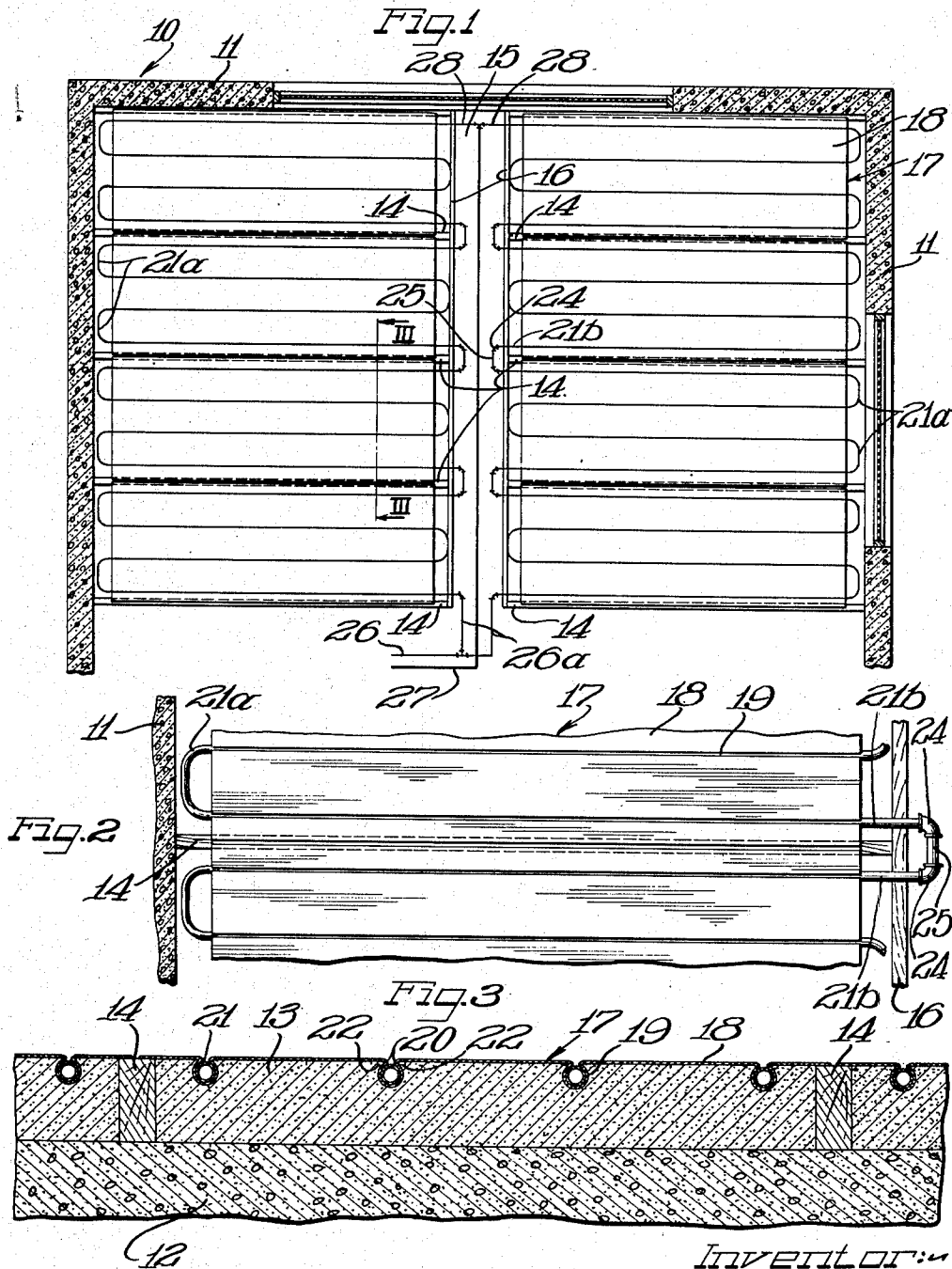
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RADIANT FLOOR HEATING PANEL

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RADIANT FLOOR HEATING PANEL

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1 Claim. (Cl. 257—124)

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This invention relates to a radiant floor heating panel and more particularly to a radiant floor heating panel in the form of a plate and tube-type heat exchanger incorporated in a floor structure to define a sub-floor surface.

Radiant floor heating for residential and similar structures has been proposed in the prior art. Such heating is provided by fluid conduits embedded in a concrete or similar floor structure. Generally, sinuous metallic or ceramic conduits are utilized for the conveying of a heat exchange fluid, usually water or air, in heat transfer relation with the floor.

