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(54) Smoke vent

(57) This invention relates to fire protection and particularly the invention relates to a smoke vent for clearing the smoke from a building. In the smoke vent according to the invention reduction of required amount of heat insulating material has been obtained by using at least two successive lid sections, between which a remaining airspace and/or space containing other gas serves as heat insulation.

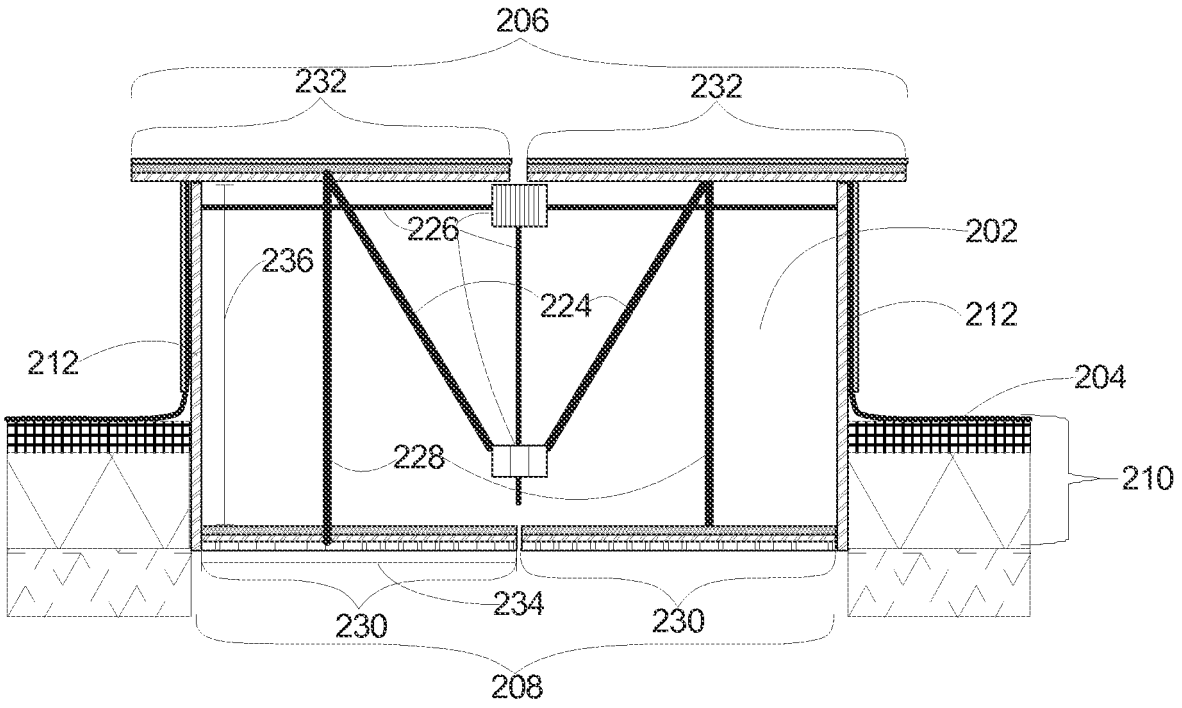

Fig. 2a

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Description

FIELD OF THE INVENTION

[0001] This invention relates to a fire protection and particularly the invention relates to a smoke vent for clearing the smoke from a building.

BACKROUND OF THE INVENTION

[0002] Lot of heat, smoke and toxic fire gases originate from a fire, which, especially in residential buildings, cause a significant risk to people inside the building and hinder the operation of rescue services. Thus, the developed hot gases must be removed efficiently and rapidly from emergency exits, so that the emergency exits would be better to discover and the exit would be safer and a fire extinction of the fire brigade would be easier.

[0003] For example, the code of building regulations of Finland includes regulations regarding to smoke venting of exit corridors of residential buildings for ensuring an inhabitant evacuation and a fire extinguishing. According to the instructions the smoke ventilation of residential apartment buildings is arranged through a smoke vent installed at the top of a staircase. Typically, the natural location for the smoke vent is in the roof covering of the building or at the upper part of walls. It is a purpose to provide a smokeless, cooler layer above the floor in the staircase of an apartment building by means of the smoke vent. The smoke vent shall be opened either electronically or mechanically so that the opening devices are positioned in the immediate vicinity of the main entrance of the stairway. In practice, several residential buildings and other buildings, however, have the electronic opening system, the operation of which can be based on an automatic smoke detection.

[0004] Figs. 1a and 1b illustrate one-door model of a smoke vent currently in use. There are also double door models in use. Most typically, the opening system of the smoke vent is motor operable or a gas spring operable. As can be seen in Fig. 1b, the smoke vent located on the roof of an apartment building is produced to be taller than the remaining roof, so that the snow on the roof in the winter would not hinder the opening of the vents. Normally, the height of the smoke vent is about 50 cm higher than the roof. For its part, this increases the need for using insulation both in the side walls and in the lid of the smoke vent, in order to avoid significant heat loss through the construction of the smoke vent. A lid section and side walls of the smoke vent depicted in Fig. 1b consist of sheets of plywood, between which there is applied about 100 mm of insulating wool, and gypsum board or tin plate upon the upper sheet of plywood. Insulation increases manufacturing costs of the smoke vent and makes the smoke vent structures heavy. Weights of the smoke vent currently in use vary on the basis of the size about from 100 kg up to more than 300 kg. Such a burden increases the encumbrance directed to the roof and complicates the installation of the vent.

SUMMARY OF THE INVENTION

[0005] The objective of the invention is to provide a smoke vent, by means of which the foregoing problems can be eliminated or they can be alleviated.

