(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
25 July 2019 (25.07.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/143238 A1

(51) International Patent Classification:
E04B 2/82 (2006.01)

(21) International Application Number:
PCT/NL2019/050019

(22) International Filing Date:
16 January 2019 (16.01.2019)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2020278 16 January 2018 (16.01.2018) NL

(71) Applicant: **STILL DESIGN B.V.** [NL/NL]; De Voerman 7, 5215 MH 's-Hertogenbosch (NL).

(72) Inventor: **PELSER, Gerardus Albertus Johannes Maria**; De Voerman 7, 5215 MH 's-Hertogenbosch (NL).

(74) Agent: **NEDERLANDSCH OCTROOIBUREAU**; P.O. Box 29720, 2502 LS The Hague (NL).

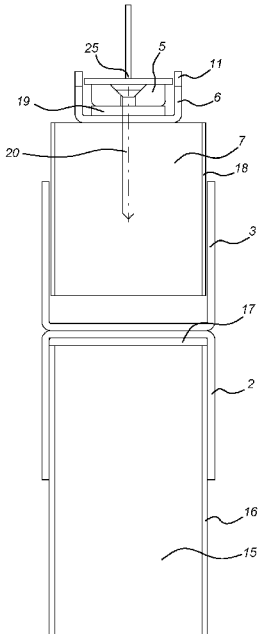
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) Title: PANEL ASSEMBLY

Fig. 2



(57) Abstract: A panel assembly (1) for installing a panel in a room, with an upper panel attachment element (2, 3) and an optional lower panel attachment element (12), arranged for holding a panel (15) in between. A ceiling mounting element (6, 7) is moveably coupled to the upper panel attachment element (2, 3), and has one or more magnets (5) for connection to metallic structure of the ceiling of a room, e.g. a belt grid. The ceiling mounting element 6 further comprises one or more extending lips (11).

WO 2019/143238 A1

Panel assembly

Field of the invention

The present invention relates to a panel assembly for installing a panel in a room, the panel assembly comprising an upper panel attachment element and a lower panel attachment element.

Background art

International patent publication WO2014/039278 discloses a moveable and demountable frameless wall panel system that is secured between a floor of a room and a ceiling rail secured to a ceiling of the room. The wall panel includes a frameless panel, an upper clamp assembly, and a lower clamp assembly. A ceiling track is configured to be removably inserted into the ceiling rail. The system further comprises a first height adjustment mechanism secured to the lower clamp assembly, and a second height adjustment mechanism.

US patent publication US 3,378,970 discloses a moveable interior wall construction for providing floor to ceiling partitions in rooms having suspended ceilings. The construction comprises rigid light weight panels having channel shaped space fillers at their top edge. Coupling of the panel to the ceiling is implemented using a two part magnetic coupling, wherein a first part is a ferromagnetic strip attached to the top of the space filler of the panel, and a second part is strip of plastic magnetic material. The first part in operation is affixed to a metal T-bar element from the suspended ceiling.

Summary of the invention

Modern day offices use various aids, such as flip-overs and (magnetic) white boards. moreover, building floor plans emphasising larger rooms and more open spaces are attracting attention widely. Choosing an open room space gives the advantage of flexibility wherein the room can be customised according to the requirements. Those multi-purpose rooms often use temporary room dividers that can be easily removed and fixed according to the specific requirement, as well as a variety of meeting support items such as flip-overs and white boards. Often the panels that are being used as the room dividers need to be removed and installed in a different orientation or location within a short time span. Hence, effective fixture means ensuring stability and durability is needed to fix such a panel into the ceiling as well as to the floor of a room, e.g. using ceiling (and floor) mounted rail systems. The present invention seeks to provide an improved and cost-effective panel assembly for easy and flexible installation in a room or office space.

According to the present invention, a panel assembly for installing a panel in a room as defined above is provided, comprising an upper panel attachment element, the upper panel attachment element being arranged for holding a panel, and a ceiling mounting element coupled to the upper panel attachment element, the ceiling mounting element comprising an elongate rail element with one or more magnets, wherein the elongate rail element further comprises one or more extending lips.

This allows easy removal and installation of a panel in a different location and orientation in the room without complex dismantling procedures. The present invention embodiments comprise

a ceiling mounting element having one or magnets that allow a flexible and cost effective means for assembling a panel into (metal parts of) the ceiling of a room. Moreover, magnetic securing means provide additional advantages of less mechanical failure and less wear and tear.

Further embodiments are described by the dependent claims.

Short description of drawings

The present invention will be discussed in more detail below, with reference to the attached drawings, in which

Fig. 1 shows a perspective view of a panel assembly according to an embodiment of the present invention,

Fig. 2 shows a partial cross sectional view of an upper part of the panel assembly according to a further embodiment of the present invention,

Fig. 3 shows a partial cross sectional view of a lower part of the panel assembly according to a further embodiment of the present invention, and

Fig. 4 shows a side view of the upper part of the panel assembly of Fig. 2.

