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(54) **CEILING TILE AND SUSPENDED CEILING SYSTEM COMPRISING SUCH A CEILING TILE**

(57) A ceiling tile (100) for a suspended ceiling system (200) comprising a grid of profiles (300) for supporting the ceiling tile (100), the ceiling tile (100) comprises a front surface (102) intended to face a room (10) in an

installed state of the ceiling tile (100) and a plurality of spacer elements (20) discretely distributed along a perimeter portion (106) of the ceiling tile (100).

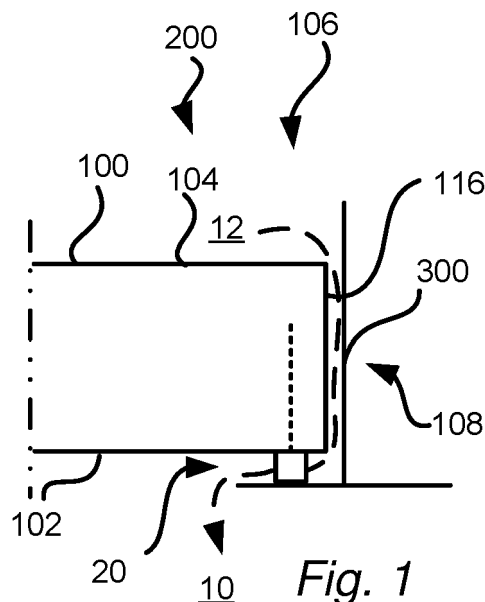


Fig. 1

Description

Field of the invention

[0001] The present invention relates to ceilings in buildings, specifically to a suspended ceiling system and to a ceiling tile for a suspended ceiling system.

Background art

[0002] Suspended ceiling systems are used in many different types of buildings e.g. to lower the ceiling, to provide sound dampening, to facilitate mounting of light sources and other building equipment and to provide an aesthetically pleasing interior ceiling. Suspended ceiling systems, as the name implies, are attached to a supporting structure of some sort, such as the ceiling structure of the building. Suspended ceiling systems usually comprises a plurality of ceiling tiles and a supporting structure in form of a grid. The grid comprises profiles which support the ceiling tiles.

[0003] The ceiling tiles may have sound-absorbing and/or sound-insulating properties in order to improve the acoustic environment of the room. In order to obtain a lightweight ceiling with satisfactory sound absorption, the tiles, for instance, may be made of a compressed fibre material such as mineral wool and especially glass wool. In addition to ceiling tiles, the profiles may also support various equipment such as lighting devices, ventilation equipment, inspection openings, detectors, cable trays, loudspeakers, signs, sprinklers etc.

[0004] In certain applications, the suspended ceiling system may be fitted with ventilation fittings such as diffusers. Typically, a diffuser replaces a ceiling tile in the grid and is supported by the grid of profiles. The ceiling tiles in such an application does not need to be provided with any particular properties for facilitating ventilation or flow of air.

[0005] In other applications, ventilation is provided above the suspended ceiling system and the air flows through the suspended ceiling system into the space below. In such an application, the suspended ceiling system must allow a certain amount of air flow to be able to pass through it in order to achieve the desired and/or required ventilation performance.

[0006] This poses certain problems, as it sometimes is not desired to have perforated ceiling tiles nor to have any visible gaps or channels that air can flow through. Providing ceiling tiles that permits air to flow through the ceiling tile itself may result in that other properties such as sound dampening may be compromised. Manufacturers of suspended ceiling system strive to produce new solutions which improve on prior art systems for facilitating ventilation while providing a suspended ceiling system that is aesthetically pleasing and easy to install.

Summary of the invention

[0007] In view of that stated above, the object of the present invention is to provide a ceiling tile and suspended ceiling system which alleviates some of the problems with prior art.

