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(54) **DAMPING ASSEMBLY**

DÄMPFUNGSANORDNUNG

ENSEMBLE D'AMORTISSEMENT

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Description

TECHNICAL FIELD

[0001] The present invention relates to a damping assembly for reducing vibrations, sound or noise. In particular the damping assembly is suitable for reducing vibrations, sound or noise propagating from one room of a building or accommodation to an adjacent room.

BACKGROUND

[0002] Undesired sound or noise, propagating from one room in a building to another, may have a negative impact on people's health. Common measures for sound proofing include increasing the thickness of the separating wall or floor/ceiling, adding an additional amount of sound damping material and increasing the number of composing layers of the separating wall or floor/ceiling. Additional measures include the employment of highly specialized damping materials built in or applied to the separating wall or floor/ceiling. However, these solutions are associated with high costs.

[0003] One mechanism, by which sound or noise propagates through a wall or floor/ceiling, involves mechanical communication between rigid parts therein. Such mechanical communication is largely due to the use of traditional stationary fastening elements, such as e.g. monolithic metallic screws or nails.

[0004] Resilient fastening elements, such as e.g. the resilient fixing arrangement of WO 2008/115119 A1, is generally preferred over traditional stationary fastening elements for assembly of separate parts of a wall or ceiling/floor, in order to achieve reduced transmission of sound or noise there through. A resilient fastening element generally comprises a spring means for resiliently retaining the different constructions at a distance from each other, thereby as far as possible preventing mechanical contact between the constructions. Improper assembly of such resilient fastening elements with the separate parts and/or in combination with other features of these separate parts may, however, result no or even increased transmission of sound or noise, which is highly undesired. For example, improper assembly may yield an internally resonating wall or floor/ceiling, which is less damping than the corresponding wall or floor/ceiling in which traditional stationary fastening elements have been used.

[0005] Hence, an improved damping assembly, e.g. damping wall or floor/ceiling, for reduction of vibrations, sound or noise would be advantageous.

SUMMARY

[0006] It is an object of the present invention, considering the disadvantages mentioned above, to provide an improved damping assembly which effectively reduces vibrations, sound or noise between two structures.

[0007] According to the invention, a damping assembly for reducing vibration, sound or noise propagation between at least two structures having the features of claim 1 is provided.

[0008] It is another object of the present invention, to provide a damping assembly which may be produced at a low cost in comparison to present techniques for achieving reduction of vibrations, sound or noise.

[0009] It is yet another object of the present invention, to provide a damping assembly, e.g. a wall or floor/ceiling, which is thinner than a damping wall or floor/ceiling of the prior-art, also allowing for equal or improved sound reduction capability.

[0010] These and other objects, which will appear from the following description. Further features of the invention and its embodiments are set forth in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] These and other aspects, features and advantages of which the invention is capable will be apparent and elucidated from the following description of non-limiting embodiments of the present invention, reference being made to the accompanying drawings, in which

Fig. 1 illustrates a damping assembly according to an embodiment;

Figs. 2a and 2b disclose a damping assembly in which the first perpendicular distance L1 is equal to the second perpendicular distance L2 resulting in relatively poor sound damping properties;

Fig. 3 illustrates a damping assembly according to a further embodiment including a flexible material structure provided in a volume thereof;

Fig. 4 illustrates a damping assembly similar to that of Fig. 2 provided with an alternative flexible material structure in a volume thereof;

Fig. 5 illustrates a damping assembly according to a further embodiment, wherein two inner ceiling or inner wall structures are connected on either side of a studwork structure by means of a resilient attachment member;

Fig. 6a illustrates a damping assembly according to an embodiment, wherein two inner ceiling or inner wall structures are connected on either side of a studwork structure fixedly attached to a foundation structure 104;

Fig. 6b illustrates a damping assembly according to an embodiment, wherein two inner ceiling or inner wall structures are connected on either side of a studwork structure, without any foundation structure 104 arranged between the two studwork structures 102; Fig. 7a illustrates a damping assembly according to an embodiment, similar to that of Fig. 1 provided with a further first structure glued to the first structure; Fig. 7b illustrates a damping assembly, according to an embodiment, similar to that of Fig. 1 and provided with further first structure rigidly screwed to the first

structure by means of conventional screws 701; Fig. 8 illustrates a damping assembly, according to an embodiment, similar to that of Fig. 1 provided with a further first structure wherein the resilient attachment member is provided straight through the two inner wall or inner ceiling structures; Fig. 9a illustrates a damping assembly according to an embodiment, in which a first structure 101 is connected to a studwork structure 102 to a second structure 104, by means of a resilient attachment member 103, wherein the resilient part of the resilient attachment member is positioned between the studwork structure 102 and the second structure 104. An additional inner ceiling or inner wall structure 601 is rigidly arranged to the first structure 101 by means of non-resilient conventional attachment screws; Fig. 9b illustrates a damping assembly according to an embodiment, in which the two inner wall or ceiling structures are connected together using commonly known attachment members, such as screws, and one of the inner wall or ceiling structures are connected using resilient attachment members to the studwork structure, wherein the intermediate resilient portion 302 of the resilient attachment member 103 is positioned between the studwork construction 102 and a foundation structure 104; and Fig. 10 illustrates a damping assembly according to an embodiment being provided with two inner ceiling or two inner wall structures with a resilient attachment member being provided straight through the inner wall or ceiling structures and anchored to the studwork construction.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0012] Embodiments of the present invention will be described in more detail below with reference to the accompanying drawings in order for those skilled in the art to be able to carry out the invention. The 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 so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. The invention is only limited by the appended patent claims. Furthermore, the terminology used in the detailed description of the particular embodiments illustrated in the accompanying drawings is not intended to be limiting of the invention.

[0013] An idea of the invention is to provide a noise reducing assembly for walls or ceilings, wherein the at least two wall sections are resiliently attached to each other, in a way such that a first volume is created between the two wall sections near the position of the resilient attachment, and a second volume being larger than the first volume is created further away from the position of the resilient attachment. The first and second volumes act as dampeners which allows for noise reduction.

[0014] A further idea is to allow for a solution of improved noise reduction for an existing wall or ceiling.

[0015] In an embodiment, according to Fig. 1, a damping assembly 10 for reducing vibrations, sound or noise propagation between at least two structures is provided. The damping assembly comprises a first structure 101, such as an inner ceiling construction. Moreover, the damping assembly comprises at least one studwork structure 102 to which the first structure is to be connected. At least one resilient attachment member 103 is provided for resiliently attaching the first structure 101 to the studwork structure 102. When attached to the first structure and the at least one studwork structure the at least one resilient attachment member 103 creates a space between the first structure and the at least one studwork structure, such that the first structure 101 and the at least one studwork structure 102 are contact with each other only via the resilient attachment member(s) 103. A first perpendicular distance L1 from the first structure to the studwork construction defines the space between the two. The at least one studwork structure 102 is connected to a second structure 104, 101 oppositely arranged to that of the first structure 101. The second structure may e.g. be a wall foundation or another inner wall or ceiling. The dimensions of the studwork construction and the placement of the second structure 104, 101 in relation to the studwork structure results in the second structure being at a second perpendicular distance L2 from the first structure 101.

[0016] The first perpendicular distance L1 and a surface area of the at least one studwork structure 102 facing the first structure 101 form a first volume V1. Although Fig. 1 is a two dimensional cross sectional view of the first volume V1 has been indicated for improved understanding. In Fig. 1 it actually relates to an area due to the two-dimensional drawing, however it should be appreciated that the volume extends in along the depth of the damping assembly in reality. Moreover, the second perpendicular distance L2 and a surface area of the second structure 104, 101 facing the first structure 101 form a total volume between the first and second structure. The total volume when subtracted with the first volume V1 and a volume of the studwork structure Vs form a second volume V2. Hence, the total volume between the first structure and the second structure is made up by the first volume, the second volume and the volume of the studwork structure. The present inventors have realized that when the second volume is larger than the first volume, the first perpendicular distance or first volume is greater than zero, and when the second perpendicular distance L2 is larger than the first perpendicular distance L1, an improved noise reduction between the first 101 and second structures 104 is noticeable. Hence, arranging the assembly in a way that the second volume is larger than the first volume is advantageous.

[0017] Accordingly, by arranging the second perpendicular distance L2 to be larger than the first perpendicular distance L1, a further improved sound damping ef-

fect is obtained.

[0018] Having Fig. 1 in mind, propagating sound waves originating from the left side of the first structure 101 will be absorbed by the first structure 101, as well as by the resilient attachment member 103, whereby the first structure 101 will start oscillating in relation to the second structure 104. Furthermore, ambient atmospheric gas residing between first structure second structure in use, will also act as a dampener for the relative oscillation of the first and second structures, thereby reducing sound transport between the first 101 and second structures 104. Moreover, as the first structure 101 and the second structure 104 are only in direct contact with each other via the resilient attachment members 103, the mechanical sound transport between the first structure and the second structure is kept to a minimum.

