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(54) FIRE-RESISTANT CONSTRUCTION ELEMENT FOR CONNECTING THERMALLY INSULATED PARTS OF A BUILDING

FLAMMBESTÄNDIGES BAUELEMENT ZUR VERBINDUNG VON WÄRMEISOLIERTEN TEILEN EINES GEBÄUDES

ÉLÉMENT DE CONSTRUCTION RÉSISTANT AU FEU POUR RELIER DES PARTIES THERMIQUEMENT ISOLÉES D'UN BÂTIMENT

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EP-A1- 0 892 118 **EP-B1- 0 892 118**

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EP 3 430 210 B1

Description

Field of the Invention

[0001] The invention is related to a construction element applicable to the construction of buildings, in particular an element for connecting parts of a building that are thermally insulated from one another, e.g. between a concrete floor and a cantilevered floor of a balcony. These elements are also known as 'thermal breaks'.

Prior Art

[0002] Connections between internal parts of a building and cantilevered external parts, e.g. a concrete balcony floor need to be realized with a minimal impact on the insulation of the building. For creating this connection, elements are known that consist of an elongate insulating portion provided with reinforcement bars that run through the insulating portion and absorb the tensile forces between the parts of the building that are to be connected. Means are also provided to absorb compression and shear forces. The latter may take the form of compression bars and bars running diagonally through the insulating portion, or of specially formed blocks that are incorporated into the insulating portion. The insulating portion is placed between the parts of the building which are to be connected, whilst the various force-absorbing elements are anchored in said building parts in order to form the connection.

[0003] The thermally insulating material used in these elements is, for example, mineral wool such as rock wool or glass wool. Another option is to use synthetic insulating materials, such as PIR, PUR, EPS, XPS, or the like. The latter have better thermal insulation properties than mineral wool and are thus preferred because the desired thermal insulation can be obtained with a lower density of insulation material than would be the case if rock or glass wool are used. On the other hand, materials such as PIR, PUR, and the like have lower fire resistance than the mineral wool variants.

[0004] Thus, there is a need for a solution that allows for the use of insulation materials with high thermal insulation properties and that also have good fire safety properties.

[0005] EP 0 892 118 A1 discloses a construction element according to the preamble of claim 1.

Summary of Features of the Invention

[0006] The invention concerns a construction element as described in the appended claims.

[0007] The invention concerns a construction element for forming a connection between two components of a building that are thermally insulated from one another. The element comprises an elongate portion comprising a thermally insulating material, bars running through the elongate portion in order to absorb tensile forces between the parts of the building, and means to absorb compression and shearing forces between the parts of the building. The construction element according to the invention is characterised in that the underside and part of the raised side walls of the elongate portion is formed by a fire-resistant profile with a undersurface and two raised side walls, and wherein a thermally insulating layer is provided on the base surface of the profile (i.e., between the raised side walls).

[0008] The invention thus more specifically concerns a construction element for forming a connection between two components of a building that are thermally insulated from one another, comprising:

- an elongate portion comprising a thermally insulating material, and configured to be placed between the parts of the building,
- bars which run through the elongate portion and which are configured to be anchored in the building parts that are to be connected, and thus to absorb the tensile forces between these building parts,
- components for absorbing compression and shear forces between the building parts,

characterised in that the underside and part of the raised side walls of the elongate portion are formed by a fire-resistant profile with a base surface and two raised side walls, and wherein a thermally insulating layer is provided on the base surface of the fire-resistant profile (i.e., between the raised side walls). According to a preferred embodiment, the thermally insulating layer is also fire-resistant.

[0009] According to one embodiment, the fire-resistant profile is made of a composite material, which may be a fire-resistant fibre cement, preferably having a thickness between 1 and 3 mm. According to an embodiment, the thermally insulating layer is formed of a material with a thermal conductivity lower than 0.06W/mK at 20°C. The thermally insulating layer may be formed of compressed rock wool.

[0010] According to one embodiment, a fire-resistant profile with a base surface and two downward side walls is also provided at the top of the elongate portion, and a thermally insulating and preferably fire-resistant layer is also provided on the base surface of the uppermost profile (i.e., between the downward side walls).

[0011] As means to absorb compression and/or shearing forces, a number of support blocks may be provided, wherein the raised side walls of the fire-resistant profile are provided with notches in order to provide space for the supporting blocks.

