An insulation element and a structural system including such an element, wherein the insulation element includes: pedestals, the top surface of which is suitable for bearing a floor panel to be placed on top of the pedestals; and a substantially continuous surface between the pedestals. The continuous surface and the pedestals are fabricated in one piece in the same process from at least one heat insulating material. The mutual layout of the pedestals and the continuous surface is implemented in such a way that onto the substantially continuous surface, through spaces between the pedestals, at least on top of the substantially continuous surface can be pulled installation cables and, in addition, possibly also installation hoses or tubes across the support foundation.
INSULATION ELEMENT AND A SYSTEM COMPRISING THE INSULATION ELEMENT

FIELD OF THE INVENTION

[0001] The invention relates to the field of construction and space utilization engineering and to insulation elements, such as insulation boards used therein, as well as to wall and floor systems and the like comprising the same, for example to raised floor systems.

PRIOR ART

[0002] An interior panel unit useful for floor installations is known from the U.S. Pat. No. 5,184,438. A readjustable floor system is known from the U.S. Pat. No. 4,852,315. A support module system for use in floor structures is known from the published international patent application WO 99/64914.

[0003] The Inventor’s earlier inventions include a protective structure, which has been described in the published international patent application WO 98/17357, and a joint arrangement for use in connection with protecting plates, which has been described in the published international patent application WO 98/46830.

[0004] The European patent application EP 0 488 312 A1 describes a system floor, which is applicable to installing for example cables for use in office automation and which has its base constructed on a base sheet of synthetic resin by pouring concrete in corner props at the base sheet corners, and in a central prop in the middle of the base sheet. After the concrete has hardened, the base sheet is turned upside down. The corner props filled with concrete and the central prop filled with concrete take up the weight of a floor to be laid on top of the base sheet.

[0005] The published Japanese patent application 03-107058 describes a floor base, consisting of steel strips or strips of synthetic resin in a side-by-side arrangement. The resulting grid has its crossover points fitted with columns of fixed height. As an option for the use of steel strips or synthetic resin, the floor base can be implemented by means of a perforated plate and columns of fixed height.

[0006] A similar type solution has also been disclosed in the published international patent application WO 99/64694, wherein the injection molded support members of fixed or variable height are interconnected with a grid.

[0007] The solutions set forth in published patent applications EP 0 488 312 A1, JP 03-107058 and WO 99/64694 are not highly suitable for use in cold conditions as the raised floor is likely to feel cold, particularly in the winter.

SUMMARY

[0008] An object of the invention is to provide a versatile and easy-to-use insulation board, which would enable i.a. a thermo-economically sensible raised floor or the like to be assembled quickly and conveniently, even for just a temporary service, such as for the duration of concerts or the like on top of a lawn or the ice in an ice hockey arena, but also for a longer-term service as a structural building element.

[0009] It is possible to achieve this object by means of an insulation element, such as an insulation board, according to claim 1.

[0010] The insulation element according to the invention is characterized by what is presented in claim 1. In addition, the floor system according to the invention is characterized by what is presented in claim 13.

BRIEF DESCRIPTION OF THE INVENTION

[0011] According to one embodiment, the insulation element has its first surface comprising pedestals with a top surface appropriate for supporting a floor panel to be laid on top of the pedestals. In addition, the insulation board comprises a substantially continuous surface present between the pedestals. Still further, according to one example, the insulation board comprises pedestals also on a second surface opposite to the first surface, the pedestals of said second surface being adapted to raise a bottom edge of the insulation board’s continuous surface higher up than what is an installation level for the insulation element. One of the benefits of this is e.g. that between the surface and the installation level is left a space for example for ventilation and demoisturization, and/ or for additional insulation. According to one embodiment, a narrow gap is in some cases particularly beneficial from the standpoint of ventilation, while a larger gap is convenient in terms of additional insulation.

[0012] The continuous surface and pedestals are fabricated in one piece with a single process from at least one heat insulating material. The pedestals and the substantially continuous surface have such a mutual layout that between the pedestals onto the substantially continuous surface across the insulation board can be laid installation cables and, in addition, possibly also installation hoses or tubes.

[0013] The floor system or the like, such as a raised floor system, contains several insulation boards as claimed above (functioning essentially as support foundations), which are linked to each other and on top of which is laid at least one panel type component for establishing a raised floor.

[0014] The dependent claims are directed to preferred support foundation and raised floor embodiments.

ADVANTAGES OF THE INVENTION

[0015] Jointly with the substantially continuous surface, the pedestals of an insulation board make up a substantially closed surface. By virtue of the substantially closed surface, the insulation board turns out to be a structure with its heat insulation improved with respect to floor support foundations disclosed in published patent publications EP 0 488 312 A1, JP 03-107058 and WO 99/64694.

[0016] The insulation board’s pedestals and the closed surface established by the substantially continuous surface and the at least one panel type component attachable to the insulation board make up therebetween a substantially closed air space, which on the one hand increases heat insulation in and of itself, but which on the other hand can be used as an installation space for a possibly required additional heat insulator. The space left between the pedestals also enables ventilation of a resulting interspace to be provided effectively, thus achieving the removal of moisture coming for example from a concrete floor or the like and thereby the prevention of moisture and mold damage. The ventilation can also be used for ventilating radon emitted from the ground.

[0017] The pedestals offer also a distinct advantage in temporary solutions, such as for construction systems built for example in connection with concerts, wherein the pedestals provide a sufficient space between a floor structure to be constructed and for example a grass lawn, whereby the lawn does not become trampled except at pedestals at the most, and hence shall not be ruined. In addition, when constructing e.g. on the ice of an ice hockey venue, the pedestals keep the insulation board off the ice surface, whereby the insulation
board surface does not freeze into attachment with the ice (pedestals with a small surface area disengage from the ice surface considerably more easily than a surface the size of an entire board). Furthermore, a space, which is established by means of pedestals and left between a board and an installation surface, enables, as pointed out elsewhere in this document, tubes and wires and the like to be laid inconspicuously and in safety between the floor and the installation surface.