[0019] The first structure 101 may be a plasterboard, Medium Density Fibreboard (MDF) board, High Density Fibreboard (HDF), Plywood, chipboard, Oriented Strand Board (OSB) or being of any other sheet of material suitable for an inner ceiling or wall.

[0020] By keeping the entire wall or ceiling construction as thin as possible, the room area or room volume will be as large as possible, which is highly desired. However, in order to get improved sound damping effects, currently additional plasterboards usually are added to the inner wall surface, which gives an additional average sound damping effect of about 5dB. However, not only is more material needed, but also the room area or room volume suffers from the additional plasterboard arrangement.

[0021] The present damping assembly allows for a thin sound damping wall construction.

[0022] Experiments performed by the present inventors have shown that the damping assembly in accordance with the embodiment, shown in Fig. 1, may reduce the sound by 8dB in comparison to a common wall or ceiling in which the first structure is rigidly attached to the studwork construction in such a way that L1 is zero. The sound damping of 8dB was observable in the noise frequency range of 50Hz to 5000Hz.

[0023] Given that adding a further first structure generally dampens the sound by 5dB, the present invention dampens sound better with only a single first structure resiliently attached to a studwork structure, than a conventional solution in which two first structures are rigidly attached to the studwork structure. Accordingly, not only does the solution of the present invention dampens the sound to a greater extent, it also saves space while significantly reducing the costs in view of the conventional solutions.

[0024] For a typical wall construction, the studwork structure is normally attached to the floor foundation and ceiling (not shown in the drawings). However, in some cases, e.g. where the second structure 104 constitutes an existing concrete wall, the studwork structure could also be attached to the second structure.

[0025] For a typical ceiling construction, the studwork structure normally constitutes the floor studwork founda-

tion of the next level of the property. However, it is possible within the scope of the present invention to attach a further studwork structure to an existing floor studwork foundation structure using flexible resilient members to resiliently attach the further studwork structure to the existing studwork structure when assembling an inner ceiling damping assembly according to some embodiments.

[0026] The resilient attachment member could be any commonly known resilient attachment member. However, preferably the resilient attachment member is configured to attach the first structure with the studwork structure in a one-directional manner, e.g. by screwing it in through the first structure to the studwork construction. Such a resilient attachment member mainly comprises three portions. A first portion 301 is provided with an outer thread for rigid connection to the first structure 101. An intermediate resilient portion 302 of the resilient attachment member connects the first portion to a second portion 303 which is provided with further outer thread for rigid connection to the studwork structure. The dimension of the further outer thread is preferably less than the outer thread of the first portion 301, whereby the resilient attachment member may be introduced through a hole in the first structure 101. Due to the lesser dimension of the outer thread of the second portion, the second portion may be introduced through the hole of the first structure without interfering with the first structure during mounting. The intermediate resilient portion 302 acts to keep the first and second portion at a distance from each other in a relaxed or idle state. Hence, the intermediate resilient portion 302 returns to its idle or relaxed state when not influenced by any external longitudinal force or sound pressure wave. The first portion 301 is provided with a first mating unit (not shown in Fig. 1), such as a protrusion or recess, which is configured to receive a second mating unit of the second portion in a compressed state, in which the first 301 and second 303 portions are forced together. When the two mating units are connected this prevents any relative rotation between the first portion and the second portion, whereby the two portions 301, 303 may be screwed into the first and second structure 104, respectively, simultaneously. The first portion and the intermediate resilient member may have a hollow interior shape, through which a mounting tool mating with the second portion 303 may be inserted for screwing the second portion 303 into the second structure 104 independently of the first portion 301. The first portion 301 may be configured with an outer recess for mating with a screw driver, thereby allowing for independent attachment of the first portion 301 to the first structure 101. Hence, such a resilient attachment member 103 allows for relative rotation between the first 301 and second 303 portion in the relaxed state by using a mounting tool, or non-relative rotation between the first 301 and second 303 portion in a compressed state when the first portion 301 and second portion 303 are mated together.

[0027] The resilient attachment member may be configured to attach the two structures involved from one

direction. For example, the resilient attachment member(s) in Figs. 1 to 4, 7a, 7b, 8, and 10 could be mounted from a left to right direction. In Figs. 5, 6a, 6b the resilient attachment member(s) on the left hand side of the studwork construction could be mounted from a left to right direction and the resilient attachment member(s) at the right hand side of the studwork construction could be mounted from a right to left direction. The resilient attachment member(s) of Figs. 9a, and 9b could be mounted from a right to left direction.

[0028] The mounting tool may be configured with a first member connectable to the first portion 301 of the resilient attachment member 103 and a second member connectable to the second portion 303 of the resilient attachment member 103, whereby upon rotation of the connected mounting tool the first portion 301 is screwed into the first structure 101 and the second portion 303 is screwed into the studwork structure 102.

[0029] The resilient attachment member may also have an extended state, in which the first 301 and second 303 portions are positioned at a maximum longitudinal distance away from each other. Accordingly, the second perpendicular distance L2 between the first structure 101 and second structure 104, 101 is larger in the extended state than that in the compressed state. The resilient attachment member 103 is in a state between the extended state and the compressed state when the intermediate resilient portion 302 is in its idle state.

[0030] In order to achieve a preferred sound reduction, the first perpendicular distance L1 should always greater than zero, for each state of the resilient attachment member. Hence, the first perpendicular distance L1 between the surface of the first structure facing the studwork structure, and the surface of the studwork structure facing the first structure is preferably always greater than zero to make sure that the only mechanical sound barrier between the first and second surface is through the resilient attachment member.

[0031] The present inventors have found that an improved sound reduction is achieved when the second perpendicular distance L2 is larger than L1, and that L1 is greater than zero. This implies that even if resilient attachment members are used, in the event that the first perpendicular distance L1 is equal to the second perpendicular distance L2, the sound reduction according to tests performed is relatively poor, compared to if L2 is larger than L1. A damping assembly in which L1 equals L2 is shown in Figs. 2a and 2b.

[0032] Accordingly, throughout the embodiments of the invention the second perpendicular distance L2 is larger than the first perpendicular distance L1.

[0033] Hence, for each embodiment could be further significantly improved, in the manner set out in the embodiments of the present invention.

[0034] In an embodiment, in accordance with Figs. 3 and 4, the second volume is at least partly filled with flexible material structure 201. The flexible material structure 201 may be an insulating material, such as rock wool

as depicted in Fig. 4, insulating balls such as plastic insulating balls as depicted in Fig. 3, glass wool, polystyrene balls, or any other insulating material. The flexible material structure 201 may also have sound damping properties, such as a sound damping material. Many insulating materials possess sound damping properties, whereby these kinds of materials are preferred.

[0035] The flexible material structure is preferably porous, allowing for accommodating a volume of atmospheric gas.

[0036] It should be appreciated that the second volume V2 may be at least partly incorporated as an atmospheric gas within the flexible material structure, and as an atmospheric gas partly exterior to the flexible material structure, in cases where the flexible material structure only partly fills the space between the first structure and second structure, such as in Fig. 10. For example, in Fig. 3, the space between the spherical insulating balls containing an atmospheric gas may form part of V2.

[0037] The second volume created between the second and first structures may according to some embodiments advantageously be at least partly unobstructed by the flexible material structure, thereby providing at least one unobstructed passage between the second structure and the first structure. This improves the atmospheric gas movement within the second volume, which may allow for improved sound reduction. For example, in view of Fig. 3, wherein the flexible material structure contains a number of plastic insulating balls, there is an unobstructed passage between each ball within the structure due to the spherical symmetry of the insulating balls.

[0038] The flexibility of the flexible material structure should be adapted to allow for absorption of sound pressure waves. Accordingly, the flexible material structure does not pertain to a fully rigid structure, such as a plaster board, MDF or the like, through which the sound waves easily mechanically propagate, as this adversely affect the sound reduction capability. Also a rigid material would create additional direct mechanical contact points between the first structure and second structure. Instead, a flexible and shapeable material is preferred. Expressed in other terms it is preferred that the acoustic impedance of the flexible material structure is lower than both that of the first structure and second structure. As characteristic acoustic impedance Z_0 , may be described by the formula $Z_0 = \rho * c$, where ρ denotes the density of a medium and c is the longitudinal wave speed or sound speed, it follows that generally a low density medium has a lower acoustic impedance than a high density medium as sound speed is generally travels faster in a high density medium. Hence, the flexible material structure preferably has a lower density than that of the first structure 101 and second structure 104, 101.