Description of embodiments

Panels are widely being used as dividers in rooms and office spaces. Generally, these panels are installed in multi-purpose rooms that can be easily altered in orientation and where permanent wall dividers are not preferred. Removable panels (e.g. using rail based systems) offer the flexibility to customise a room as per a specific requirement, in a temporary or even in a permanent manner. Typically, removable panels utilize panel assemblies (e.g. panel securing/supporting structures) having a number of components that are used to connect and support the panel with the ceiling, floor and/or with other panels. These existing panel assemblies require complex dismantling or removal procedures.

According to the present invention embodiments a panel assembly 1 is provided for installing a panel in a room, comprising an upper panel attachment element 2, 3, the upper panel attachment element 2, 3 being arranged for holding a panel 15, and a ceiling mounting element 6, 7 coupled to the upper panel attachment element 2, 3, the ceiling mounting element 6, 7 comprising an elongate rail element 6 with one or more magnets 5. Such a panel assembly 1 may be advantageously used as a removable panel or even room divider in an office space, but is was also found to be very good usable for other office type of usage, which require a flexible positioning, such as a whiteboard, memo attachment panel, or sound dampening panel. The one or more magnets 5 are used to firmly connect to available metallic parts of the ceiling of the office space, such as a belt grid 25 arranged to hold (lightweight) ceiling panels. Because of the often limited dimensions of ceiling panels, such a belt grid 25 has a regular and fine pitched pattern, allowing to position the panel assembly 1 in a very flexible manner in an office space. Further advantage is that the panel assembly 1 can also be easily removed, without leaving any visible traces, such as damage to ceiling panels.

The present invention may be implemented in an exemplary embodiment of a panel assembly 1 as partially shown in Fig. 1. The panel assembly 1 in this exemplary embodiment

comprises an upper panel attachment element 2, 3 and a lower panel attachment element 12 for holding a panel in between. For illustration purposes, the panel is not shown in Fig. 1. The panel assembly 1 parts as shown are arranged to hold the panel of a predetermined size compatible with the width of the upper panel assembly 2, 3 and the lower panel attachment element 12.

It is noted that even though the exemplary embodiments of the panel assembly described in Fig. 1-4 of the present invention show a panel assembly designed to hold a rectangular panel 15, the panel can be of any shape, e.g. curved panels are also possible. The panel 15 can be used for various applications such as, but not limited to, a room divider, a writing/erasing panel (e.g. a white board, a chalk board), a sound damping panel or as a (magnetic) memo holding/collection panel, or even for aesthetic/decoration purposes.

The one or more magnets 5 can be permanent magnets (e.g. a Neodymium based magnet) conveniently shaped to be held in the elongate rail element 6, e.g. disc shaped. The one or more magnets 5 can be selected to have sufficient pulling force to possibly even hold the weight of the entire panel assembly 1, although in case the panel assembly 1 touches the floor it is sufficient to have a pulling force to firmly hold the ceiling mounting element 6, 7 to the ceiling structure, such as the belt grid 25. The pulling force of the magnet depends on various parameters such as, thickness, material and the geometry of the magnet being used. Such a magnetic securing means provide additional advantages of less mechanical failure and less wear and tear. In an exemplary embodiment, each magnet 5 is embodied as a pot magnet with a diameter of 20mm providing a holding force of about 9 kg. The magnet 5 can further be provided with a sunken fixation hole, which allows to connect the magnet 5 to the elongate rail element 6 using a screw fixation and yet provide an entirely flat top surface

As shown in Fig. 1, 2 and 4, the upper panel attachment element comprises a panel holding part 2 and an upper mounting part 3 wherein the upper mounting part 3 is arranged on the upper side of the panel holding part 2. Fig. 2 shows a partial cross sectional view of details of an upper part of the panel assembly 1 according to a further embodiment of the present invention. Fig. 4 shows a side view of the upper part of the panel assembly of Fig. 2. The term ‘upper’ in the context of this description refers to the side of the panel assembly 1 facing the ceiling of the room during use. The panel holding part 2 and the upper mounting part 3 can be manufactured as separate components, which can be connected together during assembly. Alternatively the combination of panel holding part 2 and upper mounting part 3 can be manufactured as an individual, single component. The upper mounting part 3 of the panel assembly 1 is arranged to hold and connect to a ceiling element 6, 7. An elongate rail element 6 of the ceiling mounting element can be arranged in the same orientation as the upper mounting part 3, which in this exemplary embodiment is attached to a mounting body 7. One embodiment of the present invention relates to a panel assembly 1, wherein a ceiling mounting element 6, 7 is moveable with respect to the upper panel attachment element 2, 3. The movement is advantageously only in a vertical direction with respect to the upper panel attachment element 2, 3 during use, but additionally or alternatively can also be arranged to be in a horizontal direction. The embodiment depicted in Fig. 1 of the present invention shows that the ceiling mounting element 6, 7 is moveable in an up/down direction with respect to

the upper mounting part 3. The movement of the ceiling mounting element 6, 7 gives the flexibility to efficiently fix the panel assembly 1 to the ceiling of an office space.