[0008] More specifically, there is provided according to a first aspect a ceiling tile for a suspended ceiling system comprising a grid of profiles for supporting the ceiling tile. The ceiling tile comprises a front surface intended to face a room in an installed state of the ceiling tile and a plurality of spacer elements discretely distributed along a perimeter portion of the ceiling tile. The plurality of spacer elements is configured for separation of the ceiling tile and the grid of profiles in a direction perpendicular to the front surface, such that an air passage is generated allowing air to pass from the space above the ceiling tile into the room or space below. This facilitates diffuse ventilation without having to provide the ceiling tile itself with any particular features such as ventilation holes or materials that lets air pass through it.

[0009] The ceiling tile may comprise two opposite edges each provided with a stepped profile comprising an upper tongue having a tongue surface configured to face an associated supporting surface on the grid of profiles. The plurality of spacer elements being configured to separate the tongue surfaces and the associated supporting surface. The stepped profile facilitates hiding the air passage that is formed by the spacing between the ceiling tile and the grid of profiles from view, providing an aesthetically pleasing ceiling tile.

[0010] In one embodiment, the plurality of spacer elements is arranged on the front surface of the ceiling tile or a surface parallel thereto.

[0011] The plurality of spacer elements may be arranged on a side surface of the ceiling tile or a surface parallel thereto.

[0012] The plurality of spacer elements may further be configured for engagement with the grid of profiles for support of the ceiling tile.

[0013] The plurality of spacer elements may be configured for separation of the ceiling tile and the grid of profiles in a direction parallel to the front surface. The spacer elements may thus provide not only vertical spacing but also horizontal/lateral spacing for providing a desired air passage between the ceiling tile and the grid of profiles.

[0014] The plurality of spacer elements may be formed separately from the ceiling tile. The spacer elements being attachable to the ceiling tile. The spacer elements may be attached to each other for instance by being arranged on a strip of material such as adhesive tape or similar, thus proving the desired spacing between the spacer elements.

[0015] Each spacer element may further comprise a body portion and an anchoring portion for attaching the body portion to the ceiling tile.

[0016] Each spacer element may in one embodiment

comprise a body portion attached to the ceiling tile by means of an adhesive, such as glue or adhesive tape.

[0017] In a second aspect is a suspended ceiling system provided comprising a grid of profiles and a ceiling tile according to the first aspect. The suspended ceiling system facilitates providing diffuse ventilation through the ceiling system. Ventilation can thus be provided to the space above the suspended ceiling system, the ceiling system will then allow fresh air to pass through it effectively. No visible dedicated ventilation diffusers are needed in the ceiling system which provides a uniform appearance which is often desirable.

[0018] The grid of profiles may comprise profiles having an inverted T-shape with a web and laterally extending flanges. The ceiling tile may be supported by the flanges via the plurality of spacer elements.

[0019] Generally, all terms used in the claims are to be interpreted according to their ordinary meaning in the technical field, unless explicitly defined otherwise herein. All references to "a/an/the [element, device, component, means, step, etc]" are to be interpreted openly as referring to at least one instance of said element, device, component, means, step, etc., unless explicitly stated otherwise. The steps of any method disclosed herein do not have to be performed in the exact order disclosed, unless explicitly stated.

Brief description of the drawings

[0020] The above, as well as additional objects, features and advantages of the present invention, will be better understood through the following illustrative and non-limiting detailed description of preferred embodiments of the present invention, with reference to the appended drawings, where the same reference numerals will be used for similar elements, wherein:

Fig. 1 discloses a side view of a suspended ceiling system according to one embodiment.

Figs 2a and 2b discloses a respective embodiment of a spacer element.

Fig. 3 discloses a side view of a grid of profiles according to one embodiment.

Fig. 4 discloses a side view of a suspended ceiling system according to one embodiment.

Fig. 5 discloses a side view of a ceiling tile according to one embodiment.

Fig. 6 discloses a side view of a suspended ceiling system according to one embodiment.

Fig. 7 discloses a front view showing a perimeter portion of a ceiling tile according to one embodiment.

Fig. 8 discloses a side view of a suspended ceiling system according to one embodiment.

Fig. 9 discloses a side view of a suspended ceiling system according to one embodiment.