[0039] Fig. 5 illustrates a damping assembly 10 according to further embodiment, in which the second structure 104 is also resiliently attached to the studwork structure 102 by means of a number of resilient attachment

members 103. In this embodiment, the second structure may be identical to the first structure, thereby pertaining to an inner ceiling or wall. Hence, a difference in view of Fig. 1 is that the second structure is also resiliently attached to the studwork structure. In addition to the first and second volume, as mentioned in view of Fig. 1 above, an additional third volume V3 is created in this embodiment, as a third perpendicular distance L3 and a surface area of the at least one studwork structure 102 facing the second structure 104 form a third volume V3. In reality, the third volume V3 and the first volume V1 may be roughly equal. Total volume between the first structure and the second structure is formed by the second perpendicular distance L2 and a surface area of the second structure 104 facing the first structure 101. The total volume subtracted by the first volume V1, the third volume V3 and a volume of the studwork Vs forms the second volume in this embodiment. Hence, in the event the second structure is not directly attached to the studwork construction this additional volume may be taken into consideration when defining the second volume. This embodiment is advantageous for walls when sound proofing is desired from both sides of the wall, e.g. in open-plan office environments, and separating walls in apartments.

[0040] Fig. 6a illustrates a damping assembly according to an embodiment, similar to that of Fig. 1, in which a further studwork structure 102 and a further first structure 101 is arranged on the opposite side of the damping assembly of Fig. 1. The further first structure is arranged at a third perpendicular distance L3 from the further studwork structure, and at a fourth perpendicular distance L4 from a surface of the second structure 104 facing the further first structure 101. Here, both the second perpendicular distance L2 and the fourth perpendicular distance L4 is preferably greater than the first perpendicular distance L1 and the third perpendicular distance, respectively. The fourth perpendicular distance L4 and a surface area of the further first structure 101 facing the second structure 104 form a further total volume between the further first structure and the second structure. The total volume when subtracted by the third volume and a volume of the studwork Vs form a fourth volume V4. The further first structure may be denoted third structure for sake of clarity in the appended claims.

[0041] In an embodiment, it is also preferred that the second volume V2 is larger than the first volume V1 and if available the fourth volume V4 is larger than the third volume V3.

[0042] Fig. 6b illustrates a damping assembly according to an embodiment, wherein two inner ceiling or inner wall structures are connected on either side of a studwork structure, without any foundation structure 104 arranged between the two studwork structures 102. Hence, in this case it is preferred that L2 is greater than L1 and L3, respectively, and that each of L1 and L3 is greater than zero in order to obtain the desired sound damping properties.

[0043] In an embodiment, the first L1 or third L3 per-

pendicular distance is in the range of 0,01 to 20 mm, e.g. 1 to 10, such as 1 to 5 mm, such 3 mm.

[0044] In an embodiment, the second L2 or fourth L4 perpendicular distance is in the range of 25 to 500mm, e.g. 50 to 300, such as 50 to 200mm.

[0045] Fig. 7a illustrates an embodiment in which a further first structure or sheet of material 601 has been mounted on top of the first structure 101. The further sheet of material may e.g. be an additional plaster board, MDF, HDF or optionally glued onto the first structure 101.

[0046] Experiments have shown that adding an additional sheet of material 601, such as plasterboard, may improve the sound damping capabilities of the wall or ceiling by 5dB. On the other hand, this will increase the thickness of the wall construction.

[0047] Fig. 7b illustrates a damping assembly, according to an embodiment, similar to that of Fig. 7a in which the further first structure is rigidly screwed to the first structure by means of conventional screws 701.

[0048] According to an embodiment, in view of Fig. 8, the at least one resilient attachment member is attached to the at least one studwork structure straight through the first structure and the further first structure. Hence, this embodiment requires a slightly longer resilient attachment member than that required e.g. in view of Fig. 7a.

[0049] The second structure 104, 101 may be rigidly attached to the studwork structure acting as a foundation of a wall, roof or floor of a building or accommodation, whereas the first structure 101 is resiliently suspended in relation to the second structure 104 via the resilient attachment member 103.

[0050] An advantageous effect of the present invention is that it is possible to assemble the damping assembly in a one-directional manner, as the resilient attachment members may be screwed into the structures in essentially in the same way as commonly is performed when mounting plasterboards. The only difference is that an adapted mounting tool may be required, in case the resilient attachment member is not adapted to a particular standard. Hence, the present invention allows for a method of assembling the damping assembly as suggested by the incorporated embodiments.

[0051] Such a method may pertain to a method for assembling a first structure 101 to a studwork structure 102 using at least one resilient attachment member 103. The method comprises the steps of simultaneously attaching a first portion 301 of the resilient attachment member 103 to the first structure 101 and a second portion 303 of the resilient attachment member 103 to the studwork structure 102. The resilient attachment member 102 is arranged straight through the first structure 101, thereby allowing for assembling the first structure 101 to the studwork structure 102 from one direction.

[0052] The step of simultaneous attachment may be performed using a mounting tool connectable to the resilient attachment member 103 via a through bore provided therein. The mounting tool has a first member con-

nectable to the first portion 301 of the resilient attachment member 103 and a second member connectable to the second portion 303 of the resilient attachment member 103, whereby upon rotation of the connected mounting tool the first portion 301 is screwed into the first structure 101 and the second portion 303 is screwed into the studwork structure 102.

[0053] As may be observed from Fig. 1, the first construction is resiliently attached to the studwork structure 102, while the second structure may be rigidly attached to the studwork structure opposite the first structure.

[0054] As an alternative it is also possible to resiliently attach the second structure to the studwork structure, and optionally rigidly attaching the first structure to the studwork structure opposite the second structure. Two such embodiments are shown with reference to Figs. 8 and 9a. Here, the at least one resilient attachment member 103 is configured to resiliently attaching the at least one studwork structure 102 at a first perpendicular distance from the second structure 104, 101 such that the second structure 104, 101 and the at least one studwork structures 102 are in contact with each other only via the resilient attachment member(s) 103. The second structure 104, 101 is located at a second perpendicular distance from the first structure 101. The first distance and a surface area of the at least one studwork structure 102 facing the second structure 104, 101 form a first volume, and the second distance and a surface area of the first structure 101 facing the second structure 104, 101 less the first volume form a second volume, wherein the second volume is larger than the first volume. In the embodiment of Fig. 9a, the resilient attachment member may be provided between the studwork structure 102 and the second structure 104, whereby the first structure and optionally further first structure 601 may be rigidly attached to the studwork structure by means of conventional screws 701. It should be appreciated that the conventional screws 701 securing the further first structure to the first structure may be also attached to the studwork structure (see lower studwork structure).

[0055] On the other hand, in the embodiment of Fig. 9b, the resilient attachment member may be provided straight through the first structure and the studwork structure and then be rigidly attached to the second structure. This optionally requires a longer first portion 301 of the resilient attachment member.

[0056] For example, the damping assembly of Fig. 9a may optionally be used as an inner ceiling damping assembly for an sound proofing an existing ceiling, wherein the second structure is the floor foundation, such as an existing studwork structure of a property, whereas the studwork structure 102 is a further studwork structure, resiliently attached to the existing studwork structure 104, by means of the resilient attachment members.

[0057] Fig. 10 illustrates a damping assembly according to an embodiment being provided with two inner ceiling or two inner wall structures with a resilient attachment member being provided straight through the inner wall

or ceiling structures and anchored to the studwork construction.

[0058] It should be appreciated that each of the embodiments described herein is suitable for both inner ceiling and inner wall applications.

[0059] The scope of the invention is defined by the appended claims.

