



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
01.01.2020 Bulletin 2020/01

(51) Int Cl.:
E04F 17/00 (2006.01) E04B 1/24 (2006.01)

(21) Application number: **19020367.9**

(22) Date of filing: **06.06.2019**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

• **Sojka, Rene**
64100 Brno (CZ)

(72) Inventors:
• **Smrcek, Martin**
69701 Kyjov (CZ)
• **Sojka, Rene**
64100 Brno (CZ)

(30) Priority: **08.06.2018 CZ 201800278 U**

(74) Representative: **Kendereski, Dusan**
Turanka 115a
627 00 Brno (CZ)

(71) Applicants:
• **Smrcek, Martin**
69701 Kyjov (CZ)

(54) **MODULAR SELF-BEARING CONSTRUCTION OF A LIFT SHAFT**

(57) A modular, self-supporting structure of a lift shaft comprising columns (1) and crossbeams (2) fixed to each other by connecting elements (4), comprising horizontal elements (41) with openings and a body (43) provided with at least one opening, wherein in the body (43), a vertical element (42) with openings (14) is arranged (14), the vertical element (42) being provided with a reinforced portion (13) with openings (14), wherein the outer surface (431) of the body (43) is connected to the horizontal elements (41) while the inner surface (432) of the body (43) is connected to the outer surface (421) of the vertical element (42), the inner surface (422) of which is connected to the reinforced portion (13) with the openings (14).

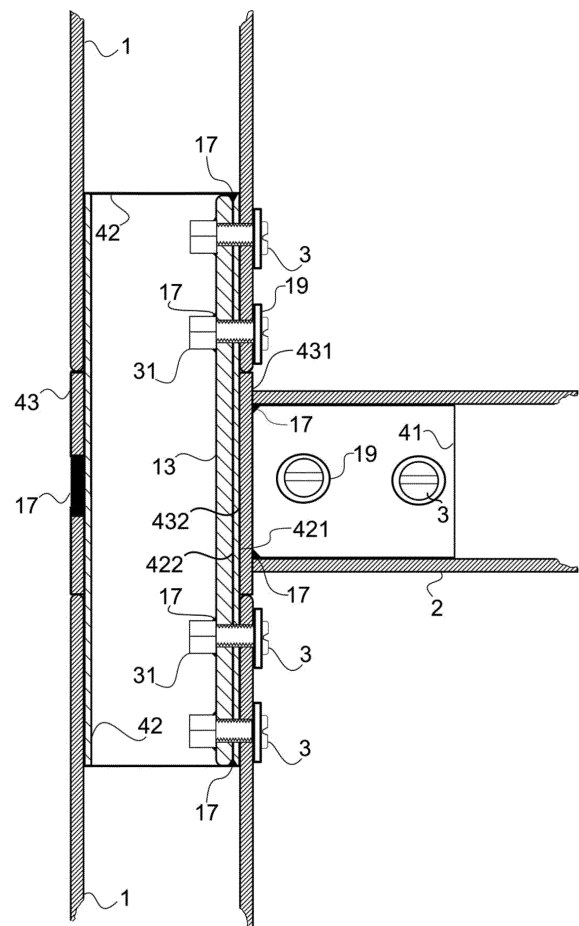


Fig. 2

Description

Field of the invention

[0001] The present invention relates to a modular, self-supporting structure of a lift shaft comprising columns and crossbeams that are fixed to each other by connecting elements.

Background of the invention

[0002] A modular self-supporting structure of a lift shaft usually consists of columns arranged in the corners of the shaft and horizontal beams that connect the columns. These elements are normally formed by closed steel profiles and are welded together.

[0003] The disadvantage of welded shafts is that they are assembled in difficult working conditions, where high quality welds are required and grinded, causing increased cutting and grinding noise, as well as clutter in and around the assembly. After grinding, it is necessary to provide these parts with coatings that release hazardous fumes from synthetic paints. These processes extend the assembly time of lift shaft structures.

[0004] The Czech utility model CZ 30697 U1 describes a structure of a lift shaft formed by columns interconnected by horizontal beams, where these beams are open steel profiles, wherein the beams are fastened to the columns by screw connections. The beams may be provided with brackets for anchoring the lift cabin guide bar. The bracket is attached by screws to a mounting plate which is inserted into the beam profile. The openings in the bracket intended for the passage of the connecting bolts are elongated in the horizontal direction so that the horizontal position of the cabin guide bar can be corrected.

[0005] The disadvantage of using open steel profiles in lift shaft structures is mainly due to their lower load-bearing capacity and strength. This results in diminished stability and rigidity of the lift shaft. In order to provide sufficient load-bearing capacity of the lift shaft made of open profiles, it is necessary to provide additional crossbeams and support elements to the structure. In addition, dust and dirt particles tend to settle in open profiles, resulting in more frequent lift shaft maintenance.

Summary of the invention

[0006] It is an object of the present invention to provide a modular, self-supporting structure of a lift shaft that allows it to quick and easy assembly directly on site.

[0007] The aforementioned object is achieved by a modular self-supporting structure comprising columns and crossbeams fixed to each other by connecting elements, the principle being that it comprises horizontal elements with openings and a body provided with at least one opening, wherein in the body, a vertical element with openings is arranged, the vertical element being provided with a reinforced portion with the openings, wherein the

outer surface of the body is connected to the horizontal elements, while the inner surface of the body is connected to the outer surface of the vertical element, the inner surface of which is connected to the reinforced portion with the openings.

[0008] The essence of this is that for the connection of the column to the crossbeams, the column is provided with the horizontal element with openings, where the outer surface of the column is connected to the horizontal element. The column provided with the horizontal element is called a modified column.