[0006] The objects of the invention are achieved with the features according to the independent claim.

[0007] A smoke vent according to the invention is characterized by the features disclosed in the characterizing part of claim 1.

[0008] According to one preferred embodiment an inner lid section and an outer lid section are interconnected with articulated arm sections and/or connected to the same motor operable opening system.

[0009] According to the other embodiment the inner lid section and the outer lid section are connected to the same gas spring operable opening system.

[0010] Various embodiments of the present invention are disclosed in dependent claims.

[0011] Significant advantages are achieved by means of the invention comparing to the prior art solutions. The required amount of insulation in the smoke vent according to the invention is significantly less than in conventional vents, as the airspace between the inner lid section (s) and the outer lid section(s) acts as insulation. In this way the total weight of the vent can be reduced and the manufacturing costs can be decreased significantly and the insulating ability can be improved remarkably comparing to the corresponding current vents.

[0012] In this patent application the expression "lid section" refers to the opening partition of the smoke vent, which has one or more doors.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Next the invention is described in more detail with reference to the appended drawings, in which

Fig. 1a depicts a perspective view of an one-door smoke vent according to prior art,

Fig. 1b depicts a side view of a diagram in accordance with Fig. 1a,

Fig. 2a depicts a side view of a smoke vent according to the invention with motorized opening method when doors of lid sections are closed,

Fig. 2b depicts the structure of a side wall according to the smoke vent of Fig. 2a,

Fig. 2c depicts the structure of an outer lid section according to the smoke vent of Fig. 2a,

Fig. 2d depicts the structure of an inner lid section according to the smoke vent of Fig. 2a,

Fig. 2e depicts a side view of the smoke vent with motorized opening method, when doors of a lid section are open, according to Fig. 2a

Fig. 3a depicts a side view of a double door embodiment of the invention, wherein doors of the inner lid section open downwards,

Fig. 3b depicts a side view of an embodiment of the invention, wherein the inner lid section and the outer lid section both have only one door and the door of the inner lid section opens downwards,

Fig. 3c depicts a side view of an embodiment of the invention, wherein the inner lid section and the outer lid section both have only one door, and wherein a motor apparatus is placed under the inner lid section,

Fig. 3d depicts a side view of an embodiment of the invention, wherein the outer lid section has two doors, which, when closed, form a ridge, and the door of the inner lid section opens downwards,

Fig. 3e depicts a side view of an embodiment of the invention, wherein the outer lid section and the inner lid section have so-called swing doors.

DETAILED DESCRIPTION OF THE INVENTION

[0014] Figures 1a and 1b have already been reviewed in connection with describing the prior art.

[0015] Figures 2a and 2e depict a side view of a sketch of the smoke vent according to the invention. In the figure the smoke vent 202 is located in the roof covering, so that the outer lid section 206 is about 50 cm higher than the roof 204 level, for example, and the inner lid section 208 is under the upper surface of the roof, for example, preferably on the level of the lower edge of the insulating material of the roof.

[0016] The most preferable the outer lid section 206 and the inner lid section 208 are separately mounted pivotably to the other structure of the smoke vent. It is possible to provide sufficiently wide insulating airspace with this kind of separately mounted outer and inner lid sections 206 and 208 in order to obtain the best heat insulation capacity.

[0017] Fig. 2b depicts the structure of side walls 212. The side walls 212 extending to the inner lid section 208 of the smoke vent are made of light and strong material, for example sheet of plywood 214. The outer side of side walls 212 can be covered with weather-resistant material, such as roofing felt 216 and roofing sheet 218, in this order.

[0018] The height of the airspace between the outer lid section 206 and the inner lid section 208 may vary, but it can be 40 -80 cm, for example. The purpose of the airspace is to act as a heat insulation layer between the inner lid section 208 and the outer lid section 206, as in an appropriate scale the air is good heat insulation. The heat insulation capability requires that the lid sections 206 and 208 are sufficiently tightly closed, when being closed, in order to minimize the convection. The airspace remaining between the lid sections 206 and 208 can alternatively be filled with some other particular gas, appropriate for the purpose, for example argon, to improve the heat insulation. Using the space containing other gas may be advantageous, for example, if there are at least two inner lid sections consecutively and the gas space between them does not open, when the doors of the inner lid sections open.

[0019] The structure of the outer lid section 206 is depicted in Fig. 2c. The outer lid section 206 can be made of strong material, for example a sheet of plywood 214, onto which the insulating layer 220 can be attached. Still, the roofing sheet 218 covering the lid section 206 can be attached on the insulating layer 220.

[0020] The structure of the inner lid section 208 is depicted in Fig. 2c. The inner lid section 208 can be made of one or more materials. In the case of Fig. 2d, gypsum board 222 is used, for example, on top of which there can be e.g. sheet of plywood 214 and insulating layer 220. In another embodiment the inner lid section can be made of e.g. a layer of polyurethane, an insulating wool layer and tin plate or aluminum foil.

[0021] The foregoing production materials of the outer lid section 206 and the inner lid section 20 are exemplary only and other materials can also be used, as well as the order of the materials can vary in the lid sections 206 and 208. In addition, a heat reflecting foil or coating can be added under the inner lid section for decreasing the heat loss. The inner lid section 208 can also be selected so that it acts as a vapor barrier, in which case it has, in some layer, some coating or surface impervious to moisture, such as tin plate or aluminum foil, for example.