[0012] The thermally insulating material is preferably selected from the group of PIR, PUR, EPS, XPS, and equivalent materials. According to one embodiment, in which the support blocks are used, the thermally insulting material is selected from the group of PIR, PUR, EPS, XPS, and equivalent materials except in the areas above at least one or more of the support blocks, where the

thermally insulating material consists of mineral wool, and wherein a tension bar passes through the mineral wool.

Brief Description of the Figures

[0013]

Fig. 1a and 1b show side views of construction elements for use as a thermal break, as known from the prior art.

Fig. 2 shows a side view of a construction element according to one embodiment of the invention.

Fig. 3 shows a three dimensional image of a construction element according to one embodiment of the invention.

Fig. 4 shows an alternative embodiment of the construction element according to the invention.

Fig. 5 shows another embodiment of the construction element according to the invention.

Detailed Description of Preferred Embodiments of the Invention

[0014] Fig. 1a shows a cross-section of a construction element for creating a thermal break, as known from the prior art. The element consists of the following components: An elongate beam-shaped part 11 comprising a shell including a thermally insulating material 2, such as mineral wool or PIR (polyisocyanurate), PUR (polyurethane), EPS (expanded polystyrene), XPS (extruded polystyrene). The shell comprises metal side walls 3 located at the upper and lower parts of each of the sides of the beam-shaped portion 11, and of upper and lower sealing caps 4 formed of a synthetic materials, e.g., PVC. It is also possible for the shell to form a contiguous whole that completely surrounds the insulating material. At the upper part of the shell, the beam-shamed portion 11, a number of bars 5 run through the beam-shaped portion 11. These bars are configured to absorb the tensile force between the connected parts of a building. The bars 5 are usually made of steel, and pass through openings in the metal side walls 3, where the bars are welded to these metal walls in order to provide a provisional connection between the bars and the walls. 'Provisional' means that: this connection serves to secure the bars relative to the beam-shaped portion 11 during the installation of the construction element.

[0015] In a lower part of the beam-shaped portion 11, support elements 7 are provided to absorb compression and shearing forces. These are support blocks made of a solid material, e.g., concrete, with the shape of the block and the composition of the material provided so as to absorb both compression and shearing forces. In and of itself, this type of block is known, and it is described, e.g., in US 2013/0276393. One or more bars 5 are provided above each of the support blocks 7. As shown in Fig. 1b, instead of these blocks 7, more conventional compression bars 8 and bars 9 passing diagonally through the insulation may also be provided, or a support block that is only configured to absorb compression forces may be combined with a diagonal 9. The construction element is placed in a building in the known manner by placing the insulating beam-shaped portion 11 between two parts of a building, e.g., between a first concrete floor inside the building and a second concrete floor that is connected to the building in a cantilevered manner, with the bars and other force-absorbing elements anchored in the concrete floors.

[0016] A construction element according to one possible embodiment of the invention is shown in cross-section in fig. 2. The element also comprises an elongate beam-shaped portion 11, filled with thermally insulating material 2. The underside and part of the side walls of the beam-shaped portion 11 is formed by a one-piece fire-resistant component 15 consisting of a flat undersurface 16 and two raised side walls 17. The fire-resistant portion 15 is formed of a rigid, fire-resistant material with low thickness, e.g., 1 - 3 mm thick. The part 15 thus forms a profile, more specifically a U-profile, of a given stiffness. Preferably, a composite material is used for the fire-resistant profile 15. According to a particular embodiment, the profile is formed of a fibre cement, such as IPC (Inorganic Phosphate Cement) reinforced with fibreglass. On the bottom of the fire-resistant profile 15, there is a thermally insulating layer 18 that is for example 1.5 cm thick. According to a preferred embodiment, the layer 18 is formed of material that is both thermally insulating and fire-resistant. This layer 18 completely covers the flat undersurface 16 of the profile. Advantageously, the thermally insulating layer 18 has a thermal conductivity lower than 0.06W/mK at 20°C. One material that is suitable for use as the layer 18 is compressed rock wool in a thickness of between 1 and 20 mm, preferably between 10 and 15 mm. Above this bottom layer, the thermally insulating material 2 of the construction element is arranged. At the top, the construction element is sealed by a plastic sealing cap 4 and metal side walls 3, as in prior-art products. The supports 7 and the tension bars 5 are identical to those used in existing products.

[0017] Fig. 3 shows a 3D image of an embodiment of the construction element according to the invention, indicating the components described above. It can be seen that, when supporting blocks 7 are used, the fire-resistant profile 15 is provided with notches 20 in the raised side walls 17 in which the supporting blocks 7 are placed. These blocks are also often provided with guides 21 on the side walls (see fig. 2), into which the sides of the notches 20 can be slid.