Fig. 10 discloses a side view of a suspended ceiling system according to one embodiment.

Fig. 11 discloses a side view of a spacer element

according to one embodiment.

Description of embodiments

[0021] The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which currently preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided for thoroughness and completeness, and fully convey the scope of the invention to the skilled person.

[0022] Fig 1 shows a ceiling tile 100 in a suspended ceiling system 200 comprising a grid of profiles 300 for supporting the ceiling tile 100. The grid of profiles 300 is suspended from a supporting structure in the building to which it is mounted. The suspension of the grid of profiles 300 could be formed in a plurality of ways as is realized by a person skilled in the art and will thus not be further elaborated on herein.

[0023] The ceiling tile 100 generally functions to provide an appealing appearance to the suspended ceiling system 200, to dampen sound and to hide the ceiling structure and possible building equipment that is arranged above the suspended ceiling system 200. Such ceiling tiles may be formed in many different ways, the teachings herein are not limited to use with any particular type of ceiling tile 100. However, in one embodiment, the ceiling tile 100 may be made of man-made mineral fibre, such as a compressed mineral fibre material. More specifically, the mineral fibre material may be mineral wool, especially glass wool. In addition to the mineral fibre material, the ceiling tile 100 may comprise a binder. The ceiling tile 100 may further comprise at least one surface layer.

[0024] The ceiling tile 100 further comprises a front surface 102 intended to face a room 10 in an installed state of the ceiling tile 100 and a plurality of spacer elements 20 discretely distributed along a perimeter portion 106 of the ceiling tile 100. A rear surface 104 may be arranged facing in the opposite direction of the front surface 102. The plurality of spacer elements 20 are configured for separation of the ceiling tile 100 and the grid of profiles 300 in a direction perpendicular to the front surface 102.

[0025] The ceiling tile 100 will thus allow air from the space 12 above the ceiling tile 100 to pass as indicated by the arrow in Fig. 1 to the room or space 10 below the ceiling tile 100. Ventilation can thus be provided without having to have any visible ventilation outlets in the suspended ceiling system 200, which is beneficial not only for the aesthetics of the suspended ceiling system 200 but also since it facilitates construction of the ventilation system above the suspended ceiling system 200. The ventilation is then provided in a diffused manner through the suspended ceiling tiles 200, removing the need for providing any ventilation diffusers in the suspended ceiling system 200 itself. By letting the air diffuse through

the suspended ceiling system 200 and into the room below, the air is allowed to be supplied over a large area, resulting in a flow of the air with no concentrated jet region, thereby providing high ventilation capacity while avoiding the creation of thermal discomfort such as draught even if the air temperature is different from the room temperature and the air flow is high. In addition, sound from ventilation devices may be suppressed by means of the suspended ceiling system 200 arranged for diffused ceiling ventilation.

[0026] Furthermore, while only one perimeter portion 106 is shown, the ceiling tile 100 may comprise an oppositely arranged perimeter portion 106 as well. In one embodiment, the ceiling tile 100 comprises two pairs of respectively opposite perimeter portions 106 such that each perimeter portion 106 adjoins two perimeter portions 106 being arranged at angle to the first mentioned perimeter portion 106. The ceiling tile 100 may further comprise two opposite edges 108 each being arranged on one perimeter portion 106, in one embodiment the ceiling tile 100 is rectangular or quadratic whereby it comprises two pairs of respectively opposite edges 108 each being arranged on a respective perimeter portion 106. In the shown embodiment, each edge 108 comprises a side surface 116.