[0022] The thickness of the sheets used for the outer lid section 206 and inner lid section 208 may vary. The thickness of the used sheet of plywood 214 is e.g. about 5 - 20 mm. It is preferable to use as a gypsum plate 222 an approx. 10 - 20 mm thick gypsum plate, the characteristics of which may also include an extra hard fire resistance. The suitable insulating material may be for example synthetic rubber based closed-cell insulating material, the thickness of which may vary in the range of 5 - 35 mm. Insulating wool or a pressed sheet can also be used as an insulating material.

[0023] The outer lid section and the inner lid section 206 and 208 can also be made of other pressed materials, such as fireproofed plywood, aggregate sheets and/or plastics. In addition, the lid section(s) is/are possible to be made of material, which melts in particular temperature, e.g. about 100 °C. In this case, a separate opening system for these lid sections is not necessarily required, but when the temperature has sufficiently risen the lid sections melt or evaporate away.

[0024] The outer lid section 206 and the inner lid section 208 may consist of one or more doors. The used

doors may be superposed, i.e. two or more of those can be one in a row. In Figs 2a and 2e, both the outer lid section 232 and the inner lid section 230 contain two doors. Figs. 3a - 3d illustrate in more detail the door solutions for the lid section of the smoke vent of the present invention.

[0025] In case of Fig. 2a, the opening of the doors 230 and 232 of the lid sections is motor operable. The motor apparatus is placed in the centre part of the smoke vent. One end of arm sections 224 of the outer lid section are attached to the outer lid section 206 and the other end to the motor apparatus 226 and one end of arm sections 228 of the inner lid section are attached to the outer lid section 206 and the other end to the inner lid section 208. The arm sections 228 may be upright, when closed, or they can be attached diagonally. The used arm sections are preferably firm and strong material, such as steel, and the both ends thereof are articulated. The length and the attachment place are chosen so that while the motor apparatus 226 opens the door of the outer and the inner lid sections 230 and 232, the doors 230 and 232 open e.g. at least a 45 degree angle. Moreover, the size of the smoke vent can be chosen so that the height 236 of the airspace between the outer lid section 206 and the inner lid section 208 is shorter than the length 234 of the door of the inner lid section. Then the doors 232 of the outer lid section can open over 90 degree angle and the doors 230 of the inner lid section at most 90 degree angle.

[0026] According to one embodiment of the present invention also the one-door outer lid section is arranged to open over 90 degree. One-door or double doors outer lid sections that open over 90 degree, as described above, may prevent the wind to push the smoke in the vent back to indoors regardless of the wind direction.

[0027] Fig. 2e depicts a motor operable smoke vent according to Fig. 2a when doors of a lid section are open. The motor operable opening in smoke vents is a known technique, so it is described just briefly. The motor apparatus 226 is placed in the centre part of the vent by means of the rod sections 224 attached to the upper part of the vent. Depending on the amount of the doors of the outer and inner lid section, the motor apparatus 226 can be placed also aside of the centre part of the vent. For example, in the embodiment, wherein both the outer lid section and the inner lid section have only one door, the motor apparatus 226 can be located in some of the side walls 212 of the smoke vent.

[0028] The motor apparatus 226 includes a motor 238, to which the threaded rod section 240, rotated by the motor 238 while running, is connected. The threaded rod section 240 has a nut section 242, which the arm sections 224 attached to the outer lid section 206 prevent to screwing. While the motor 238 is rotating the threaded rod section 240, the nut 242 rises up or lowers down along to threads of the rod 240 depending on the direction of rotation of the motor 238. When the nut 242 rises up along to the threaded rod section 240 the arm sections 224 push the doors 232 of the outer lid section open and the arm sections 228 attached between the outer lid section 206 and the inner lid section 208 pull the doors 230 of the inner lid sections open.

[0029] The gas spring operable opening system is another well known method to open a smoke vent, and every embodiment of this invention can be implemented by using a gas spring operable or some other suitable opening system. The opening of the doors of the lid sections upward or downward can also be arranged without separate motor by utilizing gravitation, for example.

[0030] In addition, the smoke vent can include other parts typically included in a smoke vent, such as burglary bars and a fall shield (not shown). These parts can be located either under the inner lid section 208 or in the space between the inner lid section 208 and the outer lid section 206, so as not to impede the opening of the doors 230 of the inner lid section. If burglary bars / fall shield is located between the smoke vent and the motor apparatus, the burglary bars / fall shield have/has to be designed so that the arm sections 224 and 228 fit to proceed through the burglary bars and the fall shield.

[0031] Figs. 3a - 3d depict possible door solutions of the lid sections. In Fig. 3a, there is one embodiment of the invention, wherein the doors 230 of the inner lid section open downwards. The doors 230 of the inner lid section are fastened with a latch (not shown), which can be connected to the motor apparatus 226, so that the motor apparatus 226, when starting, triggers the latch, or the latch has its own triggering mechanism, such as electrical or heat based. Hinges of the doors 230 of the inner lid section may also be spring-loaded, which forces the doors open, when the latch triggers. In embodiments, wherein the door/doors 230 of the inner lid section open (s) downwards, the possible burglary bars/fall shield is naturally located in the space between the lid sections, so as not to impede the doors to open.

[0032] Fig. 3b depicts an embodiment, wherein both the inner lid section 208 and the outer lid section 206 have only one door, and the door 230 of the inner lid section opens downwards, as in embodiment of Fig. 3a. In embodiments, wherein the door 230 of the inner lid section opens downwards, there can be added an arm section and/or a loop (not shown) with which the door 230 of the inner lid section can be pulled up again from outside. The foregoing arm section may be located under the door 230 of the inner lid section, in which case the door 230 of the inner lid section can be manually openable and/or closable from below. This embodiment is also possible to implement so that the inner lid section 208 hanging on a cable drops downwards, when the trigger latch opens the fastenings of the lid sections 206 and 208, for example.