[0018] The fire-resistant profile 15 may also be applied in combination with the compression bars 8 and diagonal bars 9 shown in fig. 1b, or with other combinations, such as a block that absorbs compression forces together with a diagonal bar 9.

[0019] The raised walls 17 of the fire-resistant profile 15 are high enough to cover the insulation material 2

laterally up to a certain height. Due to the fire-resistant effect of the fire-resistant profile 15 and the bottom layer 18 of the construction element, insulation material 2 with lower-level fire-resistant properties but high thermal insulation properties such as PIR, PUR, EPS, XPS, or equivalents, can be used for the construction element according to the invention. The construction element according to the invention thus offers the advantage that these high-quality materials may be used without compromising fire safety.

[0020] The tension bars 5 may be made of steel. According to one embodiment, the tension bars, or at least part of the tension bars, are made of a non-metallic material, e.g., a material based on a resin containing basalt fibres. Other possible materials for the tension bars include materials based on glass fibres or Aramid polymers.

[0021] Other embodiments are possible. Fig. 4 shows a version in which a fire-resistant profile 15 and a bottom layer 18 are provided not only at the bottom, but in which these components 15', 18' are also provided at the top of the construction element.

[0022] Fig. 5 shows an embodiment in which, above one of the support blocks 7, a plastic support 25 is positioned that holds a piece of mineral wool 26 in place. The mineral wool part 26 is approximately as wide as the support block 7, and, like the support block 7, it is positioned perpendicular to the longitudinal direction of the profile 15. The support 25 is provided with an opening 27 through which a tension bar 5 can pass so that it passes through the mineral wool part 26. The rest of the insulation (not shown) then consists of PIR foam or equivalent. The local mineral wool insulation 26 provides a further improvement in fire safety due to this local shielding of the tension bars arranged above the support blocks 7.

[0023] In order to test the effective fire resistance of the construction element according to the invention, comparative trials were carried out on elements according to the invention and elements according to the prior art. The tests were performed according to the European standard EN 1365-5:2005. Heating was carried out in accordance with the standard fire curve. The test pieces were heated from below. Four test pieces were tested according to the cross sections shown in fig. 1a, 1b, 2, and 4. Test pieces 1 and 2 are thus produced in accordance with the prior art with rock wool as the insulating material. Test pieces 2 and 3 are constructed according to the invention with PIR as the insulating material, and with a fire-resistant profile and a compressed rock wool layer at the top and/or at the bottom. The tests were carried out over a period of 120 min. The criteria of inadequate fire resistance that were verified were failure by subsidence and speed of subsidence.

[0024] None of the test pieces fulfilled the aforementioned criteria for inadequate fire resistance during the 120 min period. This means that the test pieces according to the invention are as fire-resistant as the known-art test pieces. In other words, the fire-resistant profile 15 and the compressed rock wool layer 18 confer the same fire resistance properties on the element with PIR as an element using rock wool as insulation.

Claims

1. Construction element (10) for forming a connection between two parts of a building which are thermally insulated from one another, comprising:

   • an elongate portion (11) comprising a thermally insulating material (2), and configured to be placed between the parts of the building,
   • bars (5, 6) which run through the elongate portion (11) and which are configured to be anchored in the building parts that are to be connected, and thus to absorb the tensile forces between these building parts,
   • components (7) for absorbing compression and shear forces between the building parts,

   characterised in that the underside and part of the raised side walls of the elongate portion (11) are formed by a fire-resistant profile (15) with a base surface (16) and two raised side walls (17), and wherein a thermally insulating layer (18) is provided on the base surface (16) of the fire-resistant profile (15).

2. Construction element according to claim 1, wherein the thermally insulating layer (18) is also fire-resistant.

3. Construction element according to claim 1 or 2, wherein the fire-resistant profile (15) is made of a composite material.

4. Construction element according to claim 3, wherein the composite material is a fire resistant fibre cement.

5. Construction element according to claim 4, wherein the thickness of the fire-resistant profile (15) is between 1 and 3 mm.

6. Construction element according to any one of the preceding claims, wherein the thermally insulating layer (18) is formed of a material with a thermal conductivity lower than 0.06W/mK at 20°C.

7. Construction element according to any one of the preceding claims, wherein the thermally insulating layer (18) is made of compressed rock wool.

8. Construction element according to any one of the preceding claims, wherein a fire-resistant profile (15') with a base surface and two downward side

walls is also provided at the top of the elongate portion (11), and wherein a thermally insulating layer (18') is also provided on the base surface of the uppermost fire-resistant profile (15').