A further embodiment of the present invention relates to a panel assembly 1, wherein the ceiling mounting element 6, 7 is connected to the upper panel attachment element 2, 3 by means of a slit-pin arrangement 4, 8, wherein the slit 4 is oriented substantially perpendicular to the elongate rail element 6, as visible in the exemplary embodiments shown in Fig. 1 and Fig. 4. For example, a slit (or slit hole) 4 can be oriented at an angle of 90° with respect to the elongate rail element 6. In such an embodiment, the slit 4 is positioned in the upper mounting part 3 and a pin 8 is positioned in the mounting body 7 of the ceiling mounting element 6, 7. The skilled person will recognise that the pin 8 can also be positioned in the upper mounting part 3 and then the slit 4 can be positioned in the mounting body 7 of the ceiling mounting element 6, 7. The pin 8 can have a head end that can enter into the slit 4 to ensure a flexible fixture means with which the ceiling mounting element 6, 7 can be positioned and moveably fixed to the upper panel attachment elements 2, 3. The movement of the ceiling mounting element 6, 7 is limited when the pin 8 touches the upward or the downward end of the slit 4, yet is of a dimension sufficient to allow for proper positioning of the panel assembly 1 with panel 15 with a predetermined amount of playroom to cater for different ceiling heights (e.g. by making the slit 4 by having a length of 35mm). There can be a plurality of slit-pin arrangement present within the panel assembly 1. The exemplary embodiment of Fig. 4 e.g. depicts four of such slit-pin arrangements 4, 8 in the upper mounting part 3 and the mounting body 7.

A further embodiment of the present invention relates to a panel assembly 1, wherein the elongate rail element 6 further comprises one or more extending lips 11. The one or more extending lips 11 can be placed symmetrically as pairs on either side of the elongated rail element 6. The one or more extending lips 11 will prevent the panel assembly 1 (and in particular the one or more magnets 5) from slipping off the belt grid 25 of the ceiling of the room. The extending lips 11 can be made of any shape, thickness and width as long as it will prevent the one or more magnets 5 from slipping off the belt grid 25. Fig. 1 shows four extending lips 11 arranged symmetrically (or in pairs) on two sides of the elongated rail element 6 and Fig. 2 shows a cross sectional view of two of the extending lips 11. A further embodiment of the present invention relates to a panel assembly 1, wherein the one or more extending lips 11 have a height of at least 2 mm, e.g. 4 mm, which will effectively hold the panel assembly 1 from sideways motion away from the belt grid 25. In practical implementations, the extending lips 11 can be embodied as (integral) part of the elongated rail element 6, or as components attachable to the elongated rail element 6.

A further embodiment of the present invention relates to a panel assembly 1, wherein the upper panel attachment element 2, 3 comprises two back-to-back connected U-shaped profiles, as shown in the partial cross sectional view of Fig. 2. The term 'U-shaped profile' refers to a structure having two legs, which are connected by a joining portion, i.e. an elongate profile with a U shaped cross section. The two back-to-back connected U-shaped profiles can be of different lengths, widths and thicknesses, adapted to the specific function of the panel holding part 2 and upper mounting part 3. In one embodiment of the present invention, the back-to-back connected U-shaped profiles

can be symmetric relative to each other. As shown in Fig. 2, the upward end of the U-shaped profile (upper mounting part 3) is arranged to interact with the ceiling mounting element 6, 7 and the downward end of the U-shaped profile (panel holding part 2) is arranged to attach to a panel 15. The panel 15 is placed in between the U-shaped profile of the panel holding part 2 such that a panel surface 16 is arranged to be in contact with the inner side of the downward U-shaped profile. A panel fitting layer 17 is placed in between panel 15 and the inner top side of the downward U-shaped profile 2.

A further, alternative embodiment of the present invention relates to a panel assembly 1, wherein the upper panel attachment element 2, 3 comprises an H-shaped profile. In such an embodiment, the H-shaped profile can be arranged to hold the panel 15 in its lower, down facing end and the mounting body 7 in its upper, upward facing end. The H-shaped profile is alternative to two U-shaped profiles.