According to one aspect, the mounting element is or comprises a groove, which is present on top or extends onto the top of a pedestal, and which extends from at least two edges of a pedestal to its interior, and which makes up at least one channel. This makes it possible to secure the insulation boards or support foundations more easily to each other.

According to one aspect, the mounting element comprises at least one lateral form-limited retaining element, especially a dovetail joint and/or a matching part thereof. Hence, this provides an ability to carry out the interlinking of support foundations in a simple manner.

According to one aspect, the mounting element is or comprises at least one groove or channel for the laying of an installation cable, hose or tube. This facilitates finding the installation cable, hose or tube in a fully installed floor, since the location of pedestals is much easier to find in a fully installed floor.

A raised floor system according to one aspect of the invention, implemented by using an insulation board of the invention, is constructible as a warm floor more easily in comparison with the solutions disclosed in published patent applications EP 0 488 312 A1, JP 03-107058 and WO 99/64694. A primary reason for this is that the substantially closed air space and a possibly employed additional heat insulator make up effective thermal insulation. On the other hand, because not only the substantially continuous surface is but also the pedestals are constructed from at least one heat insulating material, the sensation of draft resulting from a cold floor can be eliminated more easily with the use of a raised floor as the insulation board type support foundation is also in itself a poor conductor of heat. The raised floor can be laid directly on top of a basic cast concrete slab or elements of a building without requiring additional insulation or surface layers. The raised floor constitutes at the same time an installation flooring. This represents a major saving in construction costs.

Being fabricated in a single piece, the insulation board holds together and most of all the distance between pedestals remains constant. In addition to this aspect, it is even more important that, by virtue of a single-piece fabrication practice, the insulation board is better in terms of remaining heat-proof. If the substantially continuous surface and the pedestals were to be constructed from different materials, it would be difficult in changing temperature conditions to obviate the deterioration of heat tightness resulting from dissimilar thermal expansion behaviors thereof.

When the insulation board’s pedestals are adapted at the bottom edge thereof to terminate in a bottom edge of the continuous surface, enabling the construction of a support foundation such that it is installable in a form-fitting manner on its installation base, for example on a concrete or other raw floor, hence enabling to restrict more effectively the access of cold air under the insulation board without any excessive cold space developing under the insulation board.

When the pedestals are adapted to raise a bottom edge of the continuous surface higher than what is the insulation board installation level, it will be possible to reduce the conduction of heat from the insulation board to its installation base or vice versa. This improves outdoor service options for the insulation board, and for example its service as an ice arena cover panel.

When at least some of the pedestals include or make up at least one mounting element, the result is an increased versatility of the support foundation.

According to one aspect, the mounting element is or comprises an attachment hole or thread present on top of a pedestal for an insert attachment, especially for a bolt or screw attachment, or an insert, particularly an attachment bolt or screw, present on top of the pedestal. This provides a possibility of securing the insulation boards more easily to each other. In addition to or instead of this, it may be possible to more easily attach a floor to the insulation boards, said floor being intended to overlie the insulation board.
be picked up from the stock by means of the forks of a forklift, it is by using the insulation boards transportable in a relatively small space that the assembleable raised floor can be assembled in a mechanized fashion. Hence, it becomes easier to cover large spaces, for example ice hockey arena floors, for temporary service.

When in a floor system or the like at least some of the insulation boards are fixed to each other by using a bolt or screw attachment of an attachment hole or thread in side-by-side and/or corner-to-corner insulation boards, and/or by using an attachment bolt or attachment bolts or screws, a capability is provided of interlocking the insulation boards relative to each other in a simple fashion.

When in a floor system or the like, such as in a raised floor system, at least some of the insulation boards are fixed to each other by using a retaining element set in a channel of side-by-side and/or corner-to-corner insulation boards, such that the panel type component prevents a removal of the retaining element from an installed floor system or the like, a capability is provided of better avoiding an inadvertent removal of the retaining element from the installed floor or the like.

When in a floor system at least some of the insulation boards are fixed to each other by means of at least one laterally form-limited retaining element, a capability is provided of carrying out the attachment of insulation boards without removable retaining elements. The elimination of removable retaining elements is particularly advantageous in such floors or the like, which are intended to be transportable from place to place, because the removable elements could disappear during disassembly or transport. In addition, the presently described retaining elements expedite assembly and disassembly considerably for example in solutions intended for temporary service.

When, in at least some of the insulation boards in a floor system, the mounting element is or comprises a groove or slot on at least one wall of at least one pedestal for retaining the edge of a floor panel, and when at least some of such insulation boards are fixed by a panel type component relative to each other to become immovably stationary, a capability is provided of implementing a floor system or the like without removable retaining elements or with fewer removable retaining elements.

Still furthermore, the insulation board may comprise, in at least one of its edge zones, a feature for establishing a firebreak in the process of attaching insulation boards to each other, wherein the feature comprises a substantially incombustible material, such as metal, concrete or stone, and/or a fire retarding material different from the insulation board material in terms of its fire characteristics. The firebreak may comprise for example a fireproofed penetration. Most preferably, the firebreak has a height equal to that of the insulation board.

**DESCRIPTION OF THE FIGURES**

In the next section, preferred exemplary embodiments of the invention will be discussed in slightly more detail with reference to the accompanying figures, in which

**FIG. 1** shows one insulation board and an insert to be included in a pedestal of the insulation board, according to one preferred embodiment of the invention;

**FIG. 2** shows one possible design for an insulation board pedestal, and an insert in a more close-up view, according to one preferred embodiment of the invention;

**FIG. 3** shows one friction increasing or decreasing tablet to be included in an insulation board pedestal, according to one preferred embodiment of the invention;

**FIG. 4** shows one insulation board embodiment, wherein below a substantially continuous surface is left an air space according to one preferred embodiment of the invention;

**FIGS. 5, 6 and 10** show one way of attaching insulation boards to each other and an attachment of a panel type component for the fabrication of a raised floor according to one preferred embodiment of the invention;

**FIGS. 7 and 12** show one way of attaching insulation boards to each other according to one preferred embodiment of the invention;