9. Construction element according to claim 8, wherein the thermally insulating layer (18') at the top of the elongate portion (11) is also fire-resistant.

10. Construction element according to any one of the preceding claims, wherein a number of support blocks (7) are provided as means for absorbing compression and/or shearing forces, and wherein the raised side walls (17) of the fire-resistant profile (15) are provided with notches (20) to provide space for the support blocks (7).

11. Construction element according to any one of the preceding claims, wherein the thermally insulating material (2) is selected from the group of PIR, PUR, EPS, XPS, and equivalent materials.

12. Construction element according to claim 9, wherein the thermally insulting material (2) is selected from the group of PIR, PUR, EPS, XPS, and equivalent materials except in the areas above at least one or more of the support blocks (7), where the thermally insulating material consists of mineral wool (26), and wherein a tension bar (5) passes through the mineral wool (26).

Patentansprüche

1. Bauelement (10) zur Bildung einer Verbindung zwischen zwei Teilen eines Gebäudes, die voneinander wärmeisoliert sind, umfassend:

- einen verlängerten Abschnitt (11), umfassend ein Wärmeisoliermaterial (2) und konfiguriert, um zwischen den Teilen des Gebäudes platziert zu sein,
- Stangen (5, 6), die durch den verlängerten Abschnitt (11) verlaufen, und die konfiguriert sind, um in den Gebäudeteilen, die verbunden werden sollen, verankert zu sein und somit, um die Zugkräfte zwischen diesen Gebäudeteilen zu absorbieren,
- Komponenten (7), um Kompressions- und Scherkräfte zwischen den Gebäudeteilen zu absorbieren,

dadurch gekennzeichnet, dass die Unterseite und ein Teil der erhöhten Seitenwände des verlängerten Abschnitts (11) durch ein flammenbeständiges Profil (15) mit einer unteren Fläche (16) und zwei erhöhten Seitenwänden (17) gebildet sind, und wobei eine Wärmeisolierschicht (18) auf der unteren Fläche (16) des flammenbeständigen Profils (15) bereitgestellt ist.

2. Bauelement nach Anspruch 1, wobei die Wärmeisolierschicht (18) ebenfalls flammenbeständig ist.

3. Bauelement nach Anspruch 1 oder 2, wobei das flammenbeständige Profil (15) aus einem Verbundmaterial hergestellt ist.

4. Bauelement nach Anspruch 3, wobei das Verbundmaterial ein flammenbeständiger Faserzement ist.

5. Bauelement nach Anspruch 4, wobei die Dicke des flammenbeständigen Profils (15) zwischen 1 und 3 mm ist.

6. Bauelement nach irgendeinem der vorhergehenden Ansprüche, wobei die Wärmeisolierschicht (18) aus einem Material mit einer Wärmeleitfähigkeit von weniger als 0,06 W/mk bei 20 °C ist.

7. Bauelement nach irgendeinem der vorhergehenden Ansprüche, wobei die Wärmeisolierschicht (18) aus komprimierter Steinwolle hergestellt ist.

8. Bauelement nach irgendeinem der vorhergehenden Ansprüche, wobei ein flammenbeständiges Profil (15') mit einer unteren Fläche und zwei nach unten gerichteten Seitenwänden auch an der oberen Seite des verlängerten Abschnitts (11) bereitgestellt ist, und wobei eine Wärmeisolierschicht (18') auch auf der unteren Fläche des obersten flammenbeständigen Profils (15') bereitgestellt ist.

9. Bauelement nach Anspruch 8, wobei die Wärmeisolierschicht (18') an der oberen Seite des verlängerten Abschnitts (11) ebenfalls flammenbeständig ist.

10. Bauelement nach irgendeinem der vorhergehenden Ansprüche, wobei eine Anzahl von Stützblöcken (7) als Mittel zum Absorbieren von Kompressions- und/oder Scherkräften bereitgestellt ist, und wobei die erhöhten Seitenwände (17) des flammenbeständigen Profils (15) mit Nuten (20) ausgestattet sind, um Raum für die Stützblöcke (7) bereitzustellen.

11. Bauelement nach irgendeinem der vorhergehenden Ansprüche, wobei das Wärmeisoliermaterial (2) ausgewählt ist aus der Gruppe von PIR, PUR, EPS, XPS und ähnlichen Materialien.