As shown in Fig. 2, the mounting body 7 comprises a mounting surface 18 that is arranged to be in contact with the inner surface of the upward U-shaped profile of upper mounting part 3. The mounting surface 18 is chosen as a low friction layer, to allow movement between upper mounting part 3 and mounting body 7 of the ceiling mounting element 6, 7. A protection ring 19 is present and placed in between the elongate rail element 6 and the one or more magnets 5 in order to protect the one or more magnets 5 from any possible wear and tear or damage. Some embodiments of the present invention relate to a panel assembly 1, wherein the elongate rail element 6 comprises a U-shaped profile, wherein the one or more magnets 5 are positioned in an open end of the U-shaped profile. The magnets 5 may be high force magnets having any size or any shape. For example, the magnet can be of 6mm high and 20mm in diameter. A magnet fixation element 20 is arranged to fixate the one or more magnets 5 with the mounting body 7. The magnet fixation element 20 can be a screw that can penetrate through the protection ring 19, elongate rail element 6 and into the mounting body 7. The mounting body 7 comprises pins 8, which as described above can be inserted in the slit 4 in order to make a proper positioning of the ceiling mounting element 6, 7 with respect to upper mounting part 3.

The one or more magnets 5 are arranged to connect with a belt grid 25, which is shown in Fig. 2, but not part of the panel assembly 1, but part of the existing ceiling structure in an office space. The belt grid 25 is made up of a magnetic material (e.g. iron) and is attached to or part of the ceiling of the room. The one or more magnets 5 are arranged to magnetically connect to the belt grid 25.

In an alternative embodiment of the present invention the ceiling mounting element 6, 7 comprises an H-shaped profile, wherein the one or more magnets 5 are positioned in an open end of the H-shaped profile (i.e. the elongate rail element 6 part of the H-profile. The pins 8 can then extend from upright sides of the H-profile. This provides an alternative implementation of specifically the mounting body 7 as shown in the exemplary embodiment of Fig. 1 and 2, where the mounting body 7 is e.g. implemented as a rectangular wooden beam.

A further embodiment of the present invention relates to a panel assembly 1, wherein profiled parts (2, 3, 6, 12) of the panel assembly 1 are made of a lightweight metal. The light weight

material based profiled parts can be manufactured and assembled using time and cost effective processes. The light weight material can be aluminium or a composite material.

A further embodiment of the present invention relates to a panel assembly 1, wherein the panel assembly 1 further comprises a panel 15 attached to the upper panel attachment element 2, 3 and a lower panel attachment element 12 attached to the panel 15, the panel 15 comprising a lightweight material. The profiled parts (2, 3, 6, 12) and the panel 15 can be made of different material or of the same material. Fig. 2 and 3 show partial cross sectional views of upper and lower parts of the panel assembly 1 wherein the panel 15 is attached to the upper panel attachment element 2 and the lower panel attachment element 12. The dimensions of the panel 15 are for example, 900 mm wide and the height can be compatible with the room height (e.g. about 2400mm). There are some height adjustments possible within the top (upper part facing the ceiling) and bottom (lower part facing the floor) sides of the panel assembly 1. For example, the height can be adjusted by using a space in between the inner surface of the upper mounting part 3 and the lower surface of the mounting body 7, which is possible because of the slit-pin arrangement 4, 8 of the exemplary embodiments described above. The present invention embodiments allow the entire panel assembly 1 to be easily handled by a single person, both when installing and when removing the panel assembly 1.

An even further embodiment of the present invention relates to a panel assembly 1, wherein the panel 15 further comprises a coating layer 16 on one or both sides of the panel 15. By having a coating layer 16 on one or both sides of the panel, the panel assembly 1 can be used for a specific purpose on one or both sides thereof. A further embodiment of the present invention relates to a panel assembly 1, wherein the coating layer 16 comprises one or more from the group of: a whiteboard layer; a magnetic layer; a sound damping layer; a protection layer. The coating layer 16 can be a paint such as an epoxy based paint. An example is a white board paint that can be coated to the panel 15, which will make the panel 15 into a writeable-erasable surface. The coating layer 16 can be a chalk board paint that can be coated on one or both sides of the panel 15 to use it as chalk board based writeable-erasable surface. In some embodiments, the coating layer 16 can be mixture with magnetic particles present in it. The panel 15 coated with such a magnetic layer will allow the panel to hold magnetic items or items (e.g. papers) with a magnet placed together with it. The coating layer 16 can be a protection layer, which protects the panel 15 from scuffs and scratches caused by movement and knocks from other objects.

In some embodiments of the present invention, the panel 15 can be a panel of 40 mm thick, wherein the coating layer 16can be approximately 1.2 mm thick. The panel 15 itself is advantageously of a lightweight material, such as (corrugated) cardboard. In an exemplary implementation, the panel 15 has a dimension in height direction of about 2700mm, and is e.g. divided in a number of functional parts (e.g. a white board part in the middle of about 1600mm, and sound proofing parts above and below the white board part).