[0009] The essence is also that the modular structure of the lift shaft consists of modules or modified modules. One module comprises columns formed by closed steel profiles which are fixed to the connecting element or to a terminating element or to an anchoring plate. The connecting element and the terminating element comprise a body formed by a closed steel profile which is connected to the horizontal elements to which the crossbeams formed by closed steel profiles are attached. The crossbeams can be provided with cabin guide anchors and a filler fastening mechanism. The modified module contains modified columns made of closed steel profiles. The modified columns are attached to the anchoring plate or to the connecting element or to the terminating element. The connecting element and the terminating element comprise a body formed by a closed steel profile. The crossbeams are formed by closed steel profiles and are connected to the connecting element or to the terminating element or to the modified column through the horizontal elements. The crossbeams can be provided with the cabin guide anchors or the filler fastening mechanism. The vertical elements can be attached to the modified column at any point.

[0010] For ease of assembly of the columns and crossbeams, it is preferred that the connecting element comprises a body provided with openings intended for welded connection. Two vertical elements with screw openings are arranged opposite one other in the body, wherein a reinforced portion provided with screw openings is provided on one of the inner surfaces of the vertical elements. The connecting element further comprises horizontal elements with screw openings, wherein the outer surface of the body is connected to the horizontal elements, while the inner surface of the body is connected to the outer surface of the vertical element, the inner surface of which is connected to the reinforced portion with screw openings.

[0011] It is furthermore advantageous that the modular self-supporting structure uses closed profiles, or flat steel, which have a greater rigidity than open profiles, wherein their detachable connection is realized by a screw, while their undetachable connection is realized by a weld.

[0012] To ensure quick and easy assembly of the modular self-supporting structure of the lift shaft, the columns and crossbeams are connected to each other by a screw connection. To ensure maximum connection strength,

the screw openings are threaded, or the openings are provided with nuts at the end. A connecting element consisting of a body, at least one vertical element and horizontal elements is welded and adjusted in a workshop and is delivered the site of assembly as a finished piece, where it does not require any further adjustments before use.

[0013] In order to achieve a uniform appearance of the lift shaft, it is advantageous if the body of the connecting element and the columns are formed by closed steel profiles of the same size, which, when joined together, forms a line from their outer walls. The vertical element and the horizontal elements have a smaller diameter than the columns and crossbeams, thereby allowing the crossbeams to slide onto the horizontal elements and the columns on the vertical elements. After insertion, these are fastened with threaded bolts or nuts. The columns and crossbeams have a rectangular shape in plan view and can be made of steel, aluminium or stainless steel, where the columns are made of closed steel profiles and the crossbeams are made of closed steel profiles or flat steel with the possibility to slide onto the vertical elements of the connecting element and to be fastened with a threaded or nut screw connection, wherein the closed steel profiles include thick-walled and thin-walled profiles which can be combined.

[0014] To fasten the filler, the crossbeams are provided with a fastening mechanism, wherein the filler can be a safety glass, a "Knauf Diamant" plate, a "Fermacell" plate, a coloured safety glass, and the like. The fastening mechanism for fastening the filler comprises bars provided with a groove and a seal, and a tongue which is formed by a flat portion provided with an opening on which profile portions, which are arranged in the groove, adjoin on both sides.

[0015] To anchor the lift cabin guide bar, the crossbeam is provided with cabin guide anchors. The cabin guide anchor is fixed to the crossbeam by means of a welded bracket, rivets or bolts via a threaded connection with possibility of necessary adjustment. By necessary adjustment, it is meant the correction of the guides with respect to the lift cabin. In this case, at one height level, two opposing crossbeams are provided with guide anchors, i.e. each with at least one of the guide anchors. Thus, it is possible to attach the guides of counterweights of the lift cabin in traction lifts.

[0016] The advantage is that both the connecting element and the column with the horizontal element are prepared in a workshop, where their parts are welded together, then grinded and the surface is painted according to RAL. They are then transported to the assembly site, where the individual parts of the lift shaft are assembled into the final structure, wherein they are bolted together. Welding, grinding, cutting and coating of closed profiles of the connecting element or the modified columns is not carried out at the assembly site, which is mostly located in occupied spaces, thus reducing the risk of occupational hazards in terms of safe operational standard.

Summary of the drawings

[0017] The invention will be explained in more detail with reference to the accompanying drawings, where Fig. 1 shows a side view of a structure of the connecting element with one vertical element; Fig. 2 is a side view of a connection of the connecting element comprising one vertical member with the columns and the crossbeam in place; Fig. 3 shows a side view of the connecting element with two vertical elements; Fig. 4 shows a side view of the connecting element comprising two vertical members with the columns and the crossbeam in place; Fig. 5 is a side view of the terminating element with the column and crossbeam in place; Fig. 6 is a top view of the connection of the horizontal elements made of flat steel to the crossbeam from the outside of the crossbeam; Fig. 7 is a top view of the connection of the horizontal elements made of closed metal profiles to the crossbeam; Fig. 8 shows a side view of the connection of the horizontal elements made of flat steel to the crossbeam; Fig. 9 is a side view of the column provided with a horizontal element made of flat steel; Fig. 10 shows a detail of the mechanism for fastening the filler to the crossbeam; Fig. 11 shows an exemplary module of a modular structure of a four-column lift shaft, Fig. 12 shows a module of a modular structure of a lift shaft with four columns and two modified columns; Fig. 13 shows an exemplary embodiment of a modular structure of a five-module lift shaft; Fig. 14 shows an exemplary embodiment of a modular, self-supporting structure of a lift shaft with two modified modules and two modules; and Fig. 15 shows an exemplary embodiment of a modular, self-supporting structure of a lift shaft with n number of modified modules.