These prior art structures have been disadvantageous in that extensive site-labor is necessary to custom fit each installation to the structure, resulting in relatively high installation cost. Further, a slow heating response is obtained due to the actual embedding of the conduits within the floor structure with the resultant heating time-lag causing poor control of interior temperatures. In addition to these disadvantages, the finished radiant floor heating structure typically provides a relatively uneven surface which requires special leveling in preparation for the application of conventional floor coverings, such as linoleum, asphalt, tile, or the like.

The present invention provides an improved radiant floor heating panel which utilizes plate and tube-type heat exchangers with the backing plates of the exchangers being superimposed upon the concrete or similar floor structure to provide top surface which is actually composed of the heat exchanger heat radiating surface. The tubes of the heat exchanger are secured to the backing plate by deformation of the plate to provide grooves within which the tubes are bottomed, with the plate being deformed about the tubes into greater than semi-peripheral contact therewith to insure effective heat transfer from the tube to the plate and also to provide a substantially level upper plate surface. The heat exchangers are provided in standardized, prefabricated form so that they may be easily installed by merely coupling a plurality of standardized units together.

It will thus be seen that the present invention constitutes an improvement over the prior art radiant floor heating panel in that the use of standardized, pre-fabricated units provides a flexible, easily installed, readily erected heating system. The heat exchangers are installed on the surface of the sub-floor structure so that useful heat output is increased, heat losses to the ground are decreased, and the time-lag re-

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sponse to temperature demand is improved, and the heat exchangers simultaneously provide not only the heating system but also a level base surface for a superimposed floor covering.

It is, therefore, an important object of the present invention to provide a radiant floor heating panel composed of a plurality of standardized plate and tube-type units carried by a floor base structure.

Another important object of the present invention is to provide a radiant floor heating panel including a sub-floor structure and a plate and tube-type heat exchanger superimposed on the floor structure, with the heat exchanger backing plate forming an upper floor surface.

A further important object of the present invention is to provide a floor heating panel including a solidified floor base structure and a tube and plate-type heat exchanger superimposed on said base structure and partially embedded therein with the heat exchanger backing plate forming a level floor surface overlying the base structure.

Yet another important object of the present invention is to provide a radiant floor heating panel comprising a concrete floor base, a grooved heat exchanger backing plate superimposed on said base to form a level upper surface therefor with the plate grooves being embedded in said base structure, and a sinuous heat exchanger tube bottomed in the grooves for circulating a heat exchange fluid in effective heat exchange relation with the plate.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

On the drawings:

Figure 1 is a plan view, partly in section, illustrating a radiant floor heating panel of the present invention;

Figure 2 is a greatly enlarged view similar to Figure 1; and

Figure 3 is a greatly enlarged sectional view taken along the plane III—III of Figure 1.

As shown on the drawings:

In Figure 1, the reference numeral 10 refers to a building, such as a dwelling or the like, having upstanding side walls 11 formed of suitable material, such as poured concrete or the like. The building 10 is provided with a concrete floor slab (Figure 3), preferably poured in two courses, including a base course 12 and a superimposed fine course 13. The base course may desirably be about four inches thick and formed of ordi-

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nary Portland cement utilizing a gravel or other coarse aggregate, while the finish course 13 is desirably composed of a light-weight aggregate concrete, such as vermiculite concrete consisting of vermiculite aggregate and Portland cement in combination ratio of four to one by volume so as to give good thermal insulation against reverse heat losses (from the interior of the building 10 to the ground) and adequate bearing strength. The finish course is preferably about three inches thick and is cast directly upon the base course, and it will be appreciated that other light-weight aggregates, such as Perlite or the like, may also be utilized in the finish course.

The finish course is preferably laid out in panels which are defined by wooden screed boards 14 which are set on end and retained in upright position by the subsequently solidified finish course 13. It will be noted that the upper level of the finish course 13 corresponds in height to the height of the screed boards 14, so that a substantially constant level sub-floor surface is provided.

The radiant heating panel of the present invention is defined by a plurality of tube and plate-type heat exchangers which are positioned upon and extend transversely between the screed boards 14. More particularly, it will be seen in Figure 1 that a plurality of longitudinally extending screed boards 14 are provided for transverse alignment, the screed boards being longitudinally aligned in pairs so as to leave a central transverse space 15 therebetween. This space is defined by form boards 16 which contact corresponding ends of each set of screed boards, so that the foundation of the building 11 is divided in two longitudinally spaced sets of panels divided by the space 15 which defines a pipe chase.