**FIGS. 8 and 9** show one way of stacking insulation boards according to one preferred embodiment of the invention;

**FIG. 11** shows one way of laying installation cables, hoses and tubes according to one preferred embodiment of the invention;

**FIGS. 13 and 14** show one clamping block for the attachment of insulation boards to each other according to one preferred embodiment of the invention;

**FIGS. 15 and 16** show one way of attaching a panel type component to side-by-side arranged insulation boards according to one preferred embodiment of the invention;

**FIG. 17** shows one way of reinforcing the attachment of support elements by means of bracing elements according to one preferred embodiment of the invention;

**FIG. 18** shows one compartmentalizable insulation board according to one preferred embodiment of the invention;

**FIGS. 19A-19F** show a few pedestal elements according to one preferred embodiment of the invention;

**FIGS. 20A-20D** show a few ventilation arrangements according to one preferred embodiment of the invention; and

**FIGS. 21A-21E** show tongue-and-groove solutions according to one preferred embodiment of the invention.

**DETAILED DESCRIPTION OF THE FIGURES**

**FIG. 1** shows one insulation board of the invention, more specifically an insulation board type support foundation 100 and an insert 102 to be included in a pedestal 103 of the support foundation. A top surface of the pedestals 103 is suitable for bearing a floor panel to be placed on top of the pedestals. Even though it is a support foundation which is subsequently referred to in the context of some examples, it is just one intended use for an insulation board, nor is the insulation board of the invention by any means restricted to that.

Between pedestals, whose width is a and thickness b, is left a substantially continuous surface 101. The continuous surface 101 and the pedestals 103 are fabricated in a single piece with a single process from at least one heat insulating material.

The pedestals and the substantially continuous surface have such a mutual layout that onto the continuous surface 101 through spaces between the pedestals 103 at least substantially on top of the continuous surface 101 across the insulation board can be pulled installation cables and, in addition, possibly also installation hoses or tubes.

In the case of the insulation board 100, the pedestals 103 are adapted at a bottom edge thereof to terminate in a lower edge of the continuous surface 101.
The employed heat insulating material is expanded polypropylene (EPP), expanded polystyrene (EPS), urethane or some other closed- or open-cellularized plastic material. The heat insulating material can also be some modern mineral-based or another natural fiber material.

The pedestals 103 and the substantially continuous surface 101 are integrated with each other. They are made most preferably in the same process and from the same material. Accordingly, a top side surface and a bottom side surface of the pedestals 103 are also of the same material and produced in the same process. This enables a simplification of the fabrication process and to avoid mechanical and thermodynamic problems resulting from separate top and bottom side coating processes. Other elements, integrated with the insulation board and described in this document, such as installation elements and/or clamping elements, are also manufactured according to a preferred embodiment of the invention in the same process.

The insulation board 100 is made most preferably by casting. Preferably, the plausible fabrication methods comprise sintering, rotational casting, injection molding and vacuum forming.

In the fabrication process, the insulation board 100 has also integrated therein matching recesses and apertures required by possible clamping elements.

FIG. 2 shows an optional support foundation 200, which differs from the support foundation 100 of FIG. 1 in the sense that, in addition to the pedestals 103, the support foundation 200 now comprises also pedestals 203.

The pedestal 203 has a groove or slot 210 on its vertical surface. In addition to this, the pedestal 203 comprises grooves 211, 212 on its top surface.

Some of the pedestals 103, 203 are provided with a hole 280 for attachment pins.

All or some of pedestals 103, 203 are provided with a hole 105 for the insert 102. The insert 102 comprises a stem 107, sealing discs 291, 292, 293, 294, and a head 104. The head 104 contains an opening capable of passing a fastening screw or bolt, and the fastening screw or bolt is then engaged for example with a nut runner having a chuck for example for a screwdriver or Allen key engagement.

The substantially continuous surface 101 is most preferably a heat insulating surface of uniform thickness. In order to provide additional insulation, the continuous surface 101 may have its bottom side provided with protrusions or pedestals, which settle against the base and which increase insulating capacity of the structure.

The substantially continuous surface 101 can be configured to include a tongue-and-groove or other edge feature capable of sealing the joints between the support foundations 100, 200. A few examples of tongue-and-groove features are described e.g. in the context of FIGS. 9, 10 and 21. It is also possible to integrate in the substantially continuous surface 101 a pedestal member, which both carries a load to be placed on top of the insulation board 100, 200 and establishes under itself an insulating air space or volume suitable for pulling and laying therein necessary heating, plumbing, ventilating, electrical and other technical lines.

The elevation under the substantially continuous surface 101 can be 0-80 mm, e.g. for a grass lawn. In order to prevent freeze-adherence, there is an underside elevation m (cf. FIG. 4), which in a particularly preferred case is 5 mm. With regard to the pedestals 103, 203, there is an elevation h (cf. FIG. 1) or n (cf. FIG. 4), which is 3-180 mm.

The employed casting mold is preferably provided with an adjustable pedestal element, whereby one and the same mold enables the elevations h and m to be made as selected either in size of 25, 50 or 80 mm.

The top and bottom surface elevations n and m are most preferably substantially equal in height, especially when a growing space has to be left for example for natural grass.

The insulation board, support foundation and/or raised floor system of the invention can be used as a protective panel for various materials.

These can be used for protecting for example hockey arena ice, say in such a situation that the venue is about to be used for hosting some exercise or concert event, in which an ordinary floor (i.e. no ice) is needed. In such a case, melting the ice would be undesirable as remaking the ice takes days while the building and dismantling of a raised floor system only takes hours.

Other possible applications for the using the insulation board, support foundation and/or raised floor system to provide protection for the surface of rock-hust-floored halls, protection for a wood exercise flooring and for artificial and natural grass. With regard to protecting natural grass, the pedestals placed against the turf must be taller for leaving space for the grass.

The size of the insulation board 100, 200 depends on what is possible in terms of fabrication engineering, on what is an optimal size for a panel type component (e.g. a surface panel or structure) used for example in a floor system or the like, and on what is most sensible in terms of assembly engineering.