Exemplary embodiments of the invention

[0018] The invention will be explained in more detail with reference to the accompanying drawings which show details of the structure and preferred embodiments of the modular self-supporting lift shaft structure.

[0019] The structure of a connecting element 4 is shown in Fig. 1. The connecting element 4 in this embodiment includes a body 43 made of a closed steel profile with an inner surface 432 and an outer surface 431. The body 43 is provided with an opening 14 for connection to a vertical element 42. The connection may be realized by a screw 3 or a weld 17. The connecting element 4 further comprises the vertical element 42 made of a closed steel profile which is inserted into the body 43 where it is fixed. The vertical member 42 has an inner surface 422, an outer surface 421, and is provided with a reinforced portion 13. The vertical member 42 and the reinforced portion 13 are provided with openings 14 for connection to columns 1. After mounting the vertical member 42 to the body 43, the inner surface 432 of the body 43 and the outer surface 422 of the vertical member 42 are connected. While the inner surface 421 of the vertical member 42 is connected to the reinforced portion

13 by the weld 17. The connecting member 4 further comprises horizontal members 41 that are arranged at 90° to each other. The outer surface 431 of the body 43 is connected to the horizontal elements 41. This connection is made by the weld 17. The horizontal elements 41 can be made of flat steel or a closed steel profile and are provided with openings 14 for connection to the crossbeam 2, wherein the opening 14 has a circular shape in plan view.

[0020] The fastening of the columns 1 and the crossbeams 2 to the connecting element 4, where its body 43 is provided with one vertical element 42 is shown in Fig. 2. The body 43 and the vertical element 42 are made of steel closed profiles. The connecting element 4 further comprises the horizontal elements 41 which are arranged at 90° to each other and are made of flat steel. Their attachment to the body 43 is accomplished by means of the weld 17. To avoid vibration, it is advantageous if the screws 3 under the head are provided with washers 19. The nuts 31 are connected by the weld 17 with the reinforced portion 13. The horizontal elements 41 are made of flat steel and can be fixed to the crossbeams 2 from the inside of the crossbeam 2, as shown in Fig. 8, or from the outside of the crossbeam 2, as shown in Fig. 6. The reinforced portions 13 may be made of closed steel profiles on which the crossbeam 2 is inserted and fastened with a screw connection as shown in Fig. 7. To achieve a uniform appearance of the lift shaft, the body 43 is provided with the opening 14 for the weld 17, and this weld 17 is subsequently grinded. After grinding the weld 17, the smooth outer wall 431 of the body 43 of the connecting element 4 is formed.

[0021] Fig. 3 shows a preferred embodiment of the connecting element 4. In this embodiment, the structure comprises the body 43 made of a closed steel profile with the inner surface 432 and the outer surface 431. The body 43 is provided with the openings 14 for the weld 17. The connecting element 4 further comprises the vertical elements 42 made of a closed steel profile which are inserted into the body 43 opposite one another and are rigidly connected to the body 43. This connection is realized by the weld 17 through the openings 14 which are formed in the body 43 for this purpose. The vertical elements 42 have the inner surface 422, the outer surface 421 and the reinforced portion 13, where the vertical elements 42 and the reinforced portion 13 are provided with the openings 14 for the screws 3. The inner surface 421 of the vertical element 42 is joined by the weld 17 with a reinforced portion 13, it further comprises the horizontal elements 41, wherein the outer surface 431 of the body 43 is in communication with the horizontal elements 41. The connection is made by the weld 17. The horizontal elements 41 can be made of flat steel or closed steel profiles and are provided with the openings 14 for the screws 3.

[0022] The fastening of the columns 1 and the crossbeams 2 to the connecting element 4 provided with two vertical elements 42 is shown in Fig. 4. The vertical ele-

ments 42 of the connecting element 4 are fastened with the columns 1 and the crossbeams 2 are fixed to the horizontal elements 41 of the connecting element 4. The vertical elements 42 and the horizontal elements 41 are fixed to the columns 1 and the crossbeams 2 by means of the screws 3, the washers 19 and the nuts 31. The nuts 31 are attached to the reinforced portion 13 so that they are fixed to the reinforced portion 13 by the weld 17. In this exemplary embodiment, the horizontal elements 41 are provided as flat steel, in which the openings 14 for the screws 3 are formed. To achieve a uniform appearance of the lift shaft, the body 43 is provided with the openings 14 for the weld 17 and is subsequently grinded. After grinding the welds 17, the smooth outer wall 431 of the body 43 of the connecting element 4 is formed.

[0023] Fig. 5 shows a terminating element 44 having the body 43 made of a closed steel profile, the body 43 having the opening 14 for the weld 17 in which the vertical member 42 is inserted from the underside. The vertical member 42 is made of a closed steel profile and is connected to the body 43 by means of the weld 17 through the opening 14 in the body 43. The vertical member 42 is provided with the reinforced portion 13 with which it is connected by the weld 17. The reinforced part 13 and the vertical element 42 are provided with the openings 14 for the screw 13, wherein the reinforced element 13 is connected to the nuts 31 by means of the welds 17. The openings 14 for the screws 3 are provided with a thread 18. The body 43 is provided with a cover 20 on its upper side. The horizontal element 41 is connected to the outer surface 431 of the body 43, and this connection is made by the weld 17. The crossbeam 2 is attached to the horizontal member 41, while the column 1 is slid onto the bottom part of the vertical member 42.