[0027] In Figs 2a and 2b is a detailed view of two embodiments of the spacer element 20 shown. In Fig. 2a, the spacer element 20 is formed by a body portion 22 which is rectangular in shape. The body portion 22 may be attached to the ceiling tile 100 by means of an adhesive such as glue or adhesive tape. The spacer element 20, more specifically the body portion 22 thereof, should have an extension along the length of the perimeter portion 106 of the ceiling tile 100 that allows a plurality of spacer elements 20 to be arranged discretely/intermittently thereon having spaces formed between the spacer elements 20 (as is further illustrated in Fig. 7) for forming air passages. The body portion 22 of the spacer element 20 may have a number of shapes, for instance the body portion 22 may be cylindrical having e.g. a square, circular, ellipsoid, or a triangular bottom surface. The body portion 22 may further have a conical shape or a truncated conical shape. Other shapes of the body portion 22 are also envisioned and the teachings herein are not limited to any particular shape of the body portion 22.

[0028] The spacer elements 20 that are arranged on a ceiling tile 100 may further be connected for instance by a strip of material for facilitating attachment of the spacer elements 20 to the ceiling tile 100. Further still, such interconnected spacer elements 20 can be arranged at a predetermined spacing from each other to ensure correct spacing between the spacer elements 20 on the ceiling tile 100. In one embodiment in which the spacer elements 20 are configured to be attached to the ceiling tile 100 by means of an adhesive, a number of body portions 22 may be attached to a strip of adhesive tape which is attached to the ceiling tile 100.

[0029] The body portion 22 may be made of metal,

plastic or any other suitable material.

[0030] In Fig. 2b, another embodiment of the spacer element 20 is shown, here comprising a body portion 22 as in the embodiment shown in Fig. 2a and an anchoring portion 24 for attaching the spacer element 20 to the ceiling tile 100. The anchoring portion 24 may be a pin that is configured to be stuck into the material of the ceiling tile 100 thus anchoring the body portion 22 and the entire spacer element 20 to the ceiling tile 100. The anchoring portion 24 may for retaining purposes be provided with ribs protruding perpendicularly or at an angle to the insertion direction of the anchoring portion 24, the ribs providing additional anchoring force to the anchoring portion 24. In one embodiment, the anchoring portion 24 is threaded, allowing the spacer element to be attached to the ceiling tile 100 by screwing the spacer element 20 into said ceiling tile 100.

[0031] The spacer elements 20 that are arranged on a ceiling tile 100 may further be connected for instance by a strip of material for facilitating attachment of the spacer elements 20 to the ceiling tile 100. Further still, such interconnected spacer elements 20 can be arranged at a predetermined spacing from each other to ensure correct spacing between the spacer elements 20 on the ceiling tile 100.

[0032] Fig. 3 shows a grid of profiles 300, particularly one profile thereof in a front view. The profile has an inverted T-shape with a web 304 and laterally extending flanges 302 providing support surfaces for the ceiling tile 100. The laterally extending flanges 302 are preferably arranged at a bottom edge of the web 304 but could also be arranged in other positions along the web 304. The flanges 302 are configured to support the ceiling tile 100 by providing a contact/support surface for the spacer elements 20 attached to the ceiling tile 100. More specifically, the body portions 22 of the spacer elements 20 will carry the load of the ceiling tile 100 to which they are attached and transfer this load onto the lateral flanges 302 of the profiles on the grid of profiles 300.

[0033] The profiles of the grid of profiles 300 is preferably made in a roll forming operation out of a sheet blank of metal, for example steel. The sheet blank is fed between successive pairs of rolls that progressively bend, fold and form the sheet blank until the desired shape and cross section of the profile 300 is obtained. A beneficial profile and method for manufacturing the profile 300 can be found in EP 2 562 323 A1. The teachings herein are however not limited to use with profiles being manufactured in any specific way or of any specific material, any profile having the essential features outlined in claim 1 and 10 will be suitable for use with the suspended ceiling system 200.

[0034] The description of the embodiments of Figs 1 to 3 are also applicable to the embodiments that will be described below, in which emphasis will be made on the differing features for each embodiment.