Generally at the moment, the size of the insulation board 100, 200 may fluctuate within the range of 400×400 mm–1200×1200×2400 mm, and is most preferably 600×600 mm.

FIG. 3 shows an alternative embodiment in the form of an insulation board 300. On a pedestal 303 of the insulation board 300 is placed a tablet 305, the material of which has a friction coefficient different from a material of the pedestal 303. Thus, the table 305 makes a difference in the sense that, at a location of the pedestal 303, the friction coefficient between at least one panel type component and the insulation board 300, which panel type component is to be placed on top of the insulation board 300, is higher or lower than what it would be without using the tablet 305.

In order to fit the tablet 305 on the pedestal 303, and to keep the tablet 305 more firmly immobilized, the pedestal 303 includes recess 304 for fitting the tablet 305 therein.

The insulation board 300 of FIG. 3 is only provided with the pedestals 300. Any of the previously or subsequently described insulation board embodiments may nevertheless include one or more pedestals 303.

FIG. 4 shows an alternative embodiment in the form of an insulation board 400, wherein under the substantially continuous surface 101 is left an air space 444. In this embodiment, the pedestals 103 extend beneath what is a bottom edge of the continuous surface 101.

The air space 444 can be used for example for the laying of installation tubes 42, cables 41 or hoses 43 or as a growing space for grass.

Pedestals 411, 412, 413, 414 at corner locations of the insulation board 400 have, as an installation element, both a top end and a bottom end of the pedestals provided with a groove 211, 212 extending from at least two edges to inside
the end of each pedestal. The grooves 211, 212 make up at each end of the pedestal collectively a channel.

The insulation board 400 of FIG. 4 has such slotted pedestals 411, 412, 413, 414 at the corners only. Any of the previously or subsequently described various insulation board embodiments may nevertheless include one or more such pedestals 411, 412, 413, 414. These may particularly be present in combination with pedestals 203, as displayed e.g. in FIG. 6, such that the insulation board has pedestals 203 in the middle and pedestals 411, 412, 413, 414 at the corners.

FIG. 5 shows a raised floor system 500, which is constructed by attaching to each other insulation boards or support foundations 100 as presented e.g. in FIG. 1, the pedestals 103 at the corners thereof being replaced with pedestals 411, 412, 413, 414. The thus modified insulation boards 100 are first attached to each other. Lastly, at least one panel type component 530 is fixed by way of a hole 531 to the joined insulation boards for making a raised floor system.

The insulation boards are preferably joined with each other on both top and bottom side by using for example a molded article 1400 on top side (cf. FIG. 14) and a molded article 1300 (cf. FIG. 13) on bottom side. The molded article 1300 comprises attachment lugs 511 provided with a hole 516, and bracing arms 512 existing between the attachment lugs 511.

The at least one panel type component 530 (e.g. a surface panel or structure) can be attached e.g. by driving screws 510 in alignment with the attachment lugs 511 of the molded article 1400. At the same time, the molded articles 1300 and 1400 clamp to each other and to those insulation boards, through the pedestals 411, 412, 413, 414 of which the screw 510 passes. Hence, the employed insulation boards are locked to each other by the molded articles 1300, 1400 in a form-limited manner.

As apparent from FIG. 13, it will be sufficient that the lower molded article 1300 be provided with a threaded hole 518. The hole 516 in the upper molded article 1400 can be a larger non-threaded hole for facilitating and expediting installation.

FIG. 6 shows the way of implementing a raised floor 600 with an arrangement other than what is shown in FIG. 5 for attaching insulation boards to each other.

As opposed to the modified support foundations 100 depicted in FIG. 5, the presently employed support foundations differ from that shown in FIG. 5 in the sense that the centrally located pedestals 103 have been replaced with pedestals 203 not necessarily provided with a groove or slot 210, though.

A molded article 632 used in installation comprises a frame with four holes 633. The frame is set in each channel of the pedestal 411, 412, 413, 414, after which at least one panel type component 530 (e.g. surface panel or structure) is fixed by fastening screws 510 through each hole 633 for clamping the support foundations to the molded article 632 and thereby to each other, and at the same to at least one, but preferably to more than one panel type component 530.

In addition to or instead of the molded articles 632, the assembly of a raised floor system can be effected by using installation bars 611, 612 fitted in the grooves 211, 212, respectively, and fixed with a screw 510 to the insert 102 of a pedestal 203. If the screwing is carried out from above a panel type component 530, the attachment of the panel type component 530 is managed to the mounting bar 611, 612 and at the same time also to each other provided that the mounting bar 611, 612 is also fixed respectively to an insulation board next to this insulation board.

The raised floor system 600 can also be constructed further in such a way that insulation boards are joined to each other by using any of the above-described arrangements or combinations thereof. FIG. 7 depicts a case, in which the insulation boards comprise pedestals 103 and pedestals 411, 412, 413, 414 at the corners thereof, and in which the insulation boards are joined to each other with the assistance of molded articles 1300, 1400 and screws 510.

In the insulation boards, between the pedestals 103, 411, 412, 413, 414, can be employed reinforcement bars 501.

FIG. 8 shows a stacking process for insulation boards 800. The insulation boards 800 are similar to those shown e.g. in FIG. 7. The stacking of insulation boards 800 is a simple process by way of dimensioning and spacing the pedestals correctly. The pedestals 103, 411, 412, 413, 414 are in such a configuration that an insulation board 800 is stackable with another corresponding insulation board 800 by turning one of the insulation boards 800 upside down and offsetting this essentially over a distance about equal to the width a or b (cf. FIG. 1) of one pedestal 103, 411, 412, 413, 414, whereby the pedestals 103, 411, 412, 413, 414 become interlaced with each other and support the resulting stack at least against a push or pull in a lateral direction of the stack. Instead of or in addition to the pedestals 103, 411, 412, 413, 414, the insulation board 800 may include any of the pedestals similar to those described above or to be described hereinafter.