[0024] Fig. 9 shows a modified column 16 provided with the horizontal element 41. The modified column 16 is formed by a method of connecting the horizontal element 41 to the column 1 by means of the weld 17. The horizontal element 41 is made of a closed metal profile as shown in Fig. 9 and is connected to the crossbeam in the same manner as shown in Figure 7. This is the case where the lift shaft needs to be extended in a horizontal direction and is provided with a further crossbeam 2. In another embodiment, the horizontal member 41 is made of flat steel and is connected to the crossbeam 2 in the same manner as shown in Fig. 6 or Fig. 8.

[0025] Fig. 10 shows the fastening mechanism 12 for the filler 10, which in this embodiment is a safety-glass pane. The mechanism includes a tongue anchor 7, a tongue 6, a pair of bars 8 with a groove 11, and a seal 9. The tongue 6 forms a straight middle portion 61 which is secured to the crossbeam 2 by means of the tongue anchor 7 and two profiled portions 62 for attachment to the groove 11 of the bar 8 at both ends. The two profiled parts of the tongue 6 are arranged in the groove 11 of the bar 8, whereby the bars 8 are fixed to the crossbeam 2. The mechanism 12 further includes the seal 9, which

is provided with each bar 8, between which the filler 10 is fixed. The filler 10 is in this case formed as a glass pane 10. The tongue anchor 7 is provided by a screw.

[0026] Fig. 11 is a plan view of one lift shaft module 21 formed by four columns 1. The columns 1 are arranged at each corner of the module 21 of the modular self-supporting structure of the lift shaft and are not shown in Fig. 11. The connecting element 4 is attached to each column 1. The horizontal elements 41 of the connecting element 4 are provided with the openings 14 for the screws 3 through which they are fastened to the crossbeams 2 by means of a screw connection. The crossbeams 2 are thus fixed to the columns 1. The crossbeams 2 are further provided with cabin guide anchors 5. By interconnecting these modules 21, the desired lift height level is reached.

[0027] Fig. 12 is a plan view of one cargo lift shaft module consisting of four columns 1 and a pair of modified columns 16. The columns 1 are arranged at each corner of the cargo lift module, and the modified columns 16 are arranged between them, with the horizontal elements 41. The horizontal elements 41 are in this case arranged at an angle of 180° with respect to each other. This structure of the lift shaft is used, in particular for cargo lifts.

[0028] Fig. 13 shows an exemplary embodiment of a modular, self-supporting structure of a lift shaft with a lift elevation of 6.7 m. The structure in this embodiment comprises 5 modules 21. One module 21 comprises the columns 1 made of closed steel profiles of 1260 mm height with a dimension of 60 x 60 x 3 mm, which are connected to the connecting element 4 or to the anchoring plate 15 or to the terminating element 44. The connecting element 4 and the terminating element 44 both include the body 43 made of a closed steel profile of 60 x 60 x 3 mm to which crossbeams 2 made of closed steel profiles of 60 x 60 x 3 mm are attached. One module 21 has a height of 1340 mm. The crossbeams 2 are provided with cabin guide anchors 5. The lift shaft structure in this embodiment further includes anchoring plates 15 to which the columns 1 of the first module 211 and the terminating element 44 are attached to which the columns 1 of the last module 212 are attached.

[0029] Fig. 14 shows a further exemplary embodiment of a modular, self-supporting lift shaft structure for a two-floor building with a height of 6 m and a recess for a lift of 0.68 m. In this case, the total lift height of the lift is 6.68 m. The construction of the lift shaft includes two modules 21 with a height of 1340 mm and two modified modules 22 with a height of 2000 mm. The modified module 22 comprises the modified columns 16 made of closed steel profiles with a height of 1920 mm with a dimension of 60 x 60 x 3 mm. The modified columns 16 are connected to the anchoring plate 15 or to the connecting element 4 or to the terminating element 44. The connecting element 4 and the terminating element 44 include the body 43 made of a closed steel profile 60 x 60 x 3 mm. The crossbeams 2 are made by closed steel profiles 40 x 60 x 3 mm and are connected to the connecting element 4 or to the terminating element 44 or to the modified column

16 via the horizontal elements 41. The vertical elements 42 can be attached to the modified column 16 at any location.

[0030] A combination of both modules 21 and modified modules 22 may be used to construct a lift shaft that needs to be adapted to height differences, such as height differences between building depressions and the boarding site of the lift cabin. These modules 21 and modified modules 22 have different heights, as shown in Fig. 14. In this case, the modified columns 16 of the first modified module 221 are attached to the anchoring plates 15. The modified columns 16 are provided with the vertical members 41 for securing the crossbeams 2. In this case, the vertical members 41 are attached to the modified column 16 at the desired height of 0.68 m. Subsequently, these columns 16 are connected to the connecting element 4 of the module 21. The modified modules 22 allow to connect the crossbeam 2 to the column 16 at any height. In this way, it is possible to ensure that the fillers 10 of different dimensions and in the various height levels are fitted to the structure the self-supporting lift shaft.

[0031] Fig. 15 shows a modular structure of a self-supporting lift shaft comprising n number of modules, where n > 1. The modified modules 22, which are connected to each other by the connecting element 4, can be used to simplify the assembly of the lift shaft structure; wherein the modified columns 16 of the first modified module 221 are fastened to the anchoring plates 15, while the modified columns 16 of the last modified module 222 are attached to the terminating element 44 provided with the cover 20. The simplicity of assembly is mainly due to the fact that a smaller amount of material is carried to the assembly site of the modular structure of the lift shaft.

Industrial applicability

[0032] The invention has industrial utility in constructing lift shafts designed to be located inside or outside buildings.