[0035] In Figs 4 and 5, the ceiling tile 100, specifically each perimeter portion 106 or side edge 108 thereof, is

provided with a stepped profile 110. The stepped profile 110 is preferably formed integrally in the ceiling tile 100. The stepped profile 110 comprises an upper tongue 112 having a tongue surface 114 configured to face an associated supporting surface 302, preferably one of the lateral flanges 302 of a profile in the grid of profiles 300. In a typical application, the tongue surface 114 will be arranged facing in downwardly direction. The spacer elements 20 can thus be arranged on the tongue surface 114 to separate the tongue surfaces 114 on the ceiling tile 100 and the associated respective supporting surface 302. The front surface 102 can consequently be arranged below the lateral flanges 302 of the grid of profiles 300.

[0036] The distance D illustrated in Fig. 5 is the distance between two opposing side surfaces 116 of the ceiling tile 100, this distance should be less than the distance between the webs 304 of the grid of profiles 300 to which the ceiling tile 100 is mounted. This allows for the formation of a lateral gap between the ceiling tile 100 and the grid of profiles 300. The lateral gap may have a width in the range of 1-6 mm. Optionally, the ceiling tile 100 could be provided with a perimeter portion 106 or side edge 108 that deviates from the surface shape of the web 304 of the grid of profiles 300, such that channels are formed between the web 304 and the ceiling tile 100.

[0037] As illustrated in Fig. 5, the ceiling tile 100 may further comprise a lower tongue 118 being arranged below the upper tongue 112. The lower tongue 118 may function to hide the grid of profiles 300 from view by reducing the gap between two ceiling tiles 100. The lower tongue 118 on two opposing perimeter portions 106 or side edges 108 of the ceiling tile 100 may protrude to a different distance as is illustrated in Fig. 6.

[0038] In Fig. 7, the ceiling tile 100 is shown in a front view illustrating the extension of the perimeter portion 106 thereof. The front surface 102 is arranged facing downwards in Fig. 7. The discrete arrangement of the spacer elements 20 along the perimeter portion 106 or side edge 108 of the ceiling tile 100 is shown. The spacing between the spacer elements 20 may be varied, and as mentioned above, the spacer elements 20 may be connected by a strip of material to facilitate mounting of the spacer elements 20 with the correct spacing on the ceiling tile 100. The spacer elements may be separated by a mutual distance in the range of 50-600 mm.

[0039] Turning to Fig. 8 in which a ceiling system 200 is shown and yet another embodiment of the ceiling tile 100 and the spacer element 20. In Fig. 8, the spacer element 20 anchoring portion 24 is configured to extend from the rear surface 104 through the ceiling tile 100 such that it protrudes from an opposite surface. The opposite surface may be the tongue surface 114 as shown in Fig. 8, but it could also be the front surface 102 for instance in an embodiment in which the ceiling tile 100 does not comprise a stepped profile 110. As the anchoring portion 24 will be subjected to an axial force from the ceiling tile 100, the anchoring portion 24 may be provided with threads or circumferential ribs for increasing the axial

load capability of the connection between the anchoring portion 24 and the ceiling tile 100. The spacer element 20 may further comprise a body portion 22 which is intended to abut against the rear surface 104 of the ceiling tile 100 and thus limit/define the protrusion of the anchoring portion 24 from the opposite surface, i.e. the tongue surface 114 or the front surface 102.

[0040] Figs 9 to 11 shows further embodiments of the ceiling system 200 and the spacer element 20 respectively. In Figs 9 and 10, the spacer element 20 is attached with the anchoring portion 24 extending laterally into the perimeter portion 106 of the ceiling tile 100. Any vertical force on the spacer element 20 from the ceiling tile 100 will thus not be transmitted in an axial direction of the anchoring portion 24, which is preferable in some applications. As shown in Fig. 9, the spacer element 20 could be arranged on a ceiling tile 100 with a stepped profile 110 such that the body portion 22 of the spacer element 20 abuts against the tongue surface 114. The anchoring portion 24 can thus be relieved of some or all of the vertical forces that arise from the ceiling tile 100 interaction with the grid of profiles 300.