The insulation boards 800 are in such a configuration that, within a region between the pedestals 103 (or other pedestals), there is a distance e left between the continuous surfaces 101 of each superimposed insulation board 800, said distance being most preferably dimensioned in view of the distance e enabling an insulation board to be picked from the stack by means of the forks of a forklift. If a distance d=0, the freezing together of support foundations 800 can be impeded during storage and transport in winter conditions, because by virtue of the distance d the possible moisture is capable of evaporating away.

FIG. 9 illustrates a stacking practice similar to that shown in FIG. 8. In this case, however, insulation boards 900 are made by assembling two smaller blocks 1000 (cf. FIG. 10). In principle, the insulation boards 900 can be even more than two blocks 1000, for example an insulation board 1200 shown in FIG. 12 is useful.

According to FIG. 10, the insulation board 900 is made by joining to each other two smaller blocks 1000. The assembled insulation board 900 is more expedient to handle. The attachment is preferably effected by using pedestals 901 which include male attachment means 1002 and pedestals 902 which include female attachment means 1001. For example, the dovetail joint is a highly functional attachment method.

In addition to or instead of this, it is also possible to employ the pedestals 411, 412, 413, 414 and for example one molded article 632 or two molded articles 1300, 1400, which are screwed to the attachment with the blocks 1000.

As described, at least one panel type component 530 is screwed to the attachment with the molded articles 632 (or 1300 and 1400), and at the same time with the insulation boards 900, for providing a support foundation of the invention.
The insulation boards 900 have visible indication showing horizontal male tongues 1050 and horizontal female grooves 1051. By virtue of the male tongues and/or female grooves 1050, 1051 present on the sides of the support foundation 900, these can be overlapped relative to each other for improving acoustic and/or thermal insulation capacity with respect to the case that there would be no overlapping but just a vertical joint between the insulation boards 900. Various tongue-and-groove solutions are further illustrated in FIGS. 21A-21E, which, among other things, reduce the conduction of heat in the vertical direction of an insulation board, thus eliminating direct heat bridges and the like.

According to one example, there are horizontal male tongues 1050 for example on two sides and horizontal female grooves 1051 on the other two sides. Alternatively, every other insulation board 900 can be implemented solely with male tongues 1050 and every other with female grooves 1051 or with some hybrid tongue-and-groove/side relationship as presented particularly in FIGS. 21A-21E.

In addition to or instead of the horizontal male tongues and female grooves 1050, 1051, it is possible to employ some other feasible formation for carrying out the overlap and thereby for eliminating the development of a direct heat bridge.

The presently described overlapping concept is usable in the context of any of the insulation board or support foundation embodiments described above or to be described hereinafter.

FIG. 11 shows the laying of installation cables, tubes and hoses in the midst of a structure established by an insulation board 1100.

The insulation board 1100 has its pedestals 1103 comprising in this case for example grooves 1108 at a top end of the pedestal 1103, which can be used for conducting installations, for example for laying installation tubes 42 or hoses 41. The grooves 1108 make up a channel.

The pedestal 1103 is topped with protective parts 1104, 1105, 1106 and 1107 for protecting the installation tube 42 or hose 43 or cable 41 present in the channel.

The pedestals 1103 can be used for attaching the insulation boards 1100 to each other by means of a suitable clamping block.

FIG. 12 shows a support foundation 1200, which differs from the block 1000 shown in FIG. 10 in the sense that the support foundation 1200 has its corners provided with pedestals 1201 having joining features on two sides. In addition to this, the insulation board 1200 has pedestals 901, 902 on every side.

FIG. 15 illustrates the attachment of a panel type component 1530 to side-by-side arranged insulation boards. The panel type component 1530 has its edge 1531 bended to fit in a groove or slot 1503. This is the way of constructing for example a raised floor 1500, but a similar analogy is also suitable for some other structure, such as for example a wall, a bulkhead, a ceiling or the like system.

FIG. 16 shows an attachment practice, wherein the component 1530 has its edge 1531 bended to fit in a groove or slot 210.

FIG. 17 visualizes the attachment of insulation boards by means of bracing features, such as bars. Bars 1710, 1701 can be used for the reinforcement of insulation boards. The bars 1710, 1701 are most preferably fixed with screws 510 by fastening the same to an insert or simply just into a hole 105 present in the insulation board. Preferably, the hole 105 is in this case located in the groove 211, 212 for the bar 1701, 1710 not to rise up from the plane of an insulation board.

According to one example, the insulation board may comprise also such a bracing feature 1710, 1701, functioning as a mounting element which facilitates fitting an insulation board, or a system made up thereof, with various features and equipment such as partitions, doors, electrical and lighting solutions, HVAC devices and features, as well as other fixtures. The mounting element can be for example a molded structure, a casting or a profile, and it can be in abutment with the molded structures of an insulation board and/or with the insulation board, or it can be fixed in the inserts or holes present in the insulation board. Alternatively, it can also be fixed through an insulation board to a material present under the insulation board. By bracing a mounting element to an insulation board, there are achieved advantages in terms of heat and sound engineering, because the insulation board interrupts the propagation of heat and sound effectively.

According to one example, the mounting element can also be used for connecting or extending thereby for example wires and tubes (electricity, HVAC) and/or other required wiring systems for control and adjustment engineering. In addition, the mounting element can also be used for straightening and/or adjusting the structures related thereto, such as the above-described features and/or equipment, to a specific angle, for example to a straight upright position. The mounting element can also be used for enabling various heating, safety, electrical, adjustment and lighting features to be installed so as not to be in attachment with the cover panel of an insulation board, a system, such as a floor or wall system made up of several of such boards, thereby providing the cover panels with a capability of being easily opened and replaced. The mounting element can also be earthed, whereby an instrument associated therewith becomes readily and reliably earthed by way of the mounting element.

The insulation boards and/or support foundations according to various foregoing embodiments can be connected to each other in a separable manner, such that the resulting combined insulation boards and/or support foundations can be handled more expeditiously. For example, 4 pieces of 600x600 mm insulation boards (or blocks) can be connected to each other for obtaining a single insulation board 1200x1200 mm in size.