List of reference signs

[0033]

- | | |
|----|----------------------|
| 1 | - Column |
| 2 | - Crossbeam |
| 3 | - Screw |
| 31 | - Nut |
| 4 | - Connecting element |
| 41 | - Horizontal element |
| 42 | - Vertical element |

- 421 - Outer surface of the vertical element
- 422 - Inner surface of the vertical element
- 43 - Body
- 431 - Outer surface of the body of the connecting element
- 432 - Inner surface of the body of the connecting element
- 5 - Guide anchor
- 6 - Tongue
- 61 - Flat portion
- 62 - Profile portion
- 7 - Tongue anchor
- 8 - Bar with a groove
- 9 - Seal
- 10 - Filler
- 11 - Groove
- 12 - Mechanism
- 13 - Reinforced portion
- 14 - Opening
- 15 - Anchoring plate
- 16 - Modified column
- 17 - Weld
- 18 - Thread
- 19 - Washer
- 20 - Cover
- 21 - Module
- 211 - First module
- 212 - Last module
- 22 - Modified module
- 221 - First modified module

- 221 - Last modified module
- 23 - Building depression

5

Claims

1. A modular self-supporting structure of a lift shaft comprising columns (1) and crossbeams (2) fixed to each other by connecting elements (4), **characterized in that** it comprises horizontal elements (41) with openings and a body (43) provided with at least one opening, wherein in the body (43), a vertical element (42) with openings (14) is arranged, the vertical element (42) being provided with a reinforced portion (13) with the openings (14), wherein the outer surface (431) of the body (43) is connected to the horizontal elements (41), while the inner surface (432) of the body (43) is connected to the outer surface (421) of the vertical element (42), the inner surface (422) of which is connected to the reinforced portion (13) with the openings (14).
2. The modular self-supporting structure of a lift shaft according to claim 1, **characterized in that** two vertical elements (42) are arranged opposite one another in the body (43).
3. The modular self-supporting structure of a lift shaft **characterized in that** the column (1) is connected to the horizontal element (41) for fastening the column (1) to the crossbeam (2).
4. The modular self-supporting structure of a lift shaft according to claim 1 or 3, **characterized in that** the connection is realized by a screw (3) or a weld (17).
5. The modular self-supporting structure of a lift shaft according to claim 1 or 3, **characterized in that** for connecting a filler (10) to the crossbeam (2), the latter is provided with a mechanism (12) comprising bars (8) provided with a groove (11) and a seal (9), and a tongue (6) which is formed by a flat portion (61) provided with an opening (7) on which profile portions (62), which are arranged in the groove (11), adjoin on both sides.
6. The modular self-supporting structure of a lift shaft according to claim 1, **characterized in that** the body (43) of the connecting element, the columns (1), the crossbeams (2) and the vertical elements (42) are formed by a closed steel profile.
7. The modular self-supporting structure of a lift shaft according to claim 1 and 3, **characterized in that** the horizontal elements (41) are formed by a closed steel profile or flat steel.

8. The modular self-supporting structure of a lift shaft according to claim 1 and 3, **characterized in that** the crossbeam (2) is provided with an anchor (5) of guides.

5

9. The modular self-supporting structure of a lift shaft according to claim 1, **characterized in that** the openings (14) are provided with a weld (17) or a thread (18).