[0041] In Fig. 10, the spacer element 20 is attached to the side surface 116 of the ceiling tile 100 such that it not only creates a vertical spacing between the ceiling tile 100 and the lateral flanges 302 of grid of profiles 300 but also a lateral or horizontal spacing between the ceiling tile 100 and the web 304 of the grid of profiles 300. This is beneficial as it provides a ceiling system 200 in which both the desired vertical as well as the desired lateral spacing is automatically created during mounting of the ceiling tile 100 to the grid of profiles 300. It is in Fig. 10 shown a ceiling tile 100 with a stepped profile 110 which is beneficial as the interface between the ceiling tile 100 and the grid of profiles 300 can be hidden. It is however to be realized that the the spacer element 20 also could be used with a ceiling tile 100 without a stepped profile 110, wherein the spacer element 20 is attached such that it extends below the front surface 102 of the ceiling tile 100 instead of below the tongue surface 114 as in Fig. 10.

[0042] Fig. 11 shows another embodiment of the spacer element 20 configured for lateral attachment to the ceiling tile 100. The spacer element 20 comprises one body portion 22 and two anchoring portions 24 for increasing the vertical load that can be placed on the body portion 22. It is to be realized that more than two anchoring portions 24 could also be used, further improving the attachment of the body portion 22 to the ceiling tile 100.

[0043] It will be appreciated that the present invention is not limited to the embodiments shown. Several modifications and variations are thus conceivable within the scope of the invention which thus is exclusively defined by the appended claims.

Claims

1. A ceiling tile (100) for a suspended ceiling system

- (200) comprising a grid of profiles (300) for supporting the ceiling tile (100), the ceiling tile (100) comprises a front surface (102) intended to face a room (10) in an installed state of the ceiling tile (100) and a plurality of spacer elements (20) discretely distributed along a perimeter portion (106) of the ceiling tile (100), wherein the plurality of spacer elements (20) being configured for separation of the ceiling tile (100) and the grid of profiles (300) in a direction perpendicular to the front surface (102).
2. The ceiling tile (100) according to claim 1, wherein the ceiling tile (100) comprises two opposite edges (108) each provided with a stepped profile (110) comprising an upper tongue (112) having a tongue surface (114) configured to face an associated supporting surface (302) on the grid of profiles (300), wherein the plurality of spacer elements (20) is configured to separate the tongue surfaces (114) and the associated supporting surface (302).
 3. The ceiling tile (100) according to claim 1 or 2, wherein the plurality of spacer elements (20) is arranged on the front surface (102) of the ceiling tile or a surface parallel thereto.
 4. The ceiling tile (100) according to claim 1 or 2, wherein the plurality of spacer elements (20) is arranged on a side surface (116) of the ceiling tile or a surface parallel thereto.
 5. The ceiling tile (100) according to any one of the preceding claims, wherein the plurality of spacer elements (20) is configured for engagement with the grid of profiles (300) for support of the ceiling tile (100).
 6. The ceiling tile (100) according to any one of the preceding claims, wherein the plurality of spacer elements (20) is configured for separation of the ceiling tile (100) and the grid of profiles (300) in a direction parallel to the front surface (102).
 7. The ceiling tile (100) according to any one of the preceding claims, wherein the plurality of spacer elements (20) is formed separately from the ceiling tile (100).
 8. The ceiling tile (100) according to claim 7, wherein each spacer element (20) comprises a body portion (22) and an anchoring portion (24) for attaching the body portion (22) to the ceiling tile (100).
 9. The ceiling tile (100) according to claim 7, wherein each spacer element (20) comprises a body portion (22) attached to the ceiling tile by means of an adhesive.
 10. A suspended ceiling system (200) comprising a grid of profiles (300) and a ceiling tile (100) according to any one of claims 1 to 9.
 11. The suspended ceiling system (200) according to claim 10, in which the grid of profiles (300) comprises profiles having an inverted T-shape with a web (304) and laterally extending flanges (302), wherein the ceiling tile (100) is supported by the flanges (302) via the plurality of spacer elements (20).