10 Claims

1. A damping assembly (10) for reducing vibration, sound or noise propagation between at least two structures, comprising

a first structure (101), such as an inner ceiling construction,
at least one studwork structure (102),
at least one resilient attachment member (103) for resiliently attaching the first structure (101) at a first perpendicular distance (L1) from the at least one studwork structure (102) such that the first structure (101) and the at least one studwork structures (102) are in contact with each other only via the resilient attachment member(s) (103), the resilient attachment member (103) comprising

a first portion (301) provided with an outer thread for rigid connection to the first structure (101),
an intermediate resilient portion (302) connecting the first portion (301) to a second portion (303) which is provided with a further outer thread for rigid connection to the studwork structure (102), wherein the dimension of the further outer thread is less than the outer thread of the first portion (301), the intermediate resilient portion (302) acting to keep the first portion (301) and the second portion (303) at a distance from each other in a relaxed or idle state,
wherein the first portion (301) is provided with a first mating unit and the second portion (303) is provided with a second mating unit, wherein the first mating unit is arranged to receive the second mating unit in a compressed state of the resilient attachment member (103) such that when the two mating units are connected any relative rotation between the first portion (301) and the second portion (303) is prevented, thereby allowing the first portion (301) to be screwed into the first structure (101) and the second portion (303) to be screwed into the studwork structure (102) simultaneously, wherein the second portion (303) of the at

- least one resilient attachment member is attached to the at least one studwork structure (102) via a hole in the first structure (101) without interfering with the first structure (101) during mounting given the lesser dimension of the outer thread of the second portion (303),
 wherein the at least one studwork structure (102) is connected to a second structure (104, 101) oppositely arranged to that of the first structure (101), the second structure (104, 101) being located at a second perpendicular distance (L2) from the first structure (101),
 whereby the resilient member also has an extended state, in which the first portion (301) and the second portion (303) are positioned at a maximum longitudinal distance away from each other, the second perpendicular distance (L2) being larger in the extended state than that in the compressed state, wherein the resilient attachment member (103) is in a state between the extended state and the compressed state when the intermediate resilient portion (302) is in its idle state.
 wherein the first perpendicular distance (L1) and a surface area of the at least one studwork structure (102) facing the first structure (101) form a first volume (V1),
 wherein the second perpendicular distance (L2) and a surface area of the second structure (104, 101) facing the first structure (101) form a total volume between the first structure (101) and second structure (104, 101), wherein the total volume when subtracted with the first volume (V1) and a volume of the studwork structure (Vs) forms a second volume (V2), and
 wherein the second volume (V2) is larger than the first volume (V1), and wherein the second perpendicular distance (L2) is larger than the first perpendicular distance (L1).
2. The damping assembly according to claim 1, wherein the first perpendicular distance (L1) is greater than zero.
 3. The damping assembly (10) according to any one of the previous claims, wherein the second volume is at least partly filled with flexible material structure (201).
 4. The damping assembly (10) according to claim 3, wherein the flexible material structure (201) is an insulating material.
 5. The damping assembly (10) according to claim 3, wherein the flexible material structure (201) is a sound damping material.
 6. The damping assembly (10) according to claim 3, wherein there is at least one unobstructed passage between the second structure and the first structure.
 7. The damping assembly (10) according to any one of the previous claims,
 wherein the second perpendicular distance is greater than zero in the compressed state, and wherein the second perpendicular distance between the first structure (101) and second structure (104, 101) is larger in the extended state than that in the compressed state.
 thereby enabling movement of the first structure (101) in relation to the second structure (104, 101).
 8. The damping assembly (10) according to any one of the previous claims, wherein a shortest distance between the first structure (101) and the second structure (104, 101) is greater than zero.
 9. The damping assembly (10) according to any one of the preceding claims, wherein
 the second structure (104, 101) is rigidly attached to a foundation of a wall, roof or floor of a building or accommodation, and wherein the first structure (101) is a suspended in relation to the second structure (200) via the resilient attachment member (103).
 10. The damping assembly according to any one of the previous claims, comprising a third structure, resiliently attached to the second structure (104, 101) by a at least a further resilient attachment member (103) via at least one further studwork structure (102).
 11. A method for assembling a first structure (101) to a studwork structure (102) using a resilient attachment member (103), the method using an assembly in accordance with claim 1, by simultaneously attaching a first portion (301) of the resilient attachment member (103) to the first structure (101) and a second portion (303) of the resilient attachment member (103) to the studwork structure (102) upon introducing the second portion (303) through the hole in the first structure towards the studwork structure (102), followed by compressing the intermediate resilient portion (302) to its compressed state thereby mating the first mating unit and the second mating unit together and preventing relative rotation between the first portion (301) and second portion (303) to allow the first portion (301) to be screwed into the first structure (101) and the second portion (303) to be

screwed into the studwork structure (102) simultaneously, whereby the resilient attachment member (102) is arranged straight through the first structure (101), thereby allowing for assembling the first structure (101) to the studwork structure (102) from one direction.

Patentansprüche

1. Dämpfungsanordnung (10) zum Reduzieren von Vibration, Schall oder Geräuschausbreitung zwischen mindestens zwei Strukturen, umfassend

eine erste Struktur (101), wie zum Beispiel eine innere Deckenkonstruktion, mindestens eine Ständerwerkstruktur (102), mindestens ein elastisches Befestigungselement (103) zum elastischen Befestigen der ersten Struktur (101) in einem ersten senkrechten Abstand (L1) zu der mindestens einen Ständerwerkstruktur (102), derart, dass die erste Struktur (101) und die mindestens eine Ständerwerkstruktur (102) nur über das/die elastische(n) Befestigungselement(e) (103) miteinander in Kontakt sind, wobei das elastische Befestigungselement (103) Folgendes umfasst:

einen ersten Abschnitt (301), der mit einem Außengewinde zur starren Verbindung mit der ersten Struktur (101) versehen ist, einen elastischen Zwischenabschnitt (302), der den ersten Abschnitt (301) mit einem zweiten Abschnitt (303) verbindet, der mit einem weiteren Außengewinde zur starren Verbindung mit der Ständerwerkstruktur (102) versehen ist, wobei die Abmessung des weiteren Außengewindes kleiner ist als das Außengewinde des ersten Abschnitts (301), wobei der elastische Zwischenabschnitt (302) dazu dient, den ersten Abschnitt (301) und den zweiten Abschnitt (303) in einem entspannten oder untätigen Zustand in einem Abstand voneinander zu halten,

wobei der erste Abschnitt (301) mit einer ersten Passeinheit versehen ist und der zweite Abschnitt (303) mit einer zweiten Passeinheit versehen ist, wobei die erste Passeinheit angeordnet ist, um die zweite Passeinheit in einem komprimierten Zustand des elastischen Befestigungselementes (103) derart aufzunehmen, dass, wenn die beiden Passeinheiten verbunden sind, jede relative Drehung zwischen dem ersten Abschnitt (301) und dem zweiten Abschnitt (303) verhindert wird, wodurch ermöglicht wird, dass der erste Abschnitt (301) in die

erste Struktur (101) und der zweite Abschnitt (303) gleichzeitig in die Ständerwerkstruktur (102) eingeschraubt wird, wobei der zweite Abschnitt (303) des mindestens einen elastischen Befestigungselements an der mindestens einen Ständerwerkstruktur (102) über ein Loch in der ersten Struktur (101) befestigt ist, ohne die erste Struktur (101), aufgrund der geringeren Abmessung des Außengewindes des zweiten Abschnitts (303), während der Montage zu stören, wobei die mindestens eine Ständerwerkstruktur (102) mit einer zweiten Struktur (104, 101) verbunden ist, die der ersten Struktur (101) gegenüberliegend angeordnet ist, wobei die zweite Struktur (104, 101) in einem zweiten senkrechten Abstand (L2) von der ersten Struktur (101) angeordnet ist, wobei das elastische Element auch einen ausgefahrenen Zustand hat, in dem der erste Abschnitt (301) und der zweite Abschnitt (303) in einem maximalen Längsabstand voneinander entfernt positioniert sind, wobei der zweite senkrechte Abstand (L2) im ausgefahrenen Zustand größer ist als im komprimierten Zustand, wobei sich das elastische Befestigungselement (103) in einem Zustand zwischen dem ausgefahrenen Zustand und dem komprimierten Zustand befindet, wenn sich der elastische Zwischenabschnitt (302) in seinem untätigen Zustand befindet, wobei der erste senkrechte Abstand (L1) und ein Oberflächenbereich der mindestens einen Ständerwerkstruktur (102), der der ersten Struktur (101) zugewandt ist, ein erstes Volumen (V1) bilden, wobei der zweite senkrechte Abstand (L2) und ein Oberflächenbereich der zweiten Struktur (104, 101), der der ersten Struktur (101) zugewandt ist, ein Gesamtvolumen zwischen der ersten Struktur (101) und der zweiten Struktur (104, 101) bilden, wobei das Gesamtvolumen, wenn mit dem ersten Volumen (V1) und einem Volumen der Ständerwerkstruktur (Vs) subtrahiert wird, ein zweites Volumen (V2) bildet, und wobei das zweite Volumen (V2) größer ist als das erste Volumen (V1), und wobei der zweite senkrechte Abstand (L2) größer als der erste senkrechte Abstand (L1) ist.

2. Dämpfungsanordnung nach Anspruch 1, wobei der erste senkrechte Abstand (L1) größer als null ist.
3. Dämpfungsanordnung (10) nach einem der vorhergehenden Ansprüche, wobei das zweite Volumen zumindest teilweise mit einer flexiblen Materialstruktur (201) gefüllt ist.
4. Dämpfungsanordnung (10) nach Anspruch 3, wobei

die flexible Materialstruktur (201) ein isolierendes Material ist.