10

15

20

25

30

35

40

45

50

55

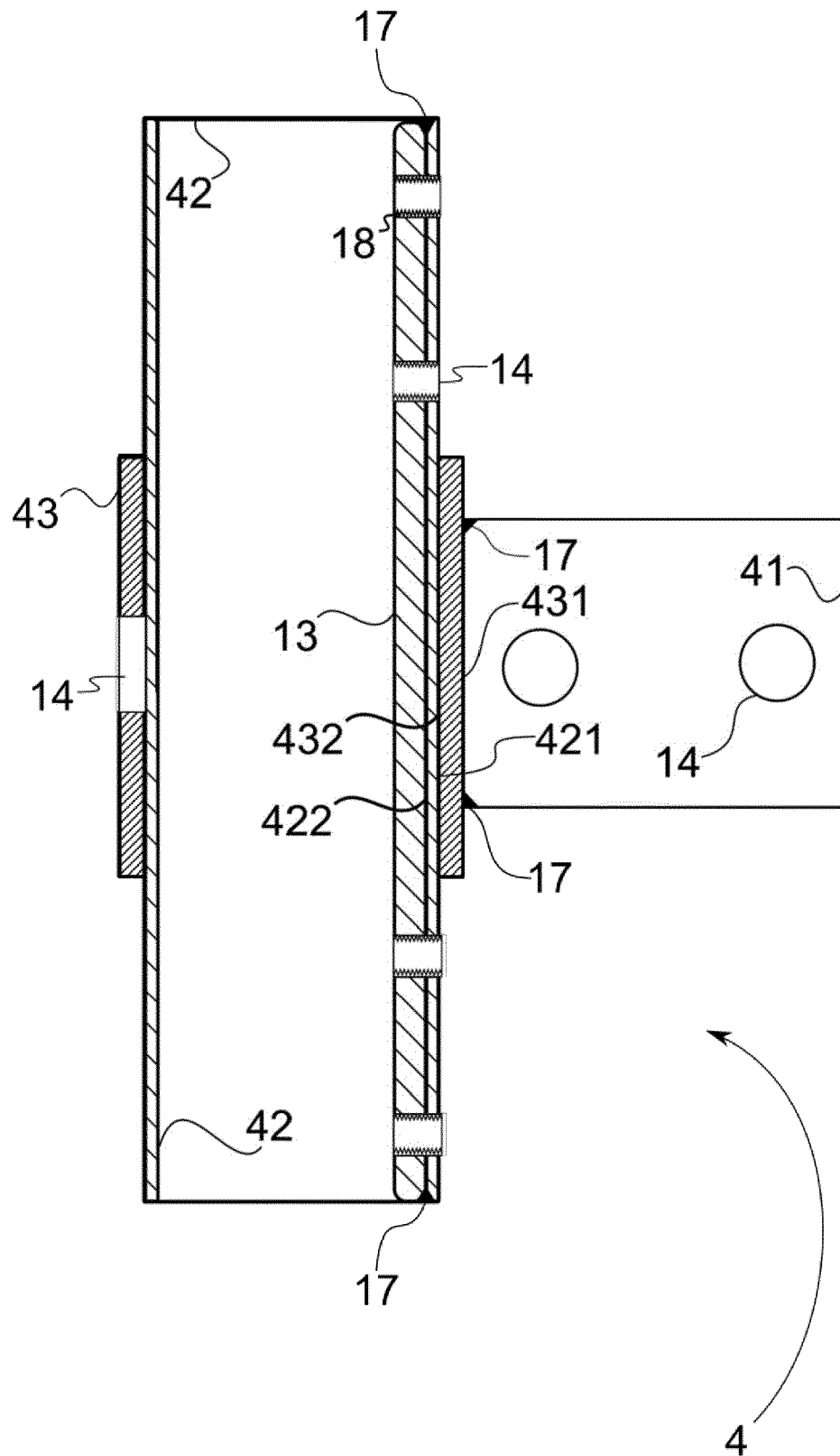


Fig. 1