One application, visible even in the drawings, for an ice covering panel is made from two 600x1200 mm blocks, which are connected removably to each other with a dovetail joint and locking pins. This results in a support foundation 1200x1200 mm in size.

The attachment of insulation boards to each other can be effected by using also clamping features other than the presently discussed pin locking or the locking by means of one or two molded articles. The attachment can be effected by using various latches, rods or wedges. The bracing elements can also be secured directly to their base.

The utilization of various locking elements and clamping systems therebetween can be applied also for securing insulation boards to each other and more firmly to the base.

The shape of insulation boards can be almost anything. The shape of pedestals can be for example quadrangular, circular or elliptical. The number of pedestals per support
The foundation is 4-400 pieces. The inventor’s first constructed insulation board has 16 pedestals to an insulation board 600×600 mm in size.

The insulation boards and be connected to each other by using various dovetail or the like formations, which are integrated with insulation boards. Thus, the attachment of insulation boards to each other can be effected without separate connecting elements.

Insulation boards can also be utilized in the construction of internal and external walls and even ceilings and roofs.

FIG. 18 shows an insulation board 1800 used for the construction of a raised floor system. In the exemplary embodiment of FIG. 18, the pedestals are depicted in the form of pedestals 203, but the pedestals can be implemented by using any of the above-described pedestals (or combinations thereof) jointly with the substantially continuous surface 101.

The insulation board 1800 has inter-pedestal partitions 1801, 1802, which enable a compartmentalization of the insulation board. Some partitions 1801, 1802 or parts thereof are removed or added for carrying out electrical, data or most generally for example HVAC cabling procedures in a compartmentalized manner. Thus, in the event of a possible (for example water) leak, the spill is controllably contained in its own compartment or does not have access to another (for example electrical) compartment.

By removing or adding partitions 1801, 1802, on the insulation board 1800 can be established at least one chute or channel 1804 and, jointly with a panel type component 530, 1530, at least one closed compartment 1803. Thus, the support foundation 1800 lends itself to constructing any of the above-described raised floor systems in a compartmentalized, chute and/or channelled configuration.

FIGS. 19A-19F illustrate a few pedestal elements 1900A-C according to one preferred embodiment of the invention, wherein the pedestal element 1900A-C can be for example part of a mounting element, a clamping element or some other component of an insulation board discussed in this document. The pedestal element may comprise for example threaded legs 1901 or other threaded elements 1902 even connectable with each other, whereby it is by means of the thread that an insulation medium of the insulation board and a surface, such as a floor or the like to be possibly located therewith, can be set at a specific angle by turning the threaded element. It should be noted that the pedestal element 1900A may comprise for example several threaded elements 1901, 1902, whereby even the angle of a pedestal element can be adjusted by means of the elements 1901, 1902. On the other hand, the pedestal element 1900B can also be in such a configuration that the threaded element or elements jointly 1901, 1902 are only in connection therewith at one point, whereby an individual pedestal element 1900B can only be adjusted in up-and-down direction, but its angle is not adjustable.

The pedestal elements 1900C can also be implemented by means of plate-like elements 1903, whereby the adjustment for the elevation of insulation boards is carried out by the addition or removal of the pedestal element’s 1900C plates 1903 or adjustment posts 1904 therebetween.

FIGS. 20A-D illustrate a few ventilation arrangements 2000 according to one preferred embodiment of the invention, wherein at least some of the insulation boards or blocks comprise elements 2001, 2002, 2003, 2004 for ventilating a space left between pedestals disposed at least on one side of the insulation board. The ventilation element can be for example a fan 2001b, either a blower or an exhauster, included in the cover solution 2003 of some insulation board and most preferably adapted to circulate air within channel systems left between the pedestals. The system consisting of insulation boards, for example the floor system, may preferably comprise make-up air elements 2001a in at least one second insulation board, from which the make-up air is either exhausted (in case the ventilation element 2001a is an exhauster) or by way of which the air to be circulated is removed from the channel system (in case the ventilation element 2001a is a blower).

According to one example, a ventilation element 2002 can be mounted not on a cover solution but on an end 2004 of the insulation board (FIG. 203), in case this is more beneficial for example from the standpoint of space efficiency and functionality.

It should be noted that, according to some examples, the pedestals for insulation boards can be designed in such a way that the airflow produced by ventilation elements can be guided effectively along channel systems established in a space between pedestals. Alternatively or in addition to these, the insulation board can be formed for example as early as in its fabrication process with deflector elements for guiding in a desired manner the airflow produced by ventilation elements.

According to one example, the ventilation element may also be just a hole, a grating 2003, 2004, a valve or the like, or a combination of these and a mechanized solution (blowing/exhausting), which enable sufficient and appropriate ventilation to be provided for example for the elimination of moisture and/or radon or the like.

FIGS. 21A-21E illustrate some tongue-and-groove solutions 2100 according to one preferred embodiment of the invention, which have been discussed even earlier in this document. An objective of the tongue-and-groove solution is both to align individual insulation boards more precisely with each other when being assembled together and at the same time to improve heat insulation particularly in a direction perpendicular to the insulation board by eliminating the formation of direct heat bridges. The tongue-and-groove solution consists most preferably of male tongues and female grooves, which can be arranged for example on alternating sides of the insulation board or by providing two adjoining edges with male tongues and the other two edges with female grooves. FIGS. 21D and 21E show various tongue-and-groove solutions for the insulation board in a view from above.

The invention is not to be construed as being limited solely to the appended claims, but it must be conceived as covering all legal equivalents thereof. The foregoing description only discloses a few embodiments for a solution of the invention. The principle as set forth in the invention can naturally be varied within the scope of protection defined by the claims, regarding for example implementation details as well as fields of use. It is particularly notable that one application for insulation blocks is a support foundation, wherein on top of the insulation board is placed a panel type component for providing for example a floor system and particularly a raised floor system. It should be noted, however, that the presently described insulation block can be used in other purposes as well, such as for example wall, bulkhead and ceiling systems either as a permanent part of a larger construction assembly or as temporary solution. It should further
be noted that, according to one embodiment of the invention, the presently described insulation boards can also be fabricated in various shapes and sizes as determined for example by dimensions obtained in advance from a space to be constructed, whereby the construction of various floor, wall or the like systems from insulation elements of the invention is particularly expedient and effortless. According to one example, some of the insulation elements can have, as early as in the fabrication process, integrated therewith appropriate mounting elements and penetrations for example for electrical lines or other wiring systems or bracing features as described hereinbefore.