[0033] Fig. 3c depicts an embodiment, wherein both inner the inner lid section 208 and the outer lid section 206 have only one door, and the motor apparatus 226 is located under the inner lid section 208. The arm section 228 is attached between the inner lid section 208 and the outer lid section, which arm section pushes the door

232 of the outer lid section open while the motor apparatus 226 is opening the door 230 of the inner lid section. The arm section may be attached upright between the lid sections or it may be attached diagonally, as in Fig. 3c. In addition, this embodiment can be implemented so that both lid sections have two or more doors and the motor apparatus 226 is located below the inner lid section 208, in which case the arm sections 228 are attached to both doors 230 and 232 of the inner lid section and the outer lid section in order to open doors 232.

[0034] Fig. 3d depicts an embodiment, wherein the outer lid section 206 has two doors and the inner lid section has one door. The doors 232 of the outer lid section, when closed, form a ridge, which reduces the gathering of snow and ice upon the doors. In that embodiment, the door 230 of the inner lid section opens downwards, but embodiments, wherein it opens upwards, are also possible. The solution presented in Fig 3c, wherein the motor apparatus 226 or a gas spring apparatus is locates under the inner lid section, can be applied in that kind of embodiments. That embodiment can also be accomplished so that the motor apparatus/gas spring apparatus is located in the space between the lid sections next to that side wall that is in the open end of the door of the inner lid section.

[0035] Fig. 3e depicts an embodiment, wherein the outer lid section 206 and the side lid section 208 have so called swing doors 232 and 230. The doors can be attached to the upper and the lower edges of the smoke vent with pins 304, so that the pins 304 are set on both sides of the centre part of the door side. When the doors 230 and 232 are closed, they are substantially in horizontal position and while opening the doors, hanging on the hinge pins, are free to swing to the vertical position, which enables free flow of smoke gases. The opening of the doors can be arranged by weighing the other edge of the door heavier, in which case it, on the influence of the Earth's gravitation, turns to vertical position while opening. The opening can also be arranged by some other way, e.g. with a spring hinge. In addition, the fastening pins 304 can be in some other location. If the opening of the doors is arranged with balancing, the fastening pins can be located aside from the center of the doors. A rotation axis of the swing door is preferably located in the door's level, but it can also be at a distance from it. When using the swing door, the rotation axis is preferably at least partially between the border planes of the door, which border plane means the perpendicular level in respect of the door level, which includes the edge of the door.

[0036] In the embodiment in question, there can be one or more doors and the doors can be openable with the same triggering latch 302 or then the doors can be arranged so that one door in the upper lid section 206 and the inner lid section 208 is openable with the triggering latch 302 and this door, while opening, releases the other doors. In that case the doors, while being closed, are set to lapping over each other so that the previous door holds up the edge of the next door. The latch 302, which releases the doors, is in the centre of the outer lid section and the inner lid section in the figure, but it can also be somewhere else, e.g. in the side edge of the vent.

[0037] Additionally, the combinations of the above described embodiments, such as one door in the outer lid section 206 and two doors in the inner lid section, which doors open upwards or downwards, are possible. In conditions where the snow, for instance, does not cause problems, the doors 232 of the outer lid section may also be openable downwards. In these embodiments, the doors 232 of the double doors outer lid section can form, when closed, a ridge and also, if needed, the doors of the double doors inner lid section 208 can form, when closed, a ridge. The one door outer and inner lid sections 206 and 208 can also be formed to the shape of a dome.

[0038] The above described embodiments with their variations may also be accomplished so that there are more lid sections in a row. In that case, the spaces of lid sections can be utilized as a gas space, for example, and a reflecting surface and/or vapor barrier material can be added to the undermost lid section. The benefit of the several successive lid sections can be a further reduced need of the heat insulating material and/or improved heat insulation capacity.

[0039] In addition, there can be separate opening systems for the inner lid section 208 and the outer lid section 206 regardless of in which direction the doors 230 of the inner lid section opens. The systems used for the opening can be motor operable or gas spring operable or the opening can be arranged by some alternative way, for example, by utilizing gravitation.

[0040] In every embodiments described above, the opening system of the lid sections can be based on a heat sensitive trigger latch, which temperature tolerance can be e.g. about 75 °C. In that case, it can be secured that the latch melts about 100 °C and releases the door (s) of the lid section(s).

[0041] Above, only some of the embodiments according to the invention have been described. The principle according to the invention can naturally be modified within the scope defined by claims in the details of implementation and practices of use, for example.

[0042] In the above mentioned embodiments, there have been described two superimposed lids. It will be apparent to those skilled in art that the number of the superimposed lid sections can greater than two, such as e.g. three or four. In addition, instead of one or two doors there can be more doors in the lid, such as e.g. four.

Claims

1. A smoke vent, **characterized in that** said smoke vent (202) comprises at least one openable inner lid section (208) and at least one openable outer lid section (206), and the inner lid section (208) and the outer lid section (206) are positioned in said smoke

vent (202) substantially one upon the other so that there is an insulating airspace and/or an insulating space containing other gas compound between the lid sections.

2. The smoke vent according to claim 1, **characterized in that** the outer lid section (206) and the inner lid section (208) are separately mounted pivotably to other structure of the smoke vent.