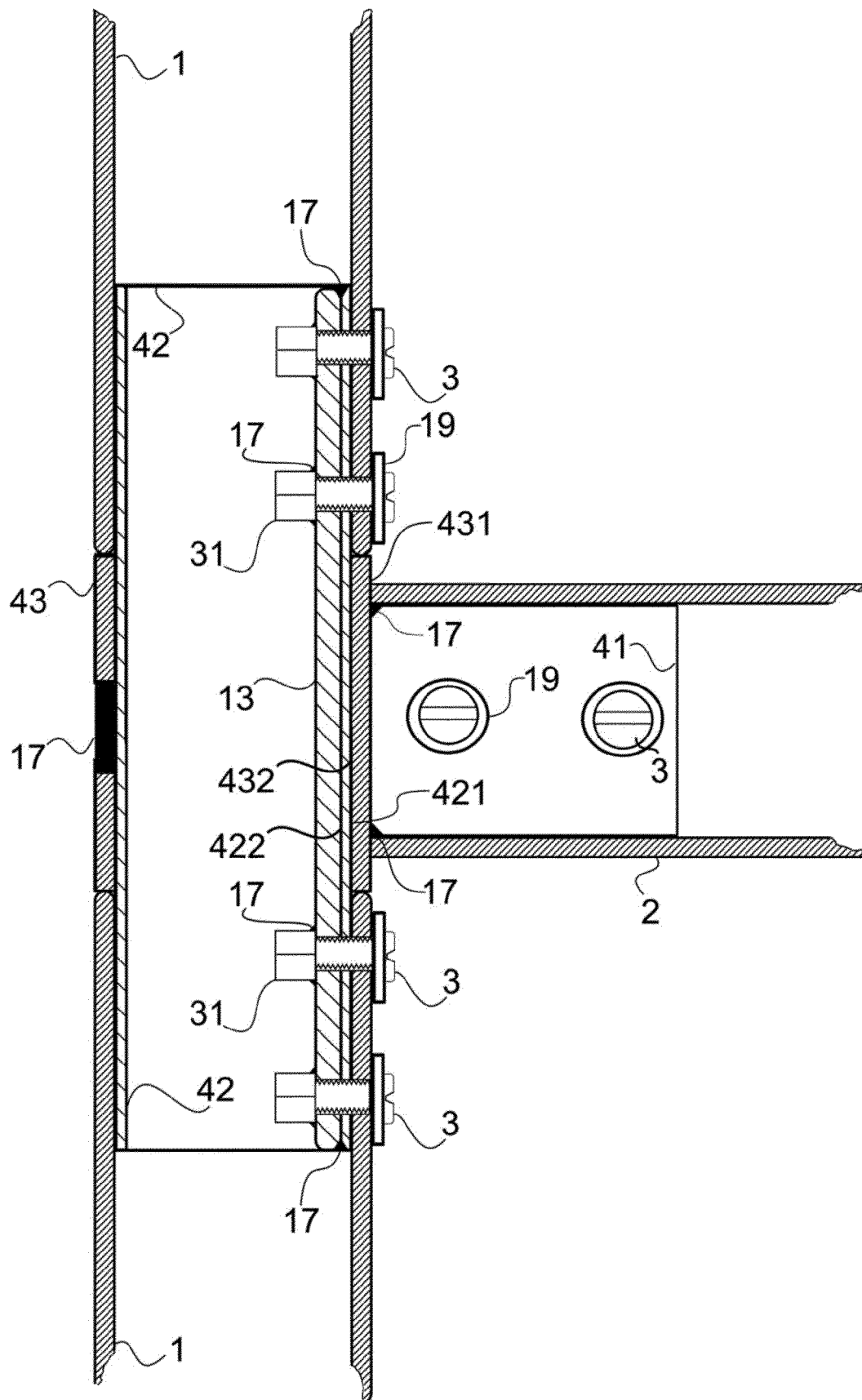


Fig. 2

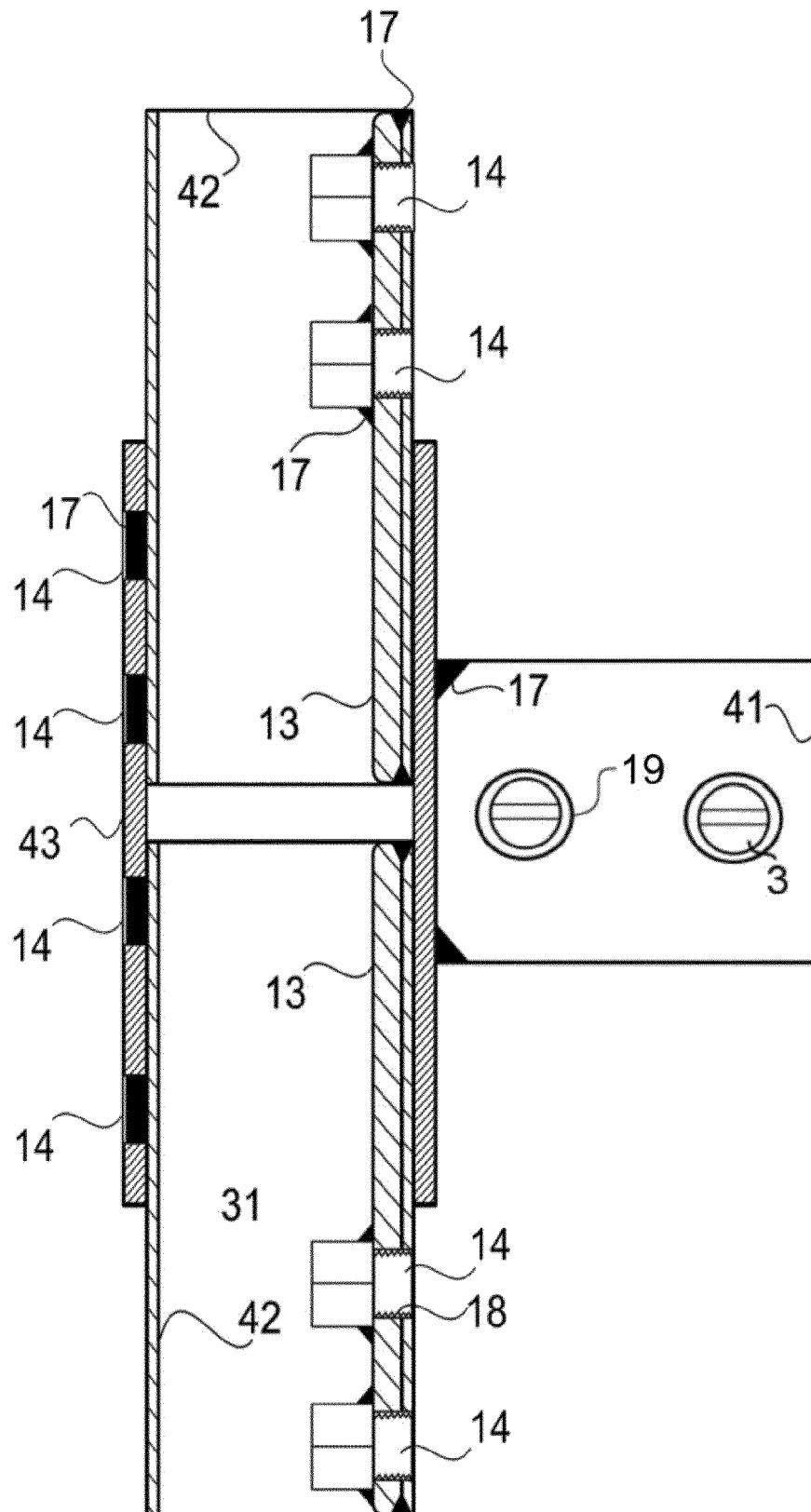


Fig. 3