Reference numerals used in the drawings:

- 0131 41 installation cable
- 0132 42 installation tube
- 0133 43 installation hose
- 0134 100 support foundation
- 0135 101 substantially continuous surface
- 0137 102 insert
- 0138 103 pedestal
- 0139 104 head
- 0140 105 hole
- 0141 106 stem
- 0142 200 support foundation
- 0143 203 pedestal
- 0144 210 groove or slot
- 0145 211 groove
- 0146 212 groove
- 0147 280 hole
- 0148 291 sealing disc
- 0149 292 sealing disc
- 0150 293 sealing disc
- 0151 294 sealing disc
- 0152 300 support foundation
- 0153 302 pedestal
- 0154 304 recess
- 0155 305 tablet
- 0156 400 support foundation
- 0157 411 pedestal
- 0158 412 pedestal
- 0159 413 pedestal
- 0160 414 pedestal
- 0161 444 air space
- 0162 500 raised floor system
- 0163 510 edge
- 0164 512 bracing arm
- 0165 516 hole
- 0166 518 threaded hole
- 0167 530 panel type component
- 0168 531 hole
- 0169 600 raised floor
- 0170 611 mounting bar
- 0171 612 mounting bar
- 0172 632 molded article
- 0173 633 hole
- 0174 900 support foundation
- 0175 901 pedestal
- 0176 902 pedestal
- 0177 1000 block
- 0178 1001 female attachment element
- 0179 1002 male attachment element
- 0180 1050 horizontal male tongue
- 0181 1051 horizontal female groove
- 0182 1100 support foundation
- 0183 1103 pedestal
- 0184 1108 groove
- 0185 1104 protective part
- 0186 1105 protective part
- 0187 1106 protective part
- 0188 1107 protective part
- 0189 1200 support foundation
- 0190 1201 pedestal
- 0191 1300 molded article
- 0192 1400 molded article
- 0193 1530 panel type article
- 0194 1531 bended edge
- 0195 1503 groove or slot
- 0196 1500 pedestal
- 0197 1701 bar
- 0198 1710 bar
- 0199 1800 support foundation
- 0200 1801, 1802 partitions
- 0201 1803 closed compartment
- 0202 1804 channel
- 0203 1900A-1900C pedestal element
- 0204 1901, 1902 threaded element
- 0205 1903 plate-like element
- 0206 1904 adjustment pin
- 0207 2000 ventilation arrangement
- 0208 20001-2004 ventilation element
- 0209 2100 tongue-and-groove solution

18. An insulation element, such as an insulation board (100, 200, 300, 400, 800, 900, 1000, 1100, 1200, 1500, 1800), said insulation element comprising a substantially continuous surface (101) as well as first and second pedestals associated with the surface, wherein at least some of first pedestals (103, 210, 303, 411, 412, 413, 414, 901, 902, 1103, 1201, 1503) are adapted to emerge from a first surface of said insulation element, the top surface of said pedestals being appropriate for bearing a panel, for example a floor panel (530, 1530) to be placed on top of the pedestals, and at least some of second pedestals (103, 411, 412, 413, 414) are adapted to emerge from said insulation element's second surface opposite to the first surface;

wherein the mutual layout of the pedestals (103, 210, 303, 411, 412, 413, 414, 901, 902, 1103, 1291, 1503) and the continuous surface (101) is implemented in such a way that onto the substantially continuous surface, through spaces between the pedestals (103, 210, 303, 411, 412, 413, 414, 901, 902, 1103, 1291, 1503), at least on a first side of the substantially continuous surface (101) can be pulled installation cables (41) and, in addition, possibly also installation hoses or tubes (42) across the insulation element, the continuous surface (101) and the pedestals (103, 210, 303, 411, 412, 413, 414, 901, 902, 1103, 1291, 1503) are fabricated in one piece in the same process from at least one heat insulating material; and the pedestals (103, 411, 412, 413, 414) are adapted to raise a bottom edge of the continuous surface higher up than what is a mounting level of the insulation element (400).

19. An insulation element (100, 200, 300, 400, 800, 900, 1000, 1100, 1200, 1500, 1800) of claim 18, wherein at least some of the pedestals (103, 210, 303, 411, 412, 413, 414, 901, 902, 1103, 1291, 1503) are adapted to raise a bottom edge of the continuous surface higher up than what is a mounting level of the insulation element (400).
comprise or make up at least one mounting element (102, 104, 105, 107, 211, 212, 305, 1001, 1002, 1108, 1503, 1504, 1701), wherein the mounting element is or comprises an attachment hole (105) or threading on top of a pedestal for an insert attachment, especially a bolt or screw attachment, or an insert (102), especially an attachment bolt or screw, on top of a pedestal, and/or wherein the mounting element is or comprises a groove (211, 212) or a channel (1108).

20. An insulation element of claim 18, wherein the insulation element, most preferably its edge or mounting element, comprises at least one laterally form-limited retaining element (1001, 1002), especially a dovetail joint and/or a matching part thereof, or wherein the insulation element, its edge and/or mounting element, comprises in its edge zone a tongue-and-groove, for example a male tongue or a female groove, substantially co-directional with the insulation element’s edge.

21. An insulation element of claim 19, wherein the mounting element is or comprises a groove or slot (1504) on at least one wall of at least one pedestal (103) for retaining an edge (1531) of the panel (1530) to be placed on top of the pedestals.

22. An insulation element of claim 18, wherein the insulation element comprises or especially the insulation element’s mounting element is or comprises at least one tablet type element (305) for changing the friction coefficient of a pedestal surface with respect to the friction coefficient of the pedestal’s own surface, such that the static friction of a panel type block (530, 1530) either decreases or increases.