12. Bauelement nach Anspruch 9, wobei das Wärmeisoliermaterial ausgewählt ist aus der Gruppe von PIR, PUR, EPS, XPS und ähnlichen Materialien, außer in den Bereichen über mindestens einem oder mehreren der Stützblöcke (7), wobei das Wärmeisoliermaterial aus Mineralwolle (26) besteht, und

wobei eine Zugstange (5) durch die Mineralwolle (26) verläuft.

Revendications

1. Élément de construction (10) pour former un raccordement entre deux parties d'un bâtiment qui sont thermiquement isolées l'une de l'autre, comprenant :

   - une partie allongée (11) comprenant un matériau thermiquement isolant (2) et configurée pour être placée entre les parties du bâtiment,
   - des barres (5, 6) qui parcourent la partie allongée (11) et qui sont configurées pour être ancrées dans les parties de bâtiment qui doivent être raccordées, et ainsi pour absorber les forces de traction entre ces parties de bâtiment,
   - des composants (7) pour absorber les forces de compression et de cisaillement entre les parties de bâtiment,

   caractérisé en ce que la face inférieure et la partie des parois latérales relevées de la partie allongée (11) sont formées par un profil résistant au feu (15) avec une surface de base (16) et deux parois latérales relevées (17), et dans lequel une couche thermiquement isolante (18) est prévue sur la surface de base (16) du profil résistant au feu (15).

2. Élément de construction selon la revendication 1, dans lequel la couche thermiquement isolante (18) est également résistante au feu.

3. Élément de construction selon la revendication 1 ou 2, dans lequel le profil résistant au feu (15) est réalisé avec un matériau composite.

4. Élément de construction selon la revendication 3, dans lequel le matériau composite est un fibrociment résistant au feu.

5. Élément de construction selon la revendication 4, dans lequel l'épaisseur du profil résistant au feu (15) est comprise entre 1 et 3 mm.

6. Élément de construction selon l'une quelconque des revendications précédentes, dans lequel la couche thermiquement isolante (18) est formée à partir d'un matériau avec une conductivité thermique inférieure à 0,06 W/mk à 20°C.

7. Élément de construction selon l'une quelconque des revendications précédentes, dans lequel la couche thermiquement isolante (18) est réalisée avec de la laine de roche compressée.

8. Élément de construction selon l'une quelconque des revendications précédentes, dans lequel un profil résistant au feu (15') avec une surface de base et deux parois latérales descendantes est également prévu au sommet de la partie allongée (11), et dans lequel une couche thermiquement isolante (18') est également prévue sur la surface de base du profil résistant au feu (15') le plus haut.

9. Élément de construction selon la revendication 8, dans lequel la couche thermiquement isolante (18') au sommet de la partie allongée (11) est également résistante au feu.

10. Élément de construction selon l'une quelconque des revendications précédentes, dans lequel un certain nombre de blocs de support (7) est prévu en tant que moyens pour absorber les forces de compression et/ou de cisaillement, et dans lequel les parois latérales relevées (17) du profil résistant au feu (15) sont prévues avec des encoches (20) pour fournir de l'espace pour les blocs de support (7).

11. Élément de construction selon l'une quelconque des revendications précédentes, dans lequel le matériau thermiquement isolant (2) est sélectionné dans le groupe comprenant PIR, PUR, EPS, XPS et les matériaux équivalents.

12. Élément de construction selon la revendication 9, dans lequel le matériau thermiquement isolant (2) est sélectionné dans le groupe comprenant PIR, PUR, EPS, XPS et les matériaux équivalents, excepté dans les zones au-dessus d'au moins un ou plusieurs blocs de support (7) où le matériau thermiquement isolant se compose de laine minérale (26), et dans lequel une barre de tension (5) passe à travers la laine minérale (26).