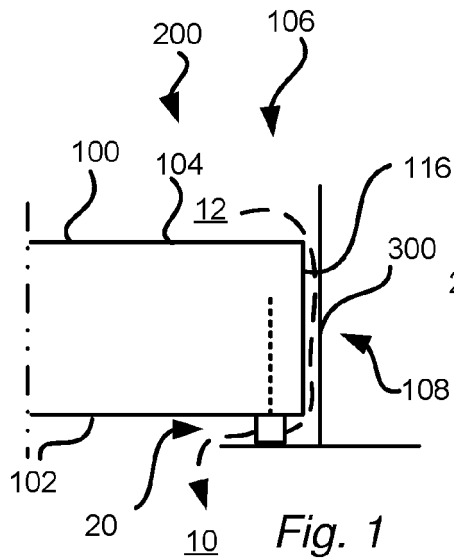
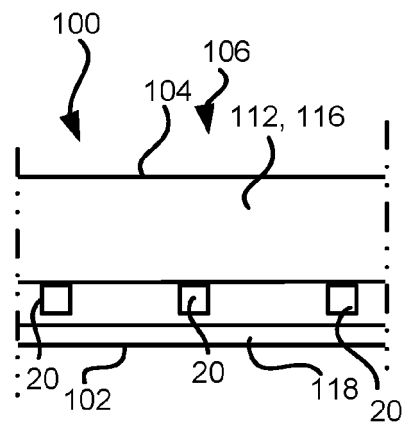
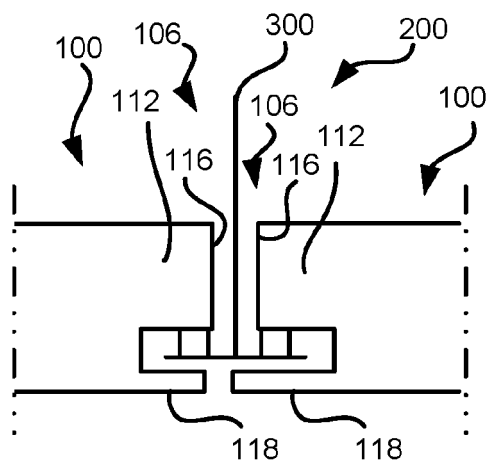
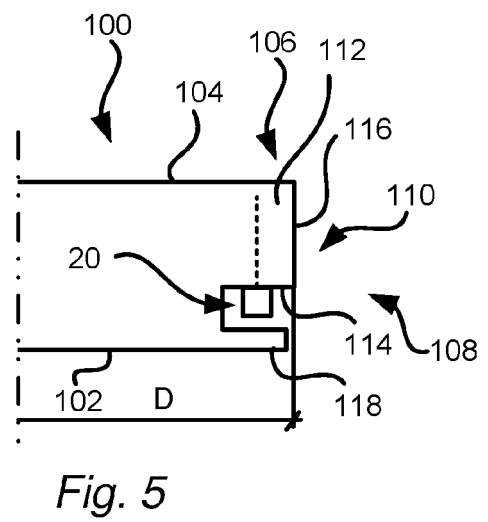
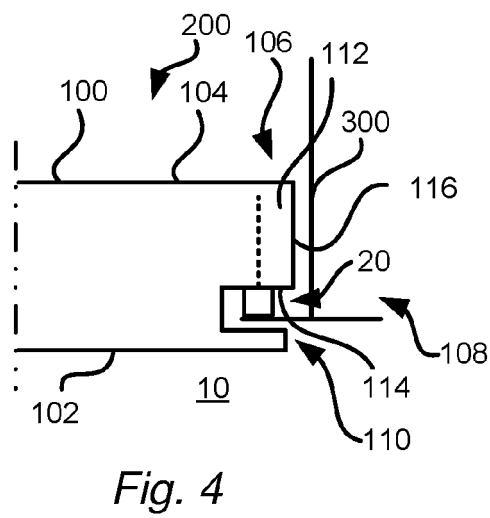
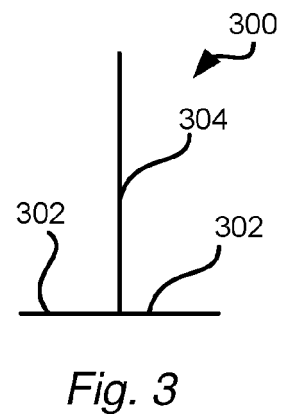
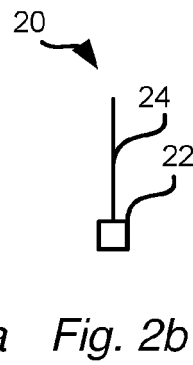