A further embodiment of the present invention relates to a panel assembly 1, wherein the panel 15 is at least partially a sound damping panel. The sound damping panel can be a fabric wrapped panel or a metal coated panel. In some examples, the sound damping panel can be a

panel that has structural modifications, for example, a plurality of holes or grooves which are patterned on one or both of its surfaces, or penetrating throughout the panel 15. In some embodiments, a fibrous material or a sound damping coating can be attached to the surfaces of the sound damping panel..

A further embodiment of the present invention relates to a panel assembly 1, wherein the lower panel attachment element 12 comprises one or more adjustable support feet 22. The one or more adjustable support feet 22 also allow to adjust the height of the panel assembly, e.g. to ensure a good contact between the one or more magnets 5 and belt grid 25.. As shown in Fig. 3, one or more (adjustable) support feet 22 are arranged perpendicularly to the elongate direction of the lower panel attachment element 12 and also provide additional support to the panel assembly 1. A panel fitting layer 23 may be placed on the bottom part of the panel 15 (inside the lower panel attachment element 12(, similar to the panel fitting layer 17 discussed above with reference to Fig. 2. The support feet 22 allow proper fixation and/or alignment of the panel assembly 1 with respect to the floor of the room. It also ensures that the panel assembly 1 can be installed in a stable manner. In even further embodiments of the present invention, the one or more adjustable support feet 22 can be fitted with wheels attached to it to make the panel assembly 1 easily movable over the floor. In an even further alternative embodiment, the bottom side of the lower panel attachment element 12 is provided with a rubber strip or other gripping surface only, which ensures secure positioning of the panel assembly 1 between floor and ceiling.

The present invention has been described above with reference to a number of exemplary embodiments as shown in the drawings. Modifications and alternative implementations of some parts or elements are possible, and are included in the scope of protection as defined in the appended claims.

Claims

1. A panel assembly (1) for installing a panel in a room, comprising
an upper panel attachment element (2, 3), the upper panel attachment element (2, 3) being arranged for holding a panel (15), and
a ceiling mounting element (6, 7) coupled to the upper panel attachment element (2, 3), the ceiling mounting element (6, 7) comprising an elongate rail element (6) with one or more magnets (5), wherein the elongate rail element (6) further comprises one or more extending lips (11).

2. The panel assembly(1) according to claim 1, wherein the ceiling mounting element (6, 7) is moveable with respect to the upper panel attachment element (2, 3).

3. The panel assembly (1) according to claim 2, wherein the ceiling mounting element (6, 7) is connected to the upper panel attachment element (2, 3) by means of a slit-pin arrangement, wherein the slit (4) is oriented substantially perpendicular to the elongate rail element (6).

4. The panel assembly (1) according to any one of claims 1-3, wherein the one or more extending lips (11) have a height of at least 2 mm, e.g. 4 mm.

5. The panel assembly (1) according to any one of claims 1-4, wherein the upper panel attachment element (2, 3) comprises two back-to-back connected U-shaped profiles.

6. The panel assembly (1) according to any one of claims 1-4, wherein the upper panel attachment element (2, 3) comprises an H-shaped profile.

7. The panel assembly (1) according to any one of claims 1-6, wherein the elongate rail element (6) comprises a U-shaped profile, wherein the one or more magnets (5) are positioned in an open end of the U-shaped profile.

8. The panel assembly (1) according to any one of claims 1-6, wherein the ceiling mounting element (6, 7) comprises an H-shaped profile, wherein the one or more magnets (5) are positioned in an open end of the H-shaped profile.

9. The panel assembly (1) according to any one of claims 1-8, wherein profiled parts (2, 3, 6, 12) of the panel assembly (1) are made of a lightweight material.

10. The panel assembly (1) according to any one of claims 1-9, wherein the panel assembly (1) further comprises a panel (15) attached to the upper panel attachment element (2, 3) and a lower panel attachment element (12) attached to the panel (15), the panel (15) comprising a lightweight material.

11. The panel assembly (1) according to claim 10, wherein the panel (15) further comprises a coating layer (16) on one or both sides of the panel (15).

12. The panel assembly (1) according to claim 11, wherein the coating layer (16) comprises one or more from the group of: a whiteboard layer; a magnetic layer; a sound damping layer; a protection layer.

13. The panel assembly (1) according to any one of claims 10-12, wherein the panel (15) is at least partially a sound damping panel.

14. The panel assembly (1) according to any one of claims 10-13, wherein the lower panel attachment element (12) comprises one or more adjustable support feet (22).