3. The smoke vent of any preceding claim, **characterized in that** a height (236) of the airspace is selected so that the heat insulation capacity of the smoke vent is maximal.

4. The smoke vent of any preceding claim, **characterized in that** the outer lid section (206) is substantially higher than the roof level, and that the inner lid section (208) is under the upper surface of the roof preferably on the level of the lower edge of insulating material.

5. The smoke vent of any preceding claim, **characterized in that** the upper lid section (206) consists of one or more doors (232) and/or the inner lid section (208) consists of one or more doors (230).

6. The smoke vent of any preceding claim, **characterized in that** there is a heat reflecting coat or surface below the inner lid section.

7. The smoke vent of any preceding claim, **characterized in that** at least one of the lid sections is melting material that melts about 80-150 °C temperature, preferably about 100 °C temperature.

8. The smoke vent of any preceding claim, **characterized in that** door(s) (230) of the inner lid section and/or outer lid section open/opens upwards.

9. The smoke vent of any preceding claims 1-7, **characterized in that** door(s) (230) of the inner lid section and/or the outer lid section open/opens downwards.

10. The smoke vent of any preceding claims 1-7, **characterized in that** door(s) (230) of the inner lid section and/or the outer lid section open/opens by rotating around a rotation axis, in which case the rotating axis is located, at least partially, between border planes of a door.

11. The smoke vent of any preceding claim, **characterized in that** the inner lid section (208) and the outer lid section (206) of the vent are connected to the same opening system.

12. The smoke vent according to claim 11, **characterized in that** the inner lid section (208) and the outer lid section (206) of the vent are connected to the opening system with the arm sections (224 and 228).

13. The smoke vent according to claim 11, **characterized in that** the opening system is located in the space between the outer and the inner lid section (206 and 208).

14. The smoke vent according to claim 11, **characterized in that** the opening system is located under the inner lid section (208)

15. The smoke vent according to claim 11, **characterized in that** the opening system of at least one lid section is based on a heat sensitive trigger latch.