5. Dämpfungsanordnung (10) nach Anspruch 3, wobei die flexible Materialstruktur (201) ein schalldämpfendes Material ist. 5

6. Dämpfungsanordnung (10) nach Anspruch 3, wobei es mindestens einen ungehinderten Durchgang zwischen der zweiten Struktur und der ersten Struktur gibt. 10

7. Dämpfungsanordnung (10) nach einem der vorhergehenden Ansprüche, 15

wobei der zweite senkrechte Abstand im komprimierten Zustand größer als Null ist und wobei der zweite senkrechte Abstand zwischen der ersten Struktur (101) und der zweiten Struktur (104, 101) im ausgefahrenen Zustand größer ist als der im komprimierten Zustand. 20

wodurch eine Bewegung der ersten Struktur (101) in Bezug auf die zweite Struktur (104, 101) ermöglicht wird. 25

8. Dämpfungsanordnung (10) nach einem der vorhergehenden Ansprüche, wobei ein kürzester Abstand zwischen der ersten Struktur (101) und der zweiten Struktur (104, 101) größer als null ist. 30

9. Dämpfungsanordnung (10) nach einem der vorhergehenden Ansprüche, wobei 35

die zweite Struktur (104, 101) starr an einem Fundament einer Wand, eines Daches oder eines Bodens eines Gebäudes oder einer Unterkunft befestigt ist, und wobei 40

die erste Struktur (101) in Bezug auf die zweite Struktur (200) über das elastische Befestigungselement (103) aufgehängt ist. 45

10. Dämpfungsanordnung nach einem der vorhergehenden Ansprüche, umfassend eine dritte Struktur, die durch mindestens ein weiteres elastisches Befestigungselement (103) über mindestens eine weitere Ständerstruktur (102) elastisch an der zweiten Struktur (104, 101) befestigt ist. 50

11. Verfahren zum Anbringen einer ersten Struktur (101) an einer Ständerwerkstruktur (102) unter Verwendung eines elastischen Befestigungselements (103), wobei das Verfahren eine Anordnung nach Anspruch 1 verwendet, indem gleichzeitig ein erster Abschnitt (301) des elastischen Befestigungselements (103) an der ersten Struktur (101) und ein zweiter Abschnitt (303) des elastischen Befestigungselements (103) an der Ständerwerkstruktur (102) befestigt wird, beim Einführen des zweiten Ab-

schnitts (303) durch das Loch in der ersten Struktur in Richtung der Ständerwerksstruktur (102), gefolgt vom Zusammendrücken des elastischen Zwischenabschnitts (302) in seinen komprimierten Zustand, wodurch die erste Passeinheit und die zweite Passeinheit zusammenpassen und eine relative Drehung zwischen dem ersten Abschnitt (301) und dem zweiten Abschnitt (303) verhindert wird, um das Einschrauben des ersten Abschnitts (301) in die erste Struktur (101) und das gleichzeitige Einschrauben des zweiten Abschnitts (303) in die Ständerwerkstruktur (102) ermöglichen, wodurch das elastische Befestigungselement (102) gerade durch die erste Struktur (101) angeordnet wird, wodurch die Montage der ersten Struktur (101) an der Ständerwerkstruktur (102) aus einer Richtung ermöglicht wird.

Revendications

1. Ensemble d'amortissement (10) pour réduire la propagation de vibrations, de son ou de bruit entre au moins deux structures, comprenant 50

une première structure (101), telle qu'une construction de plafond interne, 55

au moins une structure de travail (102),

au moins un élément de fixation élastique (103) pour fixer de manière élastique la première structure (101) à une première distance perpendiculaire (L1) de l'au moins une structure de travail (102) de telle sorte que la première structure (101) et l'au moins une structure de travail (102) soient en contact l'une avec l'autre uniquement par l'intermédiaire de l'au moins un élément de fixation élastique (103), l'élément de fixation élastique (103) comprenant

une première partie (301) pourvue d'un filetage externe pour une solidarisation à la première structure (101),

une partie élastique intermédiaire (302) reliant la première partie (301) à une seconde partie (303) qui est pourvue d'un autre filetage externe pour une solidarisation à la structure de travail (102), dans lequel la dimension de l'autre filetage externe est inférieure au filetage externe de la première partie (301), la partie élastique intermédiaire (302) agissant pour maintenir la première partie (301) et la seconde partie (303) à une certaine distance l'une de l'autre dans un état relâché ou inactif,

dans lequel la première partie (301) est pourvue d'une première unité d'accouplement et la seconde partie (303) est pourvue d'une seconde unité d'accouplement, la première unité d'accouplement étant agencée pour recevoir la seconde unité d'accouplement dans un état comprimé de l'élément de fixation élastique (103) de

- telle sorte que, lorsque les deux unités d'accouplement sont reliées, toute rotation relative entre la première partie (301) et la seconde partie (303) est empêchée, ce qui permet à la première partie (301) d'être vissée dans la première structure (101) et à la seconde partie (303) d'être vissée dans la structure de travail (102) simultanément,
- dans lequel la seconde partie (303) de l'au moins un élément de fixation élastique est fixée à l'au moins une structure de travail (102) par l'intermédiaire d'un trou dans la première structure (101) sans interférer avec la première structure (101) pendant le montage étant donné la dimension inférieure du filetage externe de la seconde partie (303),
- dans lequel l'au moins une structure de travail (102) est reliée à une deuxième structure (104, 101) agencée de manière opposée à celle de la première structure (101), la deuxième structure (104, 101) étant située à une seconde distance perpendiculaire (L2) de la première structure (101),
- moyennant quoi l'élément élastique présente également un état étendu, dans lequel la première partie (301) et la seconde partie (303) sont positionnées à une distance longitudinale maximale l'une de l'autre, la seconde distance perpendiculaire (L2) étant plus grande dans l'état étendu que dans l'état comprimé, dans lequel l'élément de fixation élastique (103) est dans un état entre l'état étendu et l'état comprimé lorsque la partie élastique intermédiaire (302) est dans son état inactif,
- dans lequel la première distance perpendiculaire (L1) et une zone de surface de l'au moins une structure de travail (102) faisant face à la première structure (101) forment un premier volume (V1),
- dans lequel la seconde distance perpendiculaire (L2) et une zone de surface de la deuxième structure (104, 101) faisant face à la première structure (101) forment un volume total entre la première structure (101) et la deuxième structure (104, 101), dans lequel le volume total, une fois le premier volume (V1) et un volume de la structure de travail (Vs) soustrait de celui-ci, forme un second volume (V2), et
- dans lequel le second volume (V2) est supérieur au premier volume (V1), et dans lequel la seconde distance perpendiculaire (L2) est supérieure à la première distance perpendiculaire (L1).
2. Ensemble d'amortissement selon la revendication 1, dans lequel la première distance perpendiculaire (L1) est supérieure à zéro.
 3. Ensemble d'amortissement (10) selon l'une quelconque des revendications précédentes, dans lequel le second volume est au moins partiellement rempli d'une structure de matériau flexible (201).
 4. Ensemble d'amortissement (10) selon la revendication 3, dans lequel la structure de matériau flexible (201) est un matériau isolant.
 5. Ensemble d'amortissement (10) selon la revendication 3, dans lequel la structure de matériau flexible (201) est un matériau d'amortissement sonore.
 6. Ensemble d'amortissement (10) selon la revendication 3, dans lequel il existe au moins un passage non obstrué entre la deuxième structure et la première structure.
 7. Ensemble d'amortissement (10) selon l'une quelconque des revendications précédentes,

dans lequel la seconde distance perpendiculaire est supérieure à zéro dans l'état comprimé, et dans lequel la seconde distance perpendiculaire entre la première structure (101) et la deuxième structure (104, 101) est plus grande dans l'état étendu que dans l'état comprimé, ce qui permet le mouvement de la première structure (101) par rapport à la deuxième structure (104, 101).
 8. Ensemble d'amortissement (10) selon l'une quelconque des revendications précédentes, dans lequel une distance la plus courte entre la première structure (101) et la deuxième structure (104, 101) est supérieure à zéro.
 9. Ensemble d'amortissement (10) selon l'une quelconque des revendications précédentes, dans lequel

la deuxième structure (104, 101) est solidarisée à une fondation d'un mur, d'un toit ou d'un plancher d'un bâtiment ou d'un logement, et dans lequel la première structure (101) est suspendue par rapport à la deuxième structure (200) par l'intermédiaire de l'élément de fixation élastique (103).
 10. Ensemble d'amortissement selon l'une quelconque des revendications précédentes, comprenant une troisième structure, fixée de manière élastique à la deuxième structure (104, 101) par au moins un autre élément de fixation élastique (103) par l'intermédiaire d'au moins une autre structure de travail (102).
 11. Procédé d'assemblage d'une première structure

(101) à une structure de travail (102) à l'aide d'un élément de fixation élastique (103), le procédé utilisant un ensemble selon la revendication 1, par la fixation simultanée d'une première partie (301) de l'élément de fixation élastique (103) à la première structure (101) et d'une seconde partie (303) de l'élément de fixation élastique (103) à la structure de travail (102) lors de l'introduction de la seconde partie (303) à travers le trou dans la première structure vers la structure de travail (102), suivie par la compression de la partie élastique intermédiaire (302) vers son état comprimé, ce qui accouple la première unité d'accouplement et la seconde unité d'accouplement l'une à l'autre et empêche une rotation relative entre la première partie (301) et la seconde partie (303) pour permettre à la première partie (301) d'être vissée dans la première structure (101) et à la seconde partie (303) d'être vissée dans la structure de travail (102) simultanément, moyennant quoi l'élément de fixation élastique (102) est disposé directement à travers la première structure (101), ce qui permet l'assemblage de la première structure (101) à la structure de travail (102) à partir d'une direction.