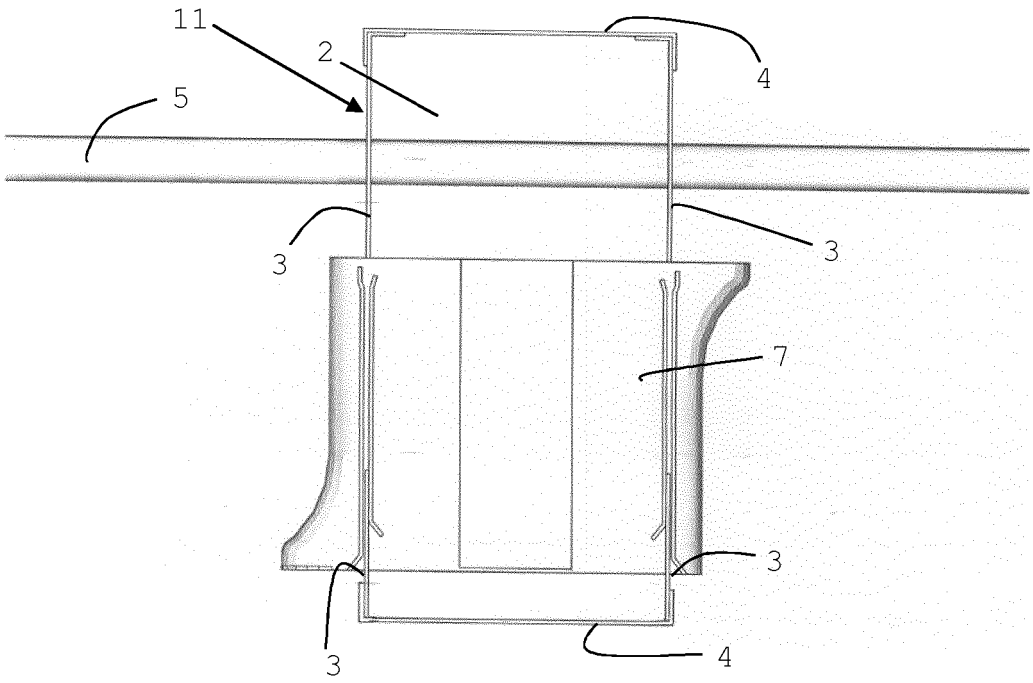

FIG. 1a

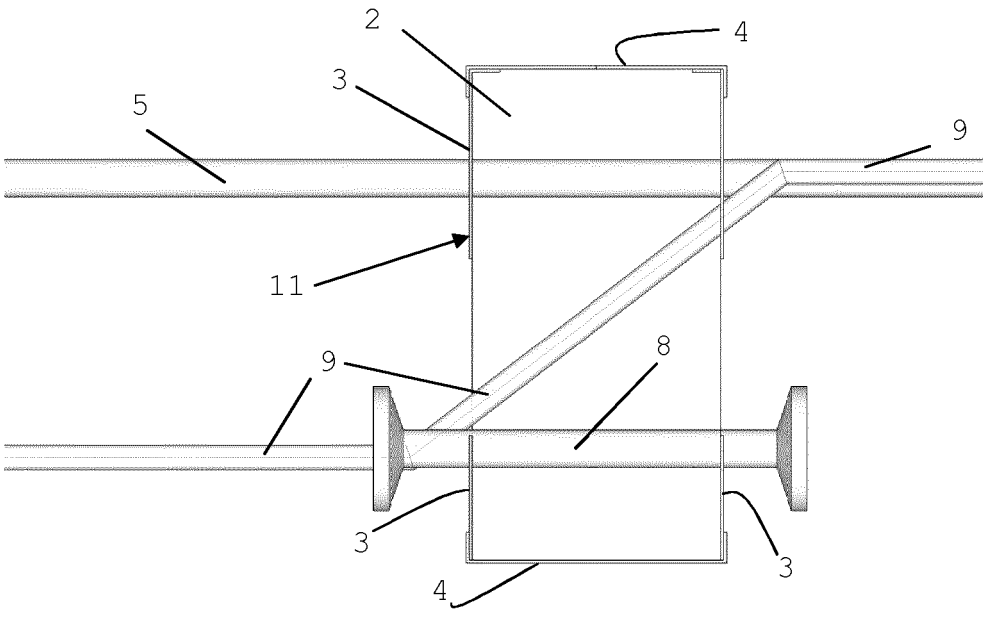

FIG. 1b

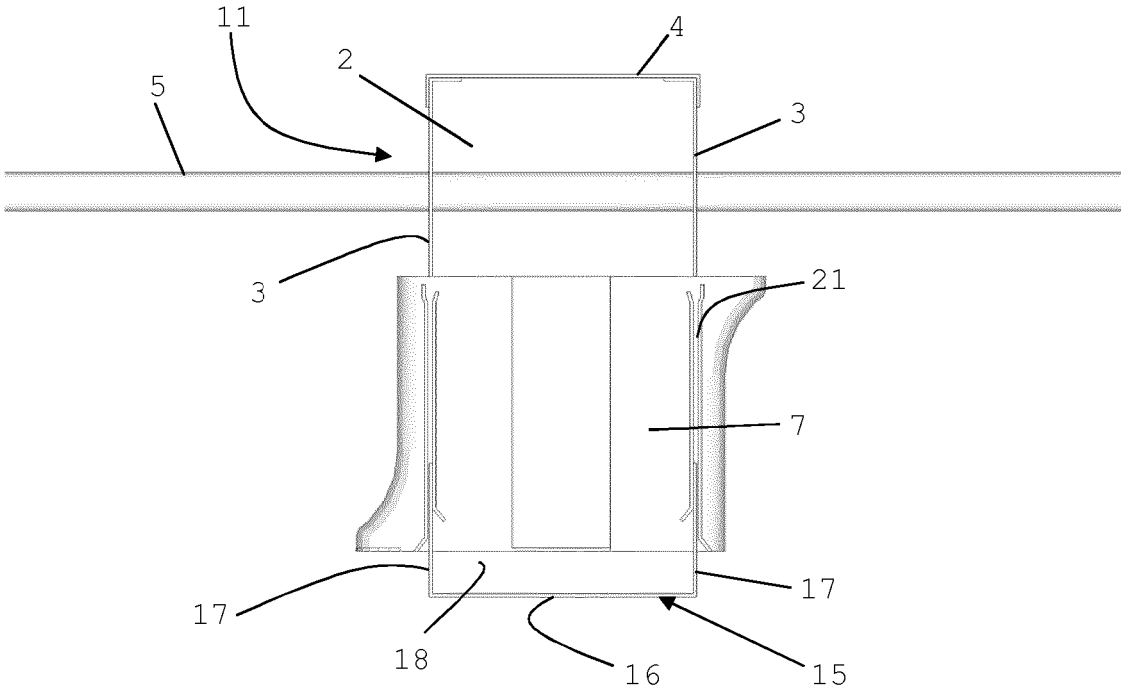