23. An insulation element (800, 900) of claim 18, which has its pedestals (103) in such a configuration that the insulation element is stackable with another similar insulation element by turning one of the support foundations upside down and by offsetting this substantially across a distance substantially about equal to a width (a, b) of one pedestal (103), whereby the pedestals (103) become interlaced with each other and support the resulting stack against a push or pull applied at least in a lateral direction of the stack.

24. An insulation element of claim 18, wherein the insulation element is adapted, jointly with ventilation elements arranged in connection therewith, to generate an airflow into a space defined by said second pedestals and the continuous surface for ventilating said resulting space.

25. An insulation element of claim 19, wherein the mounting element is adapted, by way of said mounting panel, to mount on said insulation element features, such as partitions, doors, electrical and lighting solutions, HVAC equipment, structures and fixtures, which are separate from the insulation element.

26. An insulation element of claim 18, wherein the insulation element comprises at least in one of its edge zones a feature for providing a firebreak in the process of assembling the insulation elements, wherein the feature comprises a substantially incombustible material, such as metal, concrete or stone, and/or a fire retarding material different from the insulation element’s material in terms of its fire characteristics.

27. An insulation element of claim 18, wherein the insulation element comprises at least one ventilation element, the ventilation element being a blower, an exhauster, a valve, an opening and/or a channel comprising at least one of the above.

28. An insulation element of claim 18, wherein the insulation element comprises at least on one of its sides a firebreak, the firebreak comprising a substantially incombustible material, such as metal, concrete or stone, and/or a fire retarding material different from the insulation element’s material in terms of its fire characteristics.

29. A structural system, such as a floor or wall system, which comprises a plurality of insulation elements (100, 200, 300, 400, 800, 900, 1000, 1100, 1200, 1500, 1800), such as an insulation board (100, 200, 300, 400, 800, 900, 1000, 1100, 1200, 1500, 1800), wherein said insulation element comprising a substantially continuous surface (101) as well as first and second pedestals associated with the surface, wherein at least some of first pedestals (103, 210, 303, 411, 412, 413, 414, 901, 902, 1103, 1291, 1503) are adapted to emerge from a first surface of said insulation element, the top surface of said pedestals being appropriate for bearing a panel, for example a floor panel (530, 1530) to be placed on top of the pedestals; and at least some of second pedestals (103, 411, 412, 413, 414) are adapted to emerge from said insulation element’s second surface opposite to the first surface; wherein the mutual layout of the pedestals (103, 210, 303, 411, 412, 413, 414, 901, 902, 1103, 1291, 1503) and the continuous surface (101) is implemented in such a way that onto the substantially continuous surface, through spaces between the pedestals (103, 210, 303, 411, 412, 413, 414, 901, 902, 1103, 1291, 1503), at least on a first side of the substantially continuous surface (101) can be pulled installation cables (41) and, in addition, possibly also installation hoses or tubes (42) across the insulation element, the continuous surface (101) and the pedestals (103, 210, 303, 411, 412, 413, 414, 901, 902, 1103, 1291, 1503) are fabricated in one piece in the same process from at least one heat insulating material; and the pedestals (103, 411, 412, 413, 414) are adapted to raise a bottom edge of the continuous surface higher than what is a mounting level of the insulation element (400), wherein said insulation elements are joined to each other and on top of which is mounted at least one panel type component (530, 1530) for constructing a floor or a wall.

30. A system as set forth in claim 29, wherein at least some of the pedestals (103, 210, 303, 411, 412, 413, 414, 901, 902, 1103, 1291) comprise or make up at least one mounting element (102, 104, 105, 107, 211, 212, 305, 1001, 1002, 1108, 1503, 1504, 1701), and wherein the mounting element is or comprises an attachment hole (105) or threading on top of a pedestal for an insert attachment, especially a bolt or screw attachment, or an insert (102), especially an attachment bolt or screw, on top of a pedestal, and/or wherein the mounting element is or comprises a groove (211, 212) or a channel (1108), and wherein insulation elements are attached to each other with the following features of side-by-side and/or corner-to-corner insulation elements: by using a bolt or screw attachment in an attachment hole (105) and/or by using an attachment bolt (107) or attachment bolts (107) or screws, and/or by using a retaining element (632, 1300, 1400) set in a channel (1108), such that the panel type component (530, 1530) prevents a removal of the retaining element (632, 1300, 1400) from the installed floor system.
31. A system of claim 29, wherein at least some of the insulation element, most preferably its edge or mounting element, comprises at least one laterally form-limited retaining element (1001, 1002), especially a dovetail joint and/or a matching part therefor, or wherein the insulation element, its edge and/or mounting element, comprises in its edge zone a tongue-and-groove, for example a male tongue or a female groove, substantially co-directional with the insulation element’s edge, and wherein said insulation elements are attached to each other by means of at least one laterally form-limited retaining element (1001, 1002).

32. A system of claim 29, wherein at least some of the insulation elements comprises the mounting element, which is or comprises a groove or slot (1504) on at least one wall of at least one pedestal (103) for retaining an edge (1531) of the panel (1530) to be placed on top of the pedestals, and wherein insulation elements are immobilized relative to each other by means of the panel type component (530, 1530).

33. A system of claim 29, wherein the system comprises at least one elevation adjustment element associated with the insulation element for adjusting a position or angle of the insulation element.

34. An insulation element of claim 19, wherein the insulation element, most preferably its edge or mounting element, comprises at least one laterally form-limited retaining element (1001, 1002), especially a dovetail joint and/or a matching part therefor, or wherein the insulation element, its edge and/or mounting element, comprises in its edge zone a tongue-and-groove, for example a male tongue or a female groove, substantially co-directional with the insulation element’s edge.

35. An insulation element of claim 20, wherein the mounting element is or comprises a groove or slot (1504) on at least one wall of at least one pedestal (103) for retaining an edge (1531) of the panel (1530) to be placed on top of the pedestals.

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