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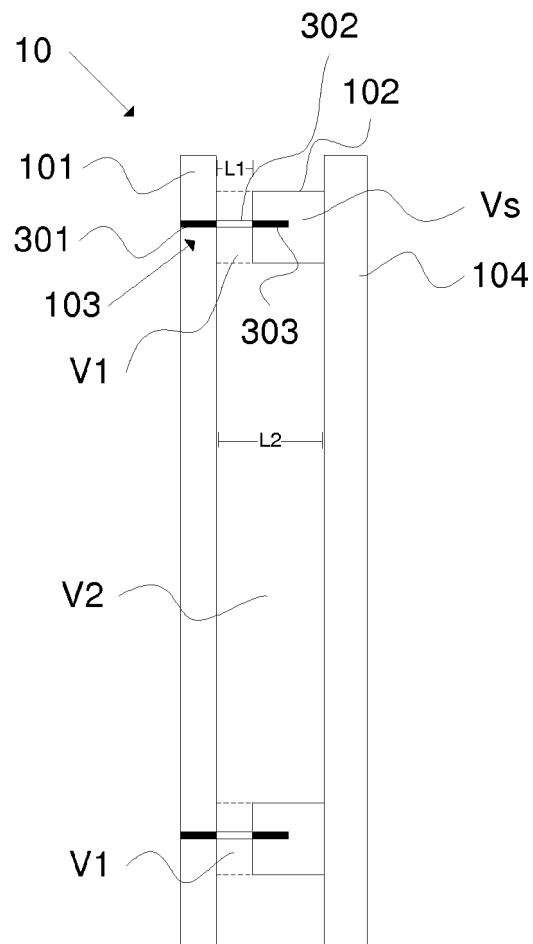