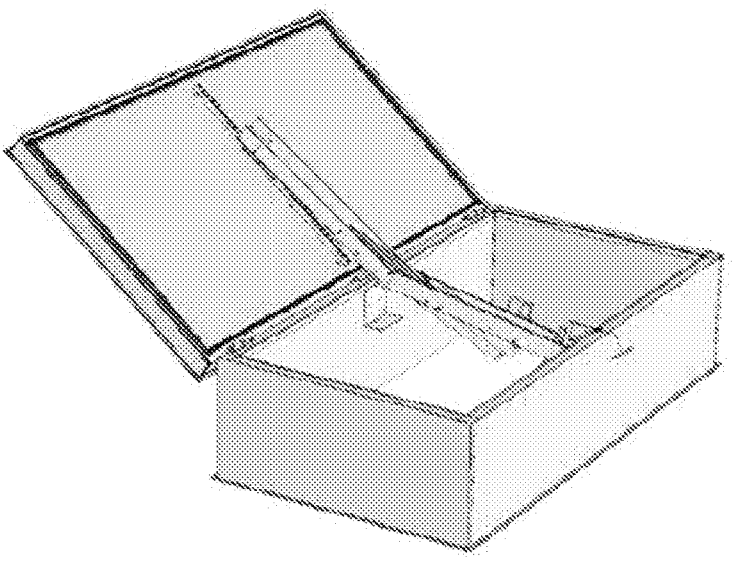

Fig. 1a

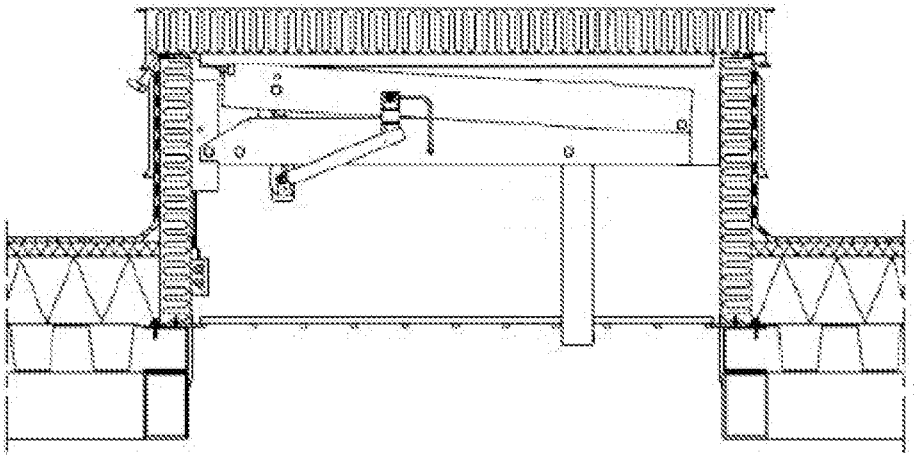

Fig. 1b

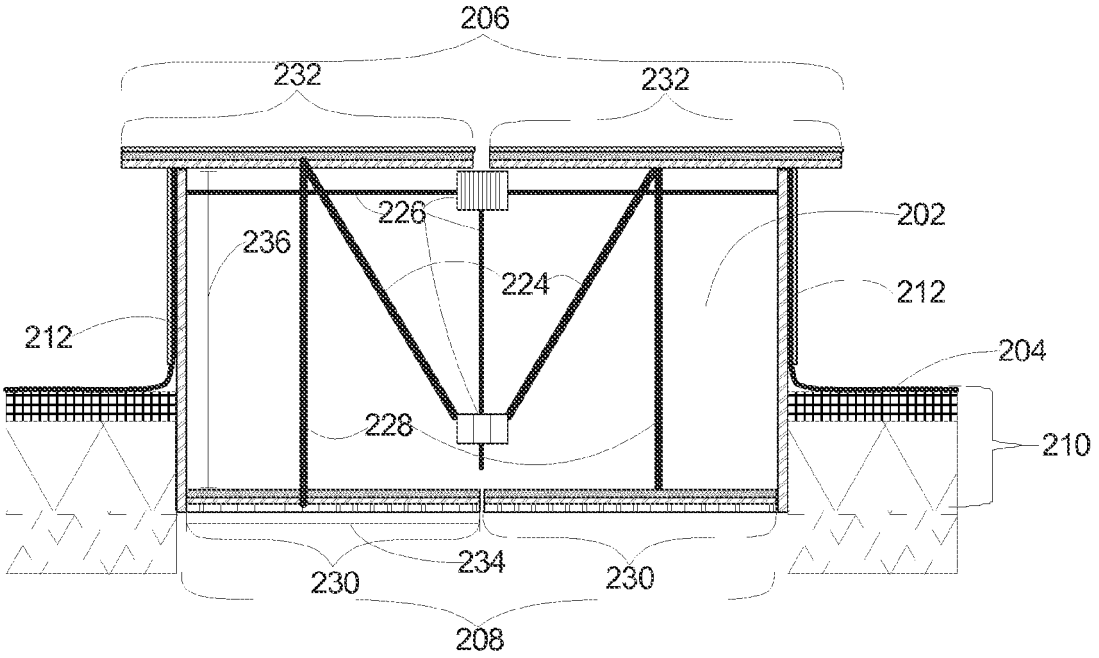

Fig. 2a

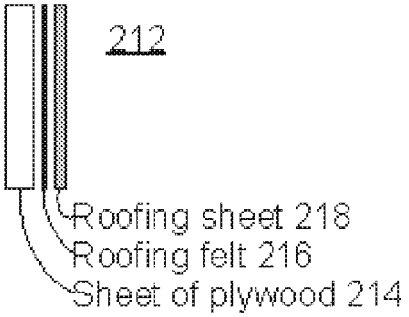

Fig. 2b

Fig. 2c

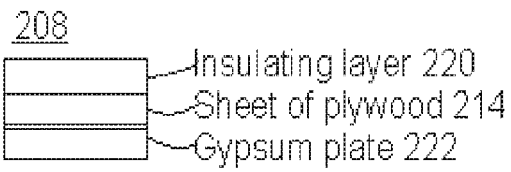

Fig. 2d

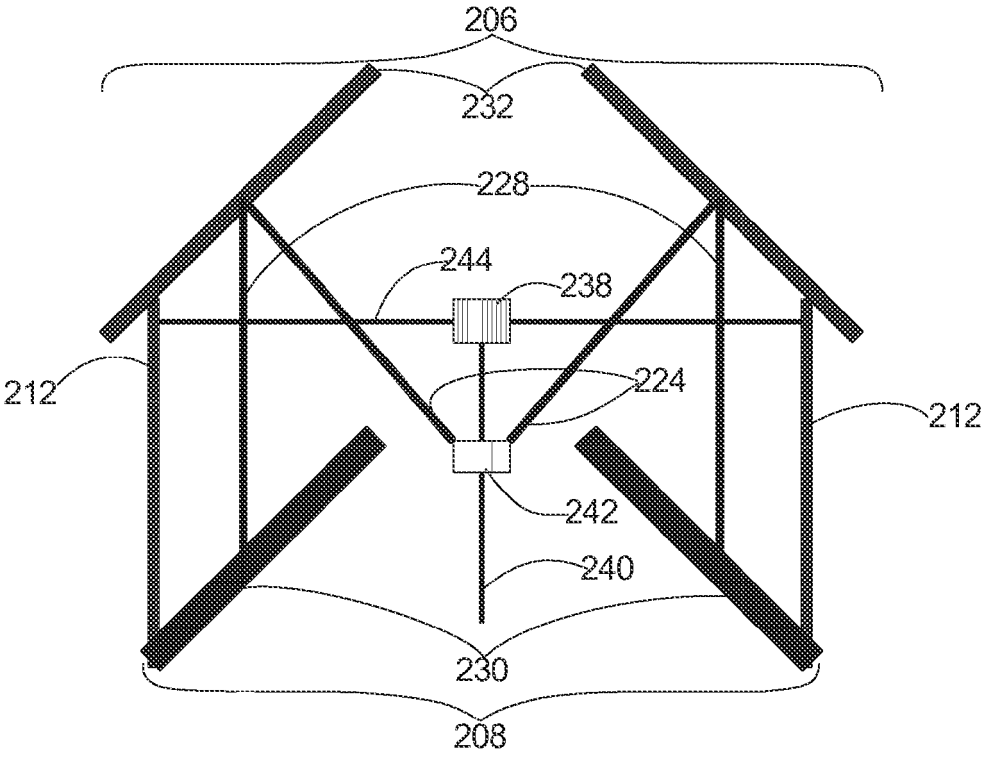
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Fig. 2e