Fig. 2a



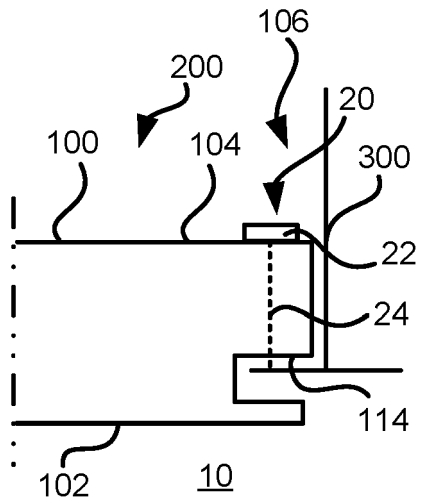


Fig.8

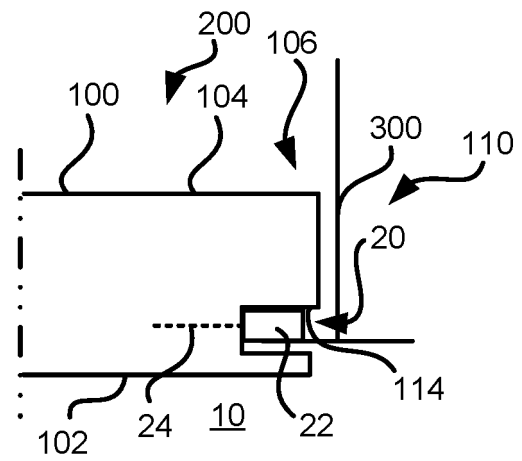


Fig. 9

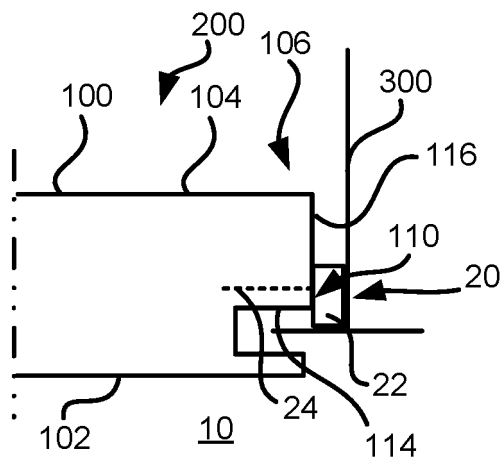


Fig. 10

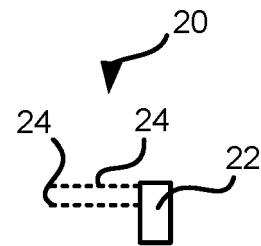


Fig. 11



EUROPEAN SEARCH REPORT

Application Number
EP 20 16 2918

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	US 5 033 247 A (CLUNN GORDON E [US]) 23 July 1991 (1991-07-23) * column 4, line 58 - column 9, line 6; figures 2a,5a *	1,3-7, 9-11	
A	EP 2 546 429 A1 (SAINT GOBAIN ECOPHON AB [SE]) 16 January 2013 (2013-01-16) * the whole document *	1-11	
A	EP 2 365 152 A1 (TNO [NL]) 14 September 2011 (2011-09-14) * the whole document *	1-11	
			TECHNICAL FIELDS SEARCHED (IPC)
			E04B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 September 2020	Examiner Lopes, Claudia
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 16 2918

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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30-09-2020

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2562323 A1 [0033]