Plate and tube-type exchangers are positioned within each panel defined by the sets of screed boards and the associated form boards 16. The heat exchangers 17 are best illustrated in Figures 2 and 3 and consist of a backing plate 18 having grooves 19 formed therein to extend in parallel spaced relation across the width of each plate. The plate 18 is deformed, as at 20, in the upper portions of each of the grooves 19 to overlie an intermediate diameter of a tube 21 associated with the plate and bottomed in the grooves 19. The tube 21 has straight portions lying within the grooves 19 and curved joining portions 21a projecting beyond the plate to joint adjacent straight portions, thereby defining a continuous sinuous tube length. It will thus be seen that the deformed portions 20 of the plate 18 overlie the tubes so as to securely clamp the tubes to the plate in intimate, elongated surface contact and in effective heat transfer relation. The groove deformed portions 20 define undercuts 21 which extend along the entire length of each straight tube length, while the upper surface of the plate 18 is substantially plain with the exception of the space between the plate deformed portions 20 directly overlying the tube.

In forming the radiant heating panel of the present invention, the plate 18 of each exchanger 17 is positioned to overlie the sub-floor structure with its lateral margins bearing upon adjacent screed boards 14 to support the plate along the length. It will be seen that the grooves 19 and tubes 21 carried thereby project downwardly into upper course 13 of the sub-floor and the heat exchangers are so positioned while the upper course is still fluid, or at least capable of flowing. Following the positioning of the heat exchanger

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17, as hereinbefore described, the heat exchangers are lightly tamped and pressed to form a level surface with the plate grooves and tubes becoming embedded within the upper regions of the upper course 13. The fluid material of the upper course will enter the undercut area 22 so that, when the whole assembly is permitted to stand until the concrete is hard, the heat exchanger will be firmly bonded in the position illustrated in Figure 3.

To complete the assembly of the radiant heating panel, adjacent heat exchange panels are joined by suitable piping as particularly illustrated in Figure 2, wherein it will be seen that the straight terminal ends 21b of adjacent heat exchangers 17 are joined by means of elbows 24 and transverse joining piping 25. The straight ends 21b of the tubes 21 project outwardly to overlie the form boards 16, or alternatively, the form boards 16 may be recessed to accommodate the tubing ends. Inasmuch as a complete panel is provided on each side of the pipe chase 15, a header pipe 26 connected to a source of heated fluid, such as a steam boiler, or the like, is connected to lead piping 26a for each panel through suitable plumbing which need not be described in detail. A return line 27 to the source of heated fluid is connected with the outlet ends 28 of the heat exchangers in each panel, so that return flow of heat exchange fluid to the primary heat exchanger may be accomplished. Preferably, the point where the terminal ends 28 join the return line 27 is the low point of the installation, so that at least some measure of gravity flow of heat exchange fluid is obtained.

It will be seen that the present invention thus provides an improved radiant floor heating panel having the advantages hereinbefore set forth. First, the heating panel is composed of standardized, pre-fabricated elements which are capable of flexible utilization and cheap installation. Secondly, the heat exchangers are installed upon the surface of the sub-floor or concrete slab rather than being completely embedded in or buried under the slab so as to increase the useful heat output, to decrease reverse heat losses to the ground, and to reduce the time lag response to temperature demands of the building. Thirdly, the heat exchanger not only provides a heat exchange surface overlying the sub-floor, but also actually provides the finished sub-floor surface to which suitable floor covering, such as linoleum, asphalt tile, or the like, may be directly applied. In addition, the heat exchanger plate 18 provides an extended radiation surface which underlies the complete floor covering area, giving an even heat without temperature variation to any material extent across the complete dimensions of the panel. The resulting even temperatures, which may be obtained, the improved heat output, and quick response to heating demands will be readily appreciated by those skilled in the art.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

A radiant floor heating structure comprising a two-course concrete floor slab including a base course of coarse aggregate and a finish course of a light-weight aggregate concrete, a plurality of rectilinearly arranged partition members defining generally rectangular floor sections embedded in said top course, plate and tube type

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heat exchangers each including a backing plate having plane edge portions in contact with and supported by said partition members and extending in flush surface relationship with the adjacent heat exchangers to provide a level upper surface for said floor structure, said backing plates having spaced, parallel grooves formed therein, and heat exchanger tubing seated in said grooves and adapted for the flow of heat exchange fluid therethrough, the walls defining said plate grooves overlying the tubing disposed therein to engage more than a semi-periphery of said tubing and to provide re-entrant groove portions on the under surface of said plate into which the

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material of said upper course extends to anchor said heat exchangers thereto.

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