****

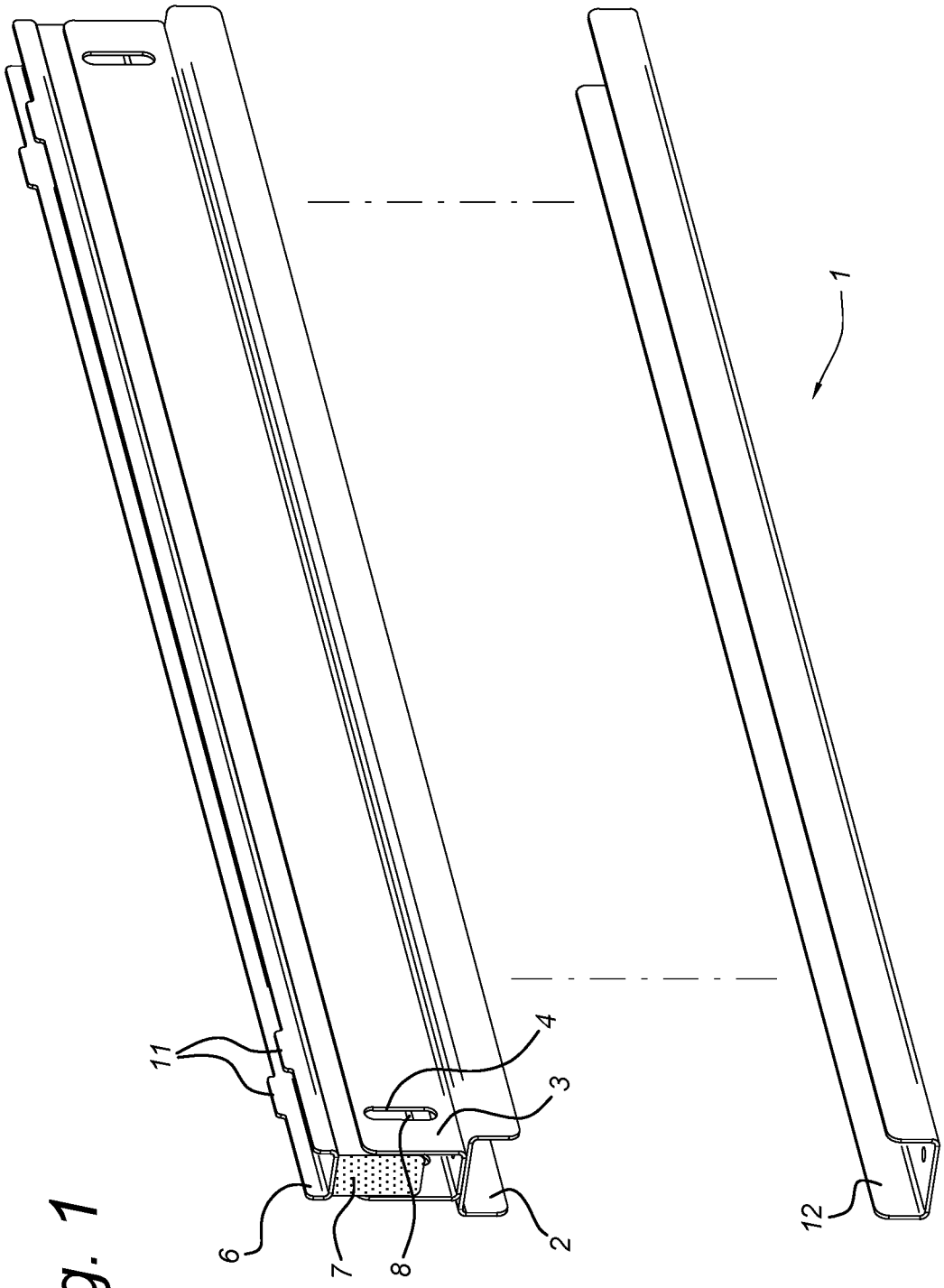


Fig. 1

Fig. 2

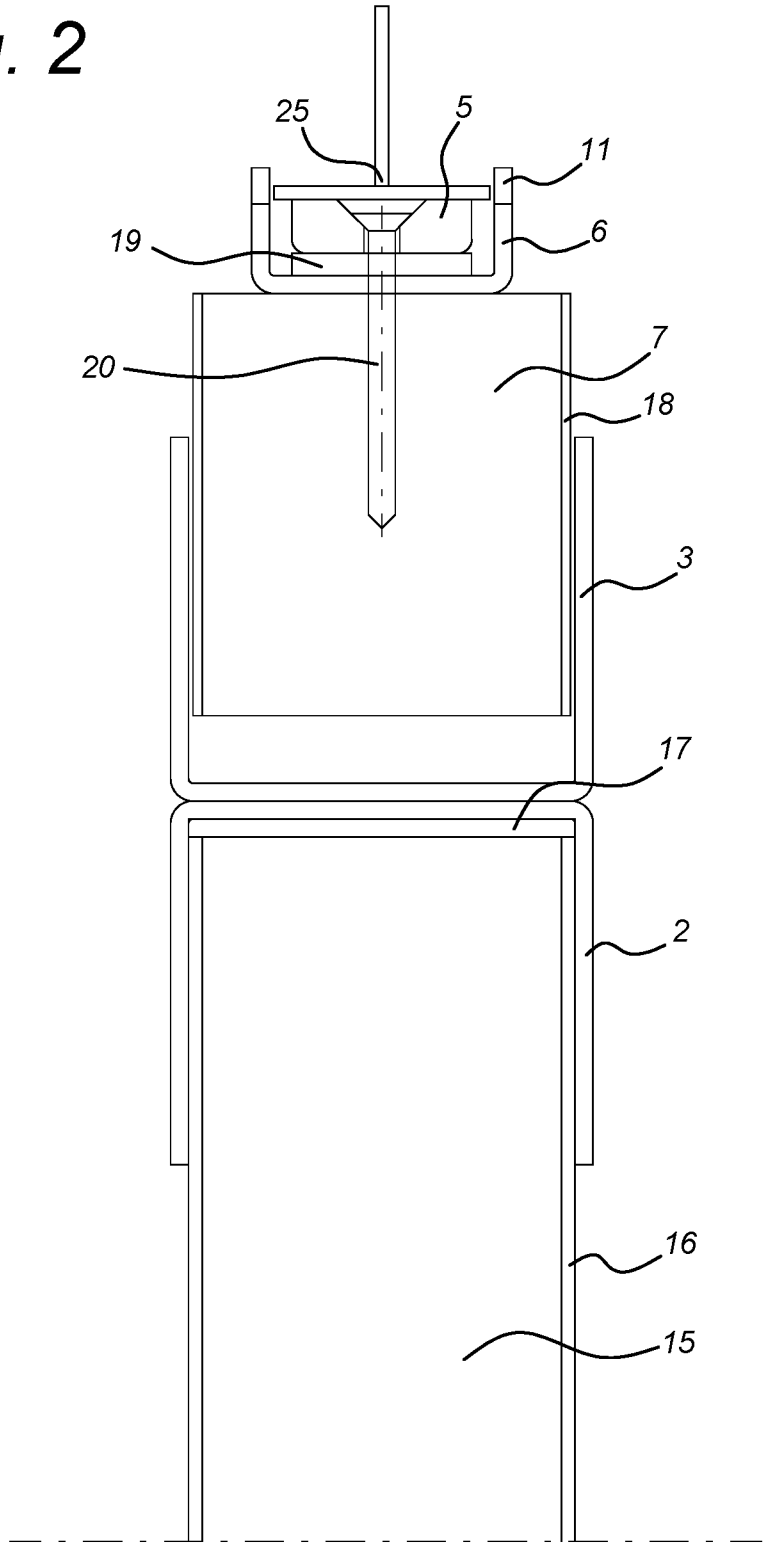


Fig. 3

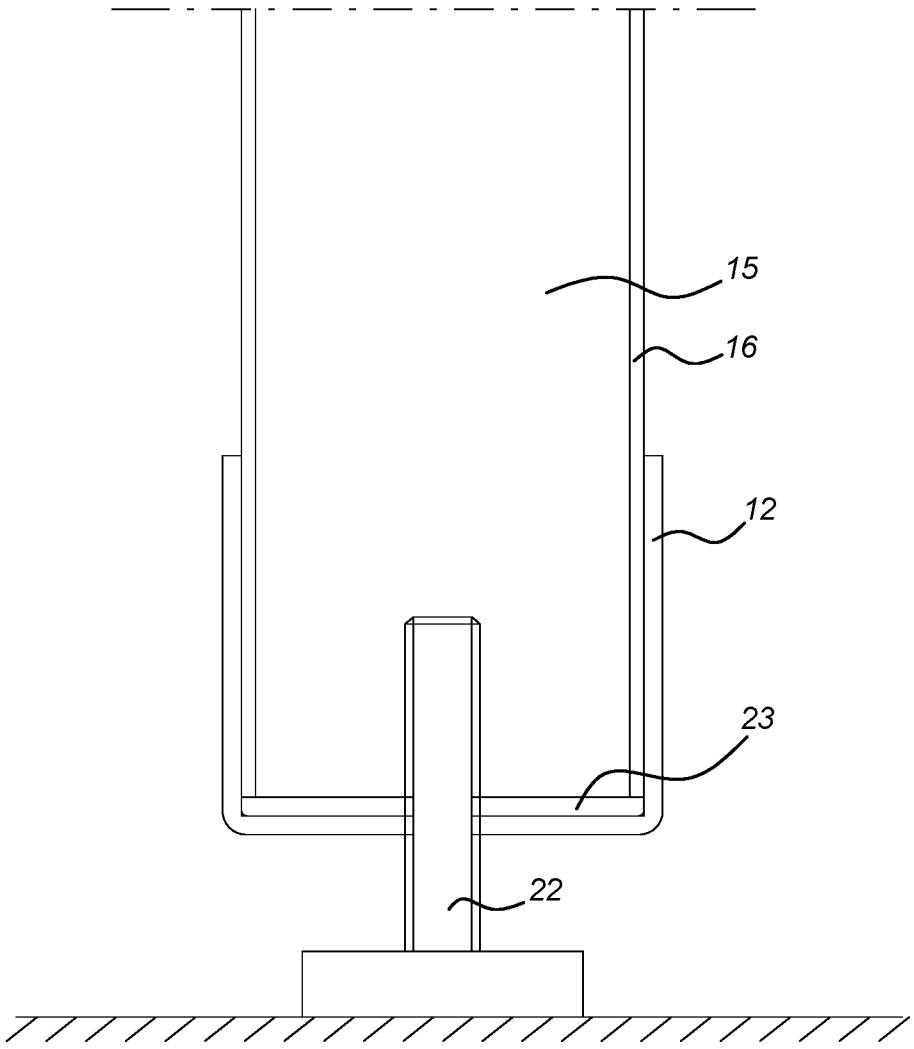
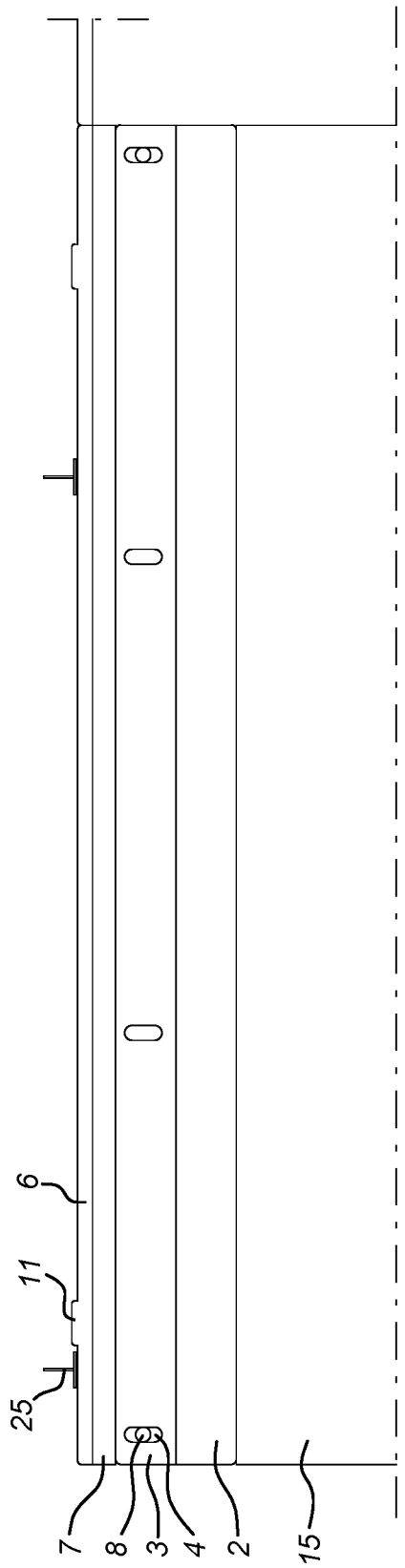


Fig. 4



INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2019/050019

A. CLASSIFICATION OF SUBJECT MATTER
INV. E04B2/82
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 378 970 A (IMBRECHT ARTHUR G) 23 April 1968 (1968-04-23) column 1, line 58 - column 3, line 69; figures 1-5	1-14
A	US 4 263 761 A (KRISTOFF KIM C) 28 April 1981 (1981-04-28) column 3, line 10 - column 5, line 7; figures 1-6	1-14
A	DE 28 36 126 A1 (VKI RHEINHOLD & MAHLA AG) 28 February 1980 (1980-02-28) page 13, line 8 - page 15, line 15; figures 1-2	1-14

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 May 2019	03/06/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Dieterle, Sibille

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/NL2019/050019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3378970 A	23-04-1968	NONE	
US 4263761 A	28-04-1981	CA 1151386 A	09-08-1983
		US 4263761 A	28-04-1981
DE 2836126 A1	28-02-1980	NONE	