Fig. 1

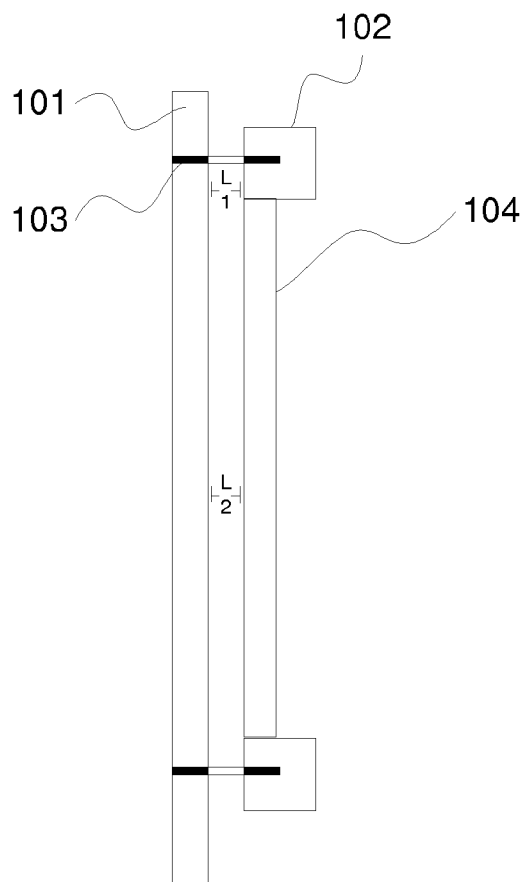


Fig. 2a

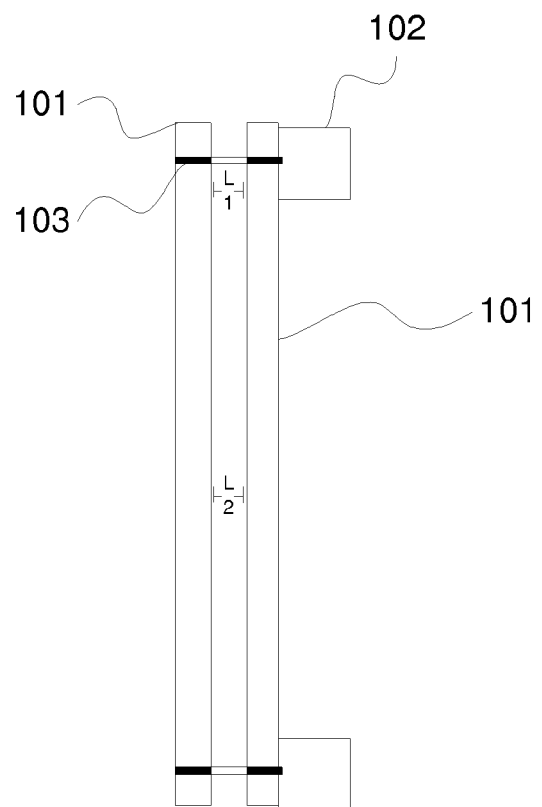


Fig. 2b

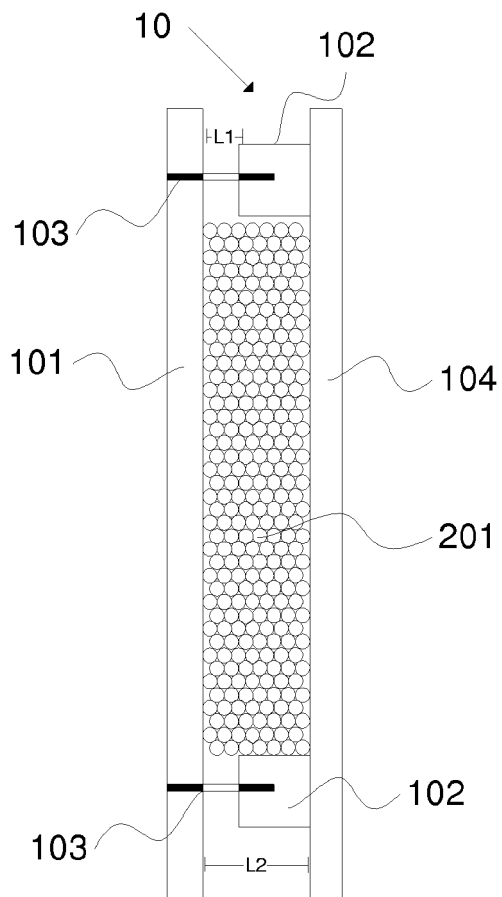


Fig. 3

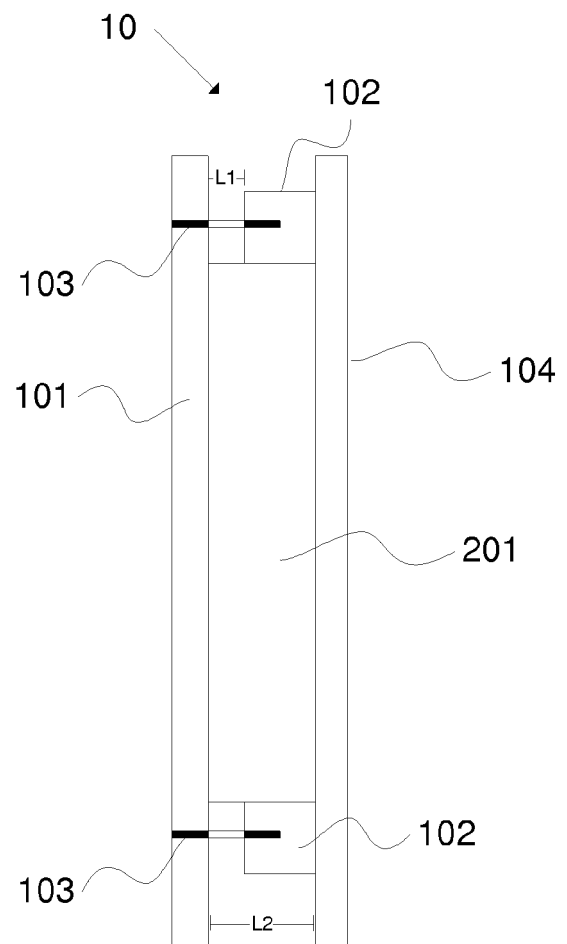


Fig. 4

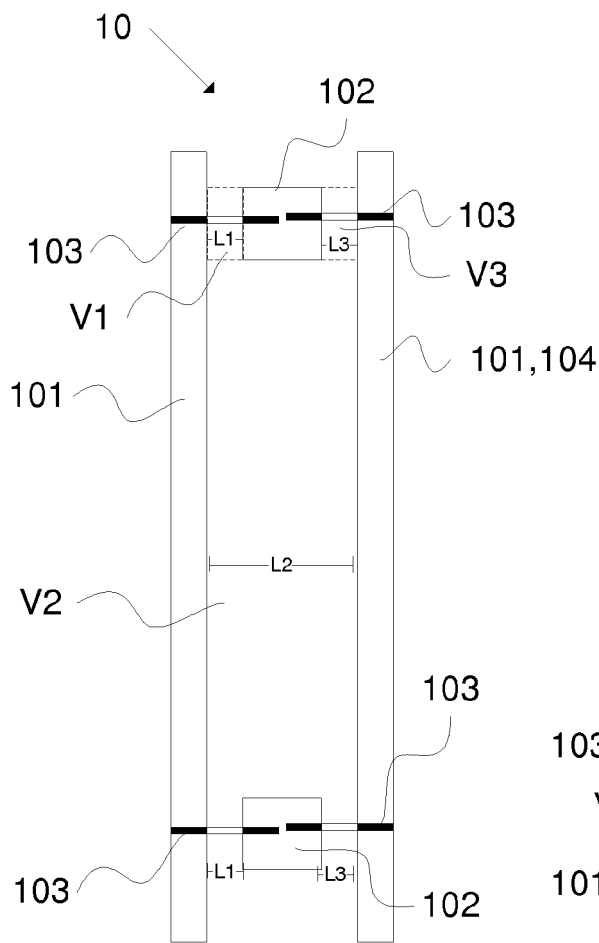


Fig. 5

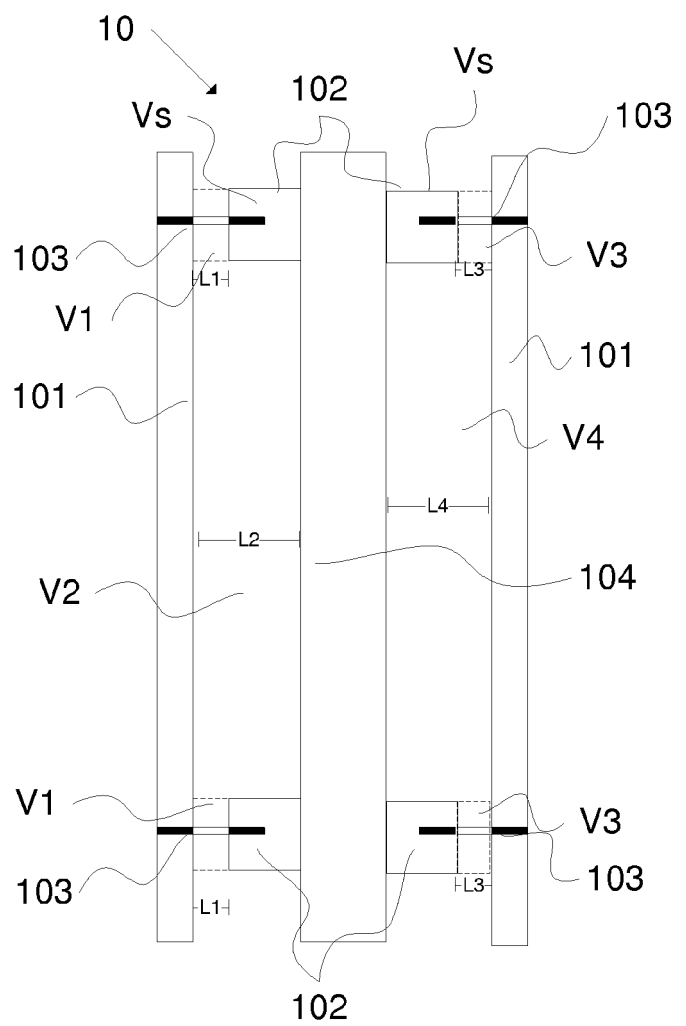


Fig. 6a

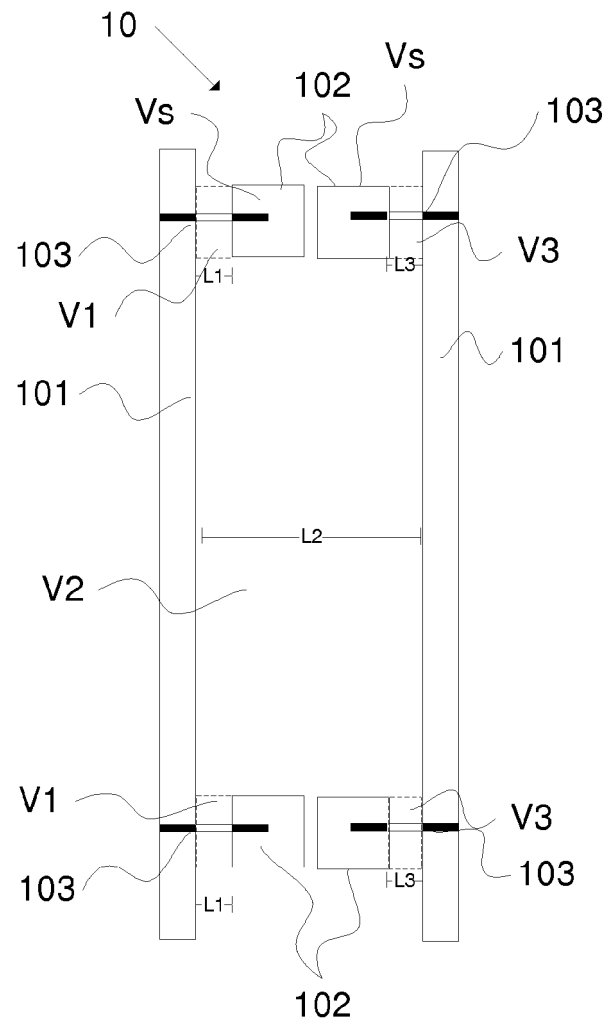


Fig. 6b