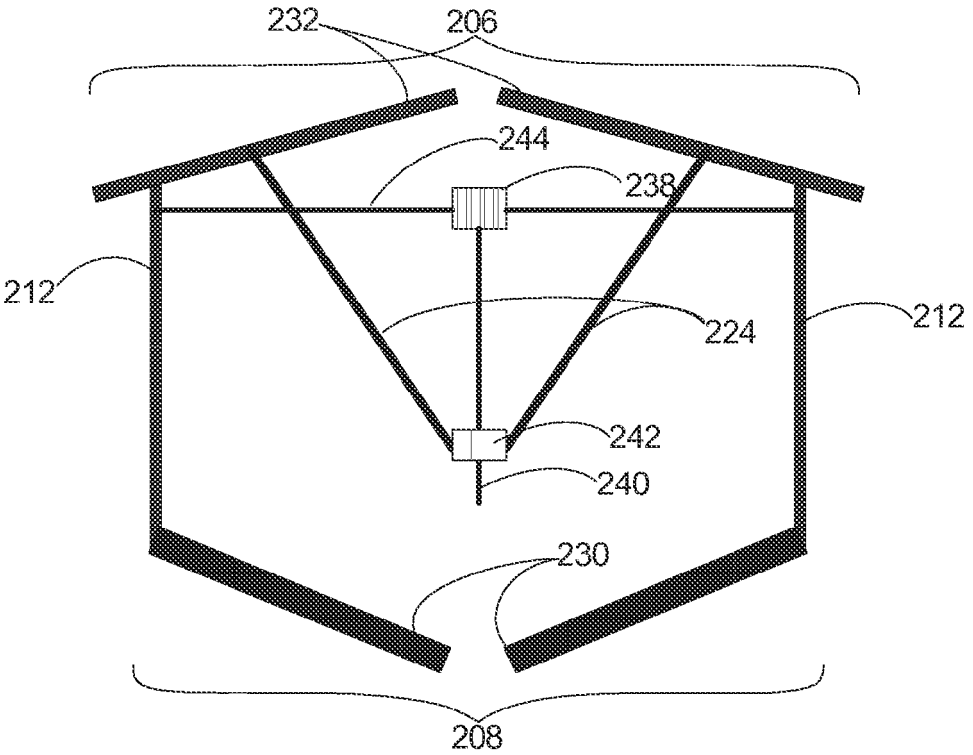
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Fig. 3a

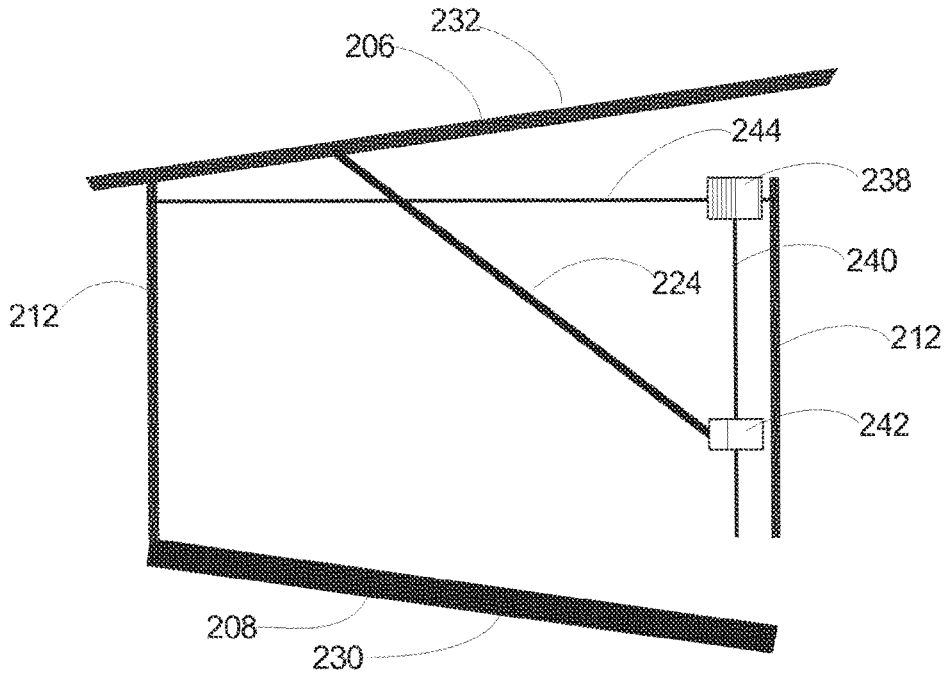
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Fig. 3b

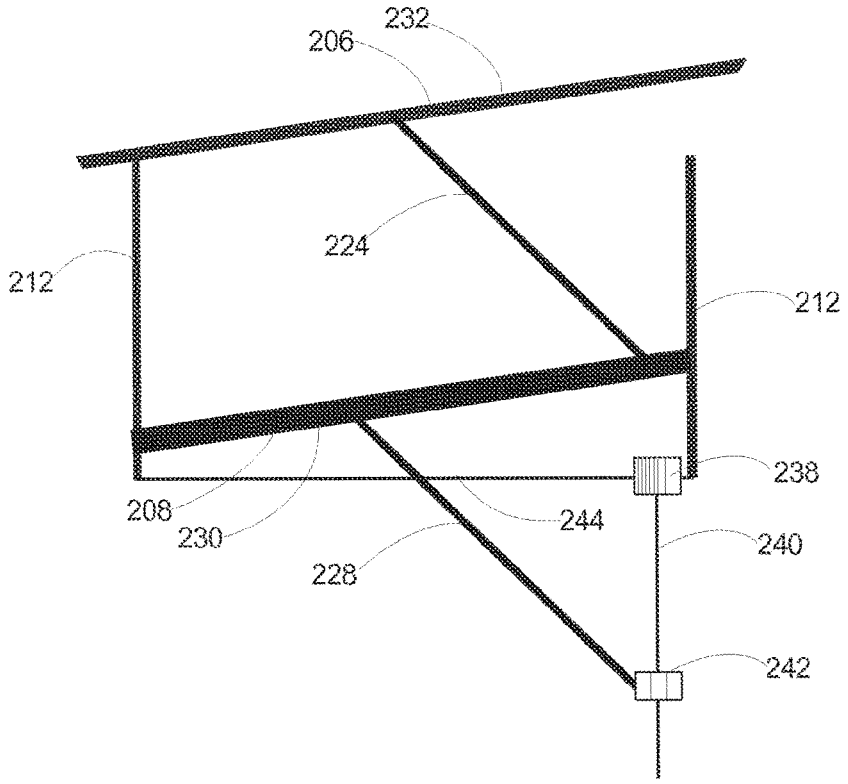
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Fig. 3c