FIG. 2

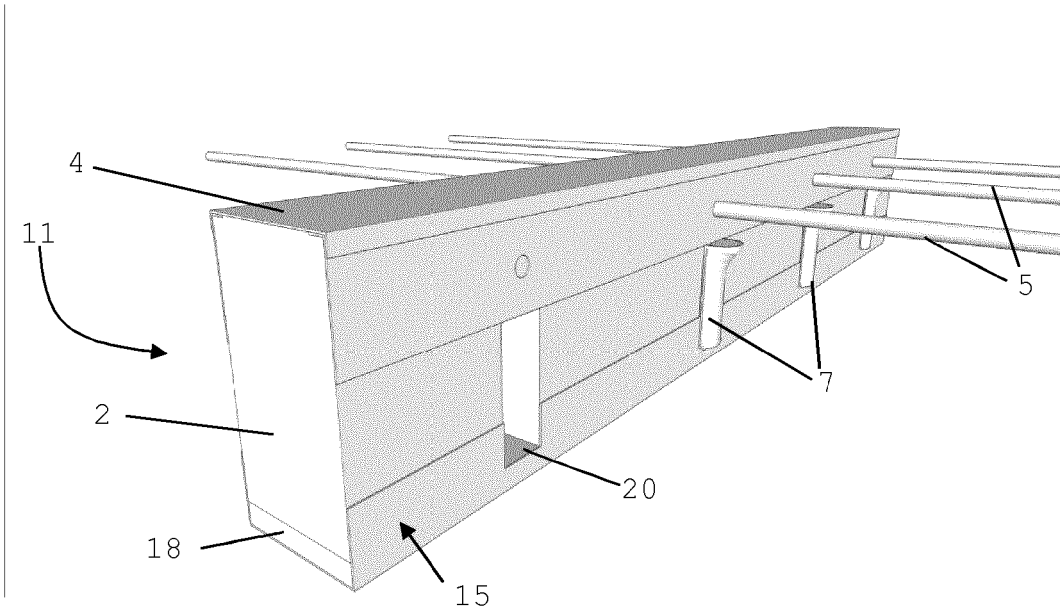

FIG. 3

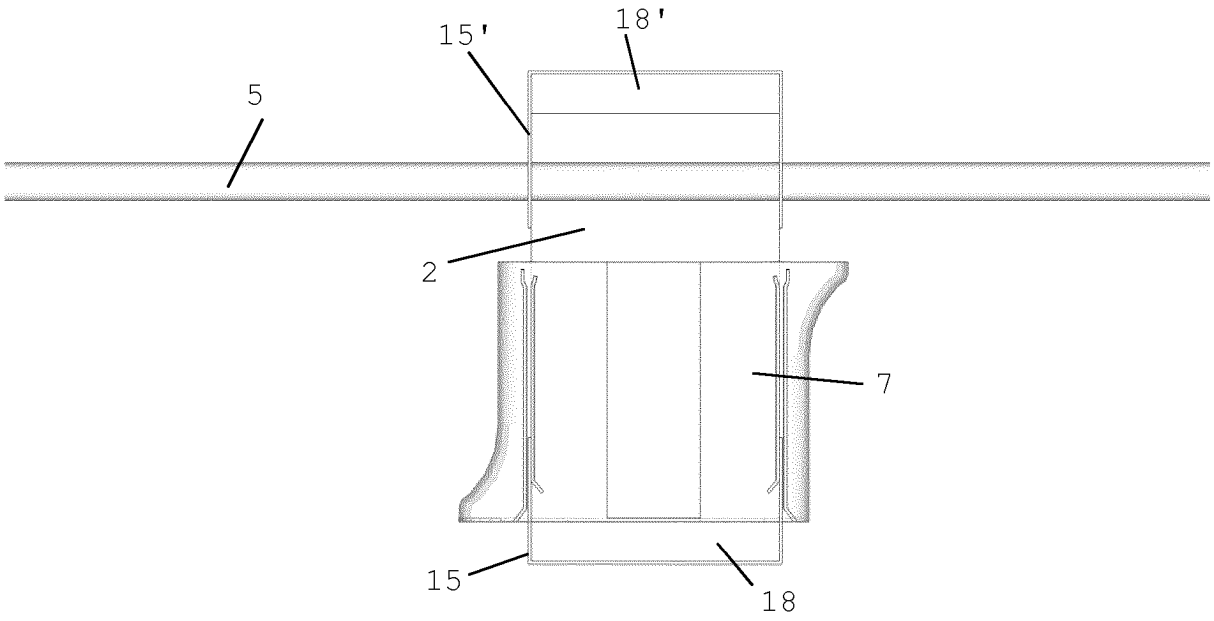

FIG. 4

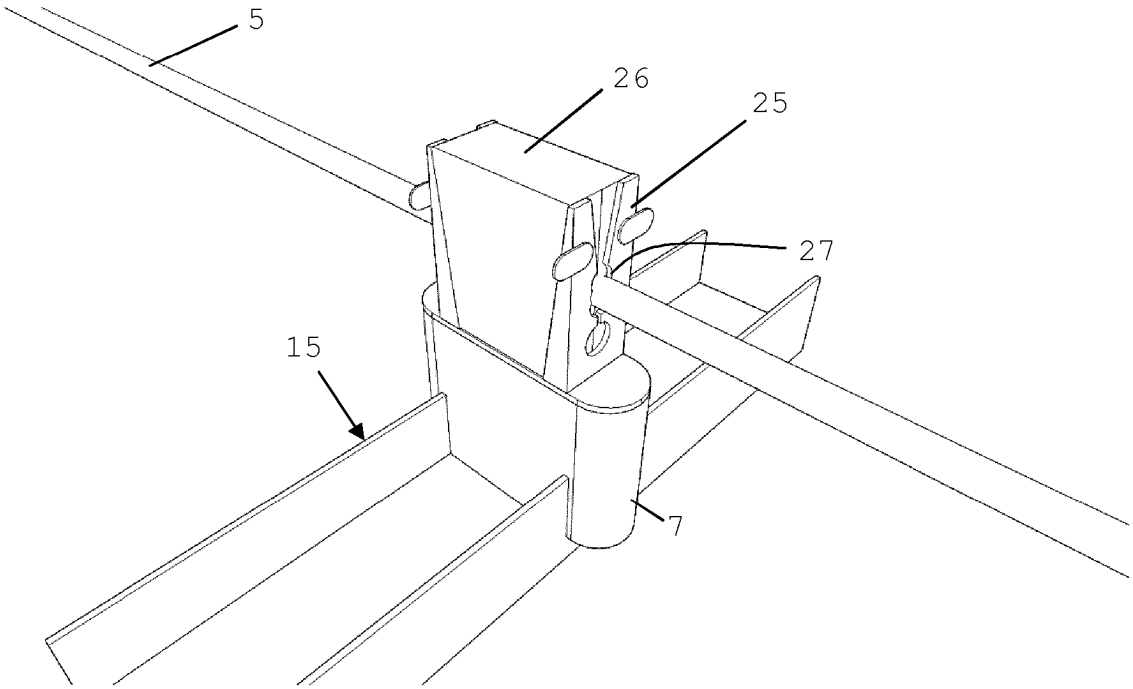

FIG. 5

REFERENCES CITED IN THE DESCRIPTION

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- US 20130276393 A **[0015]**