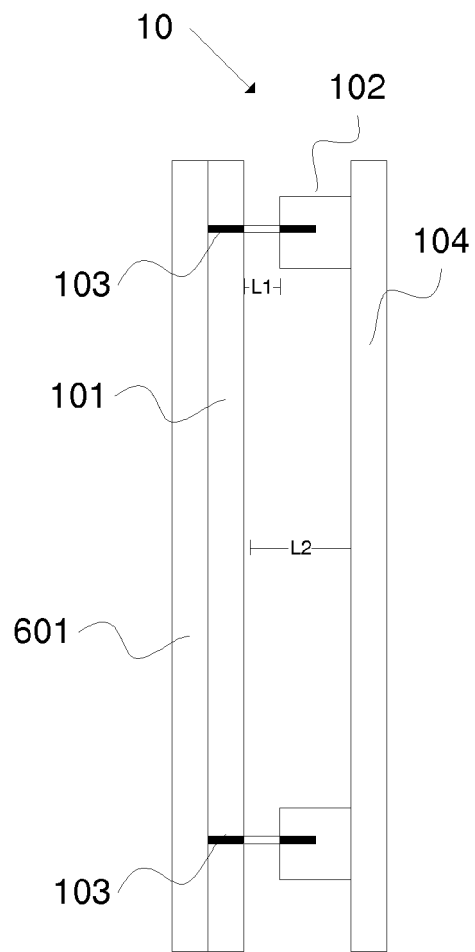


Fig. 7a

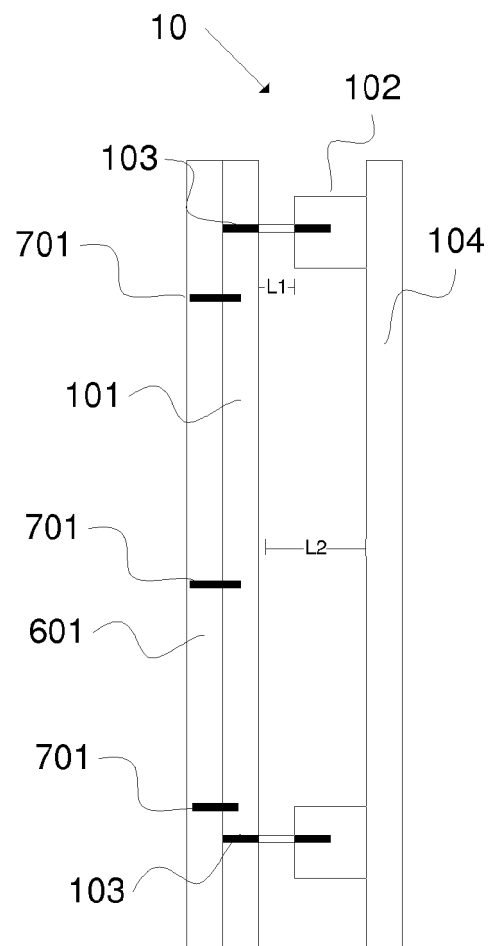


Fig. 7b

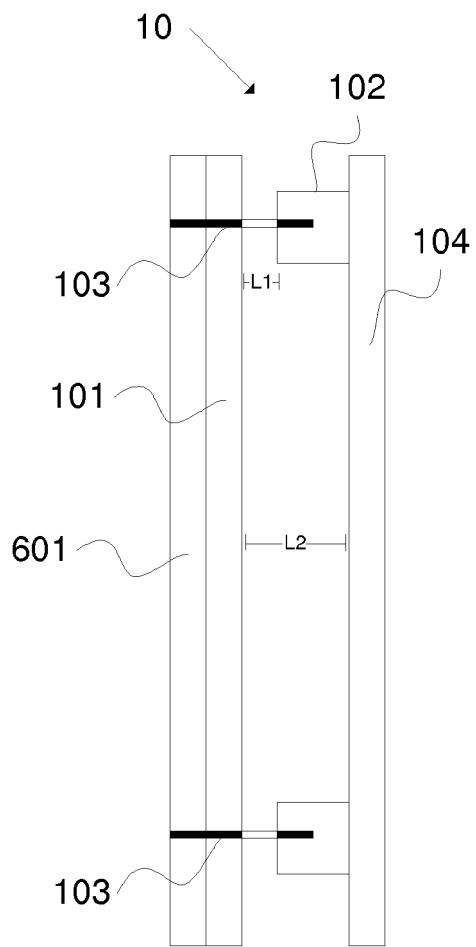


Fig. 8

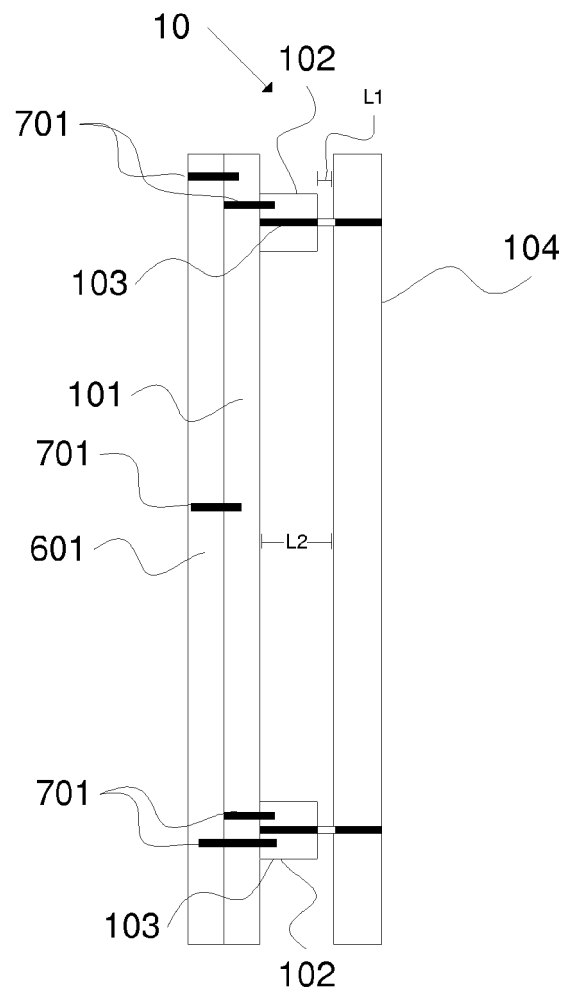
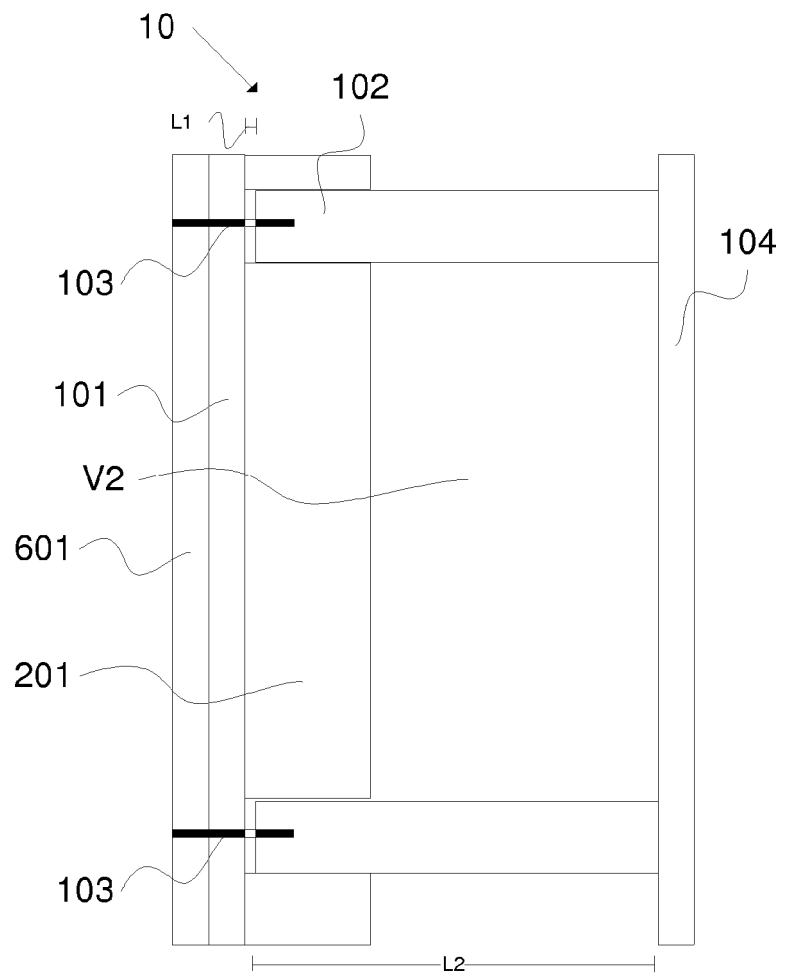
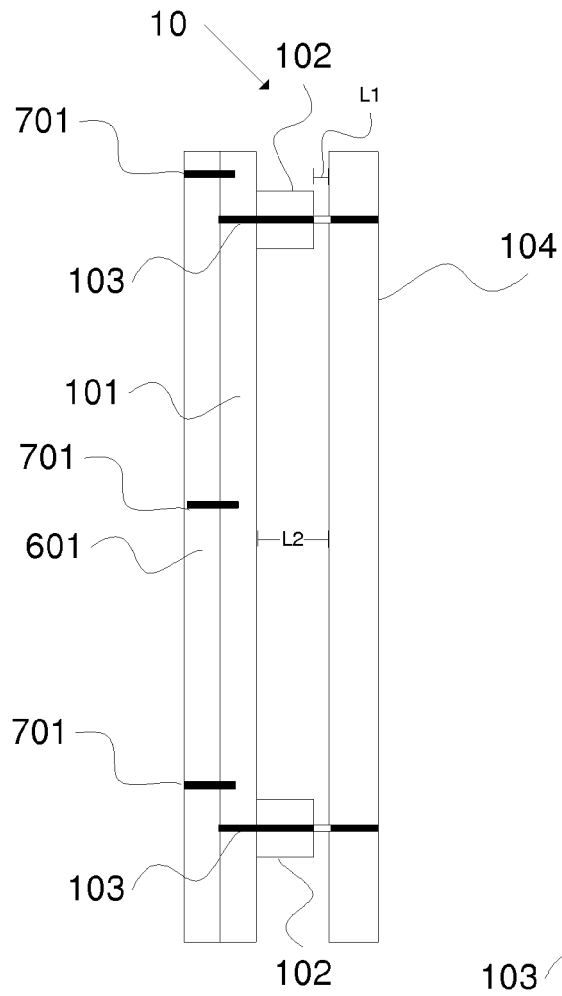


Fig. 9a



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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