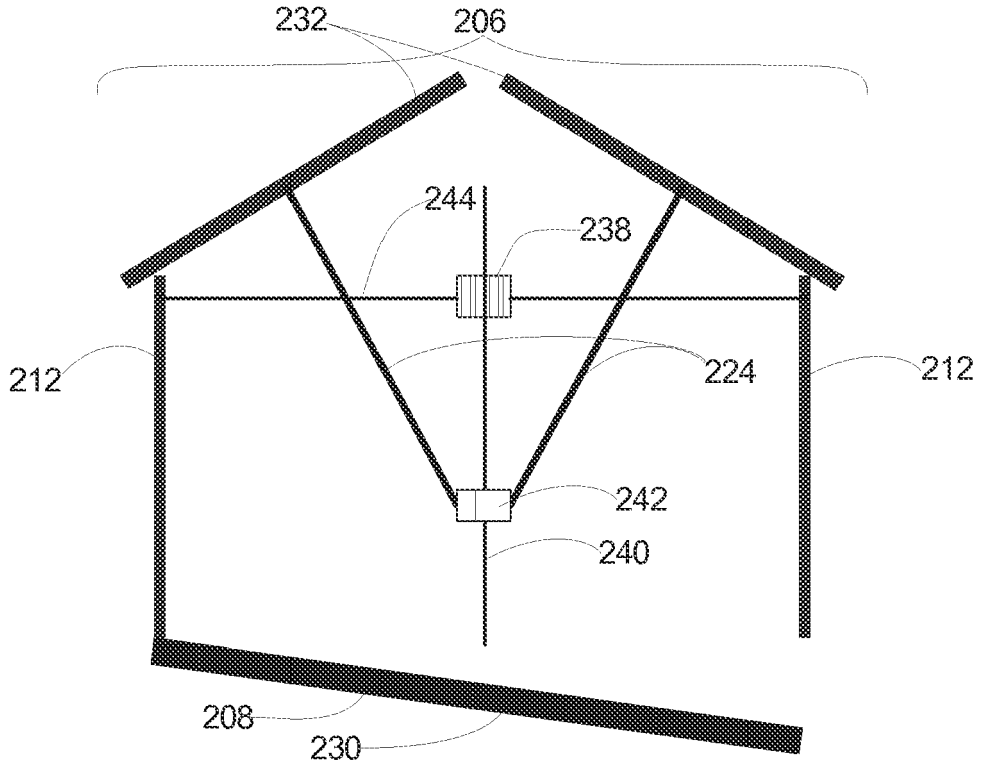
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Fig. 3d

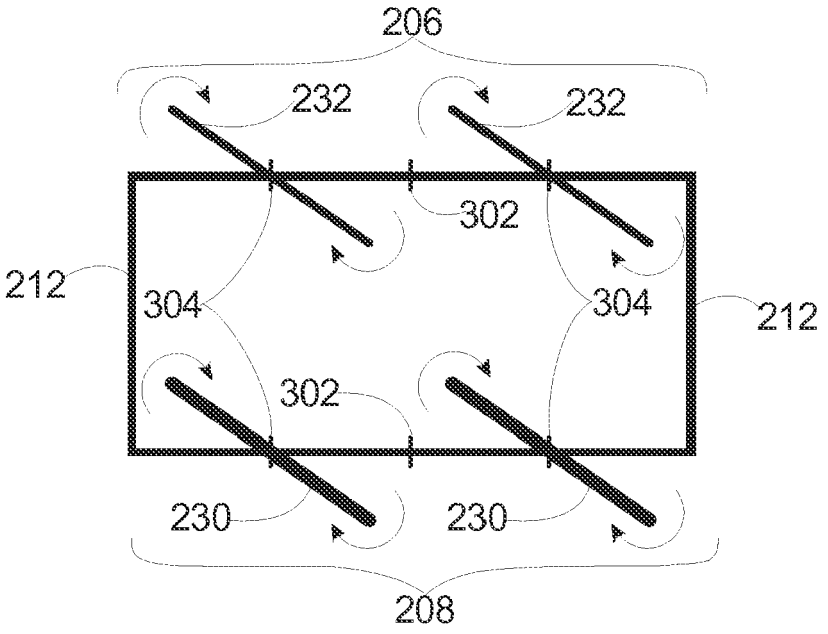
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Fig. 3e

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 09 17 5512

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2004/063632 A2 (NYSTROM INC [US]) 29 July 2004 (2004-07-29) * abstract *	1	INV. F24F7/02 E04D13/035
A	EP 1 739 248 A1 (ECODIS ETUDE COORDINATION DIST [FR]) 3 January 2007 (2007-01-03) * abstract *	1	
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Place of search	Date of completion of the search	Examiner
Munich	5 March 2010	Valenza, Davide

CATEGORY OF CITED DOCUMENTS

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