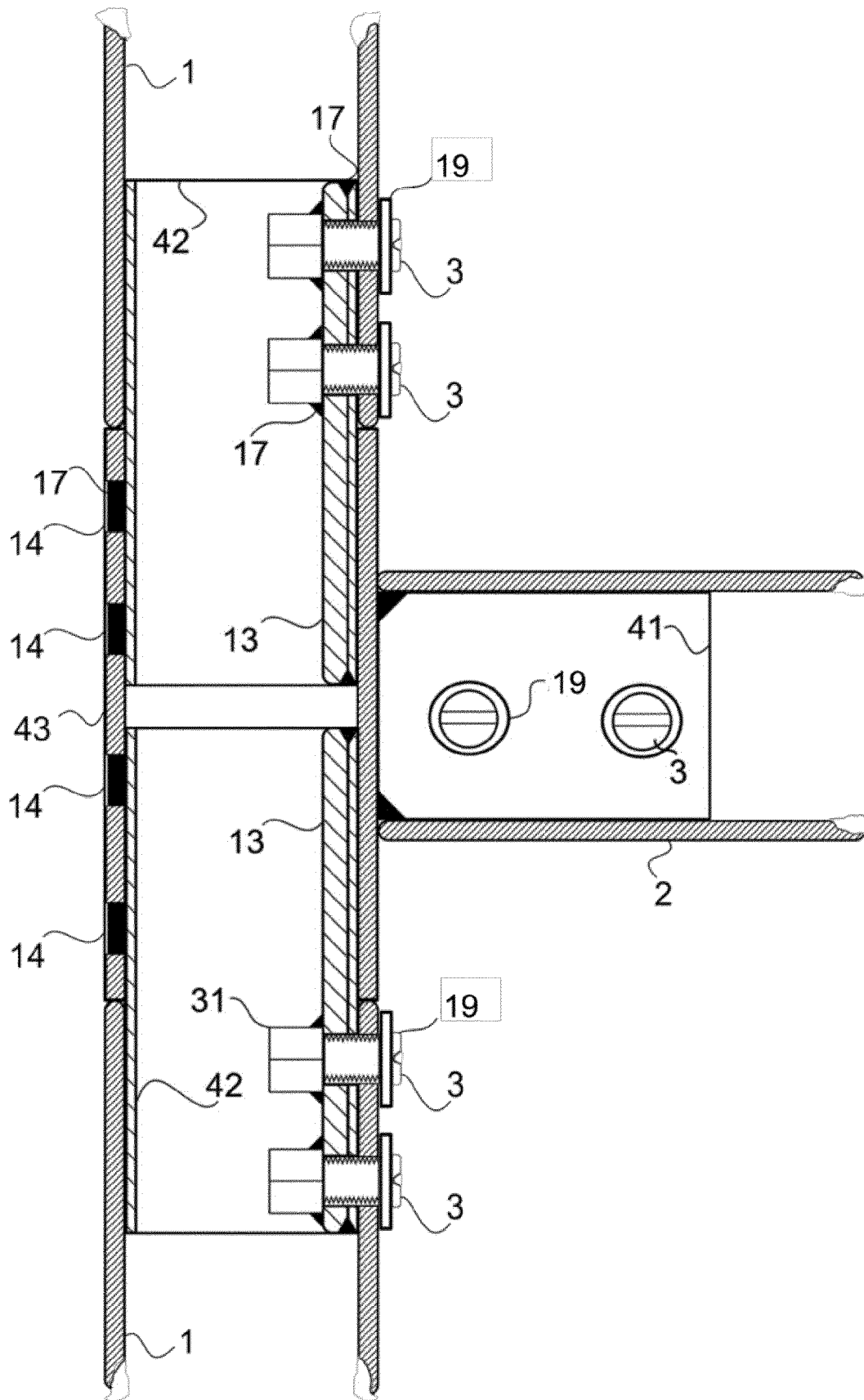


Fig. 4

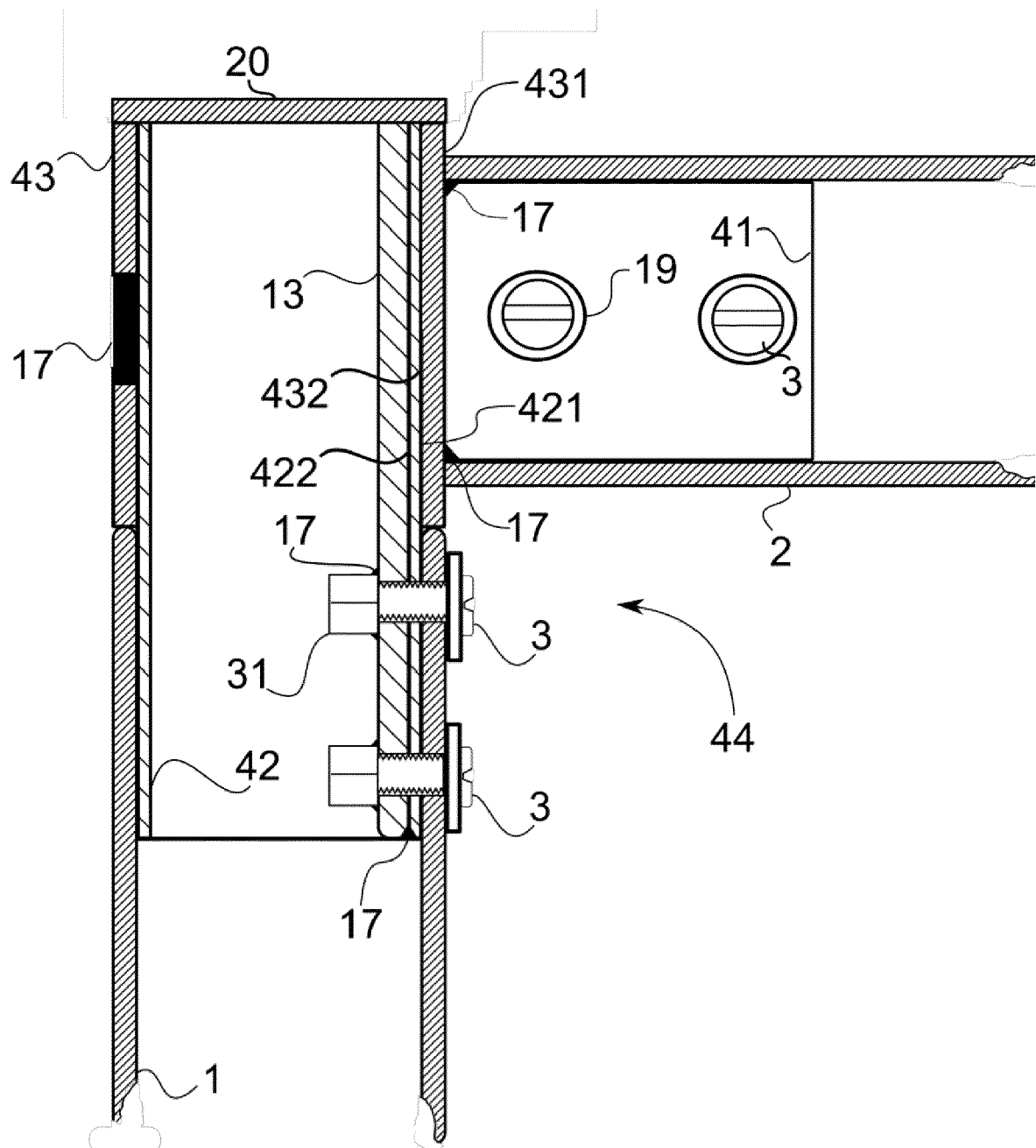


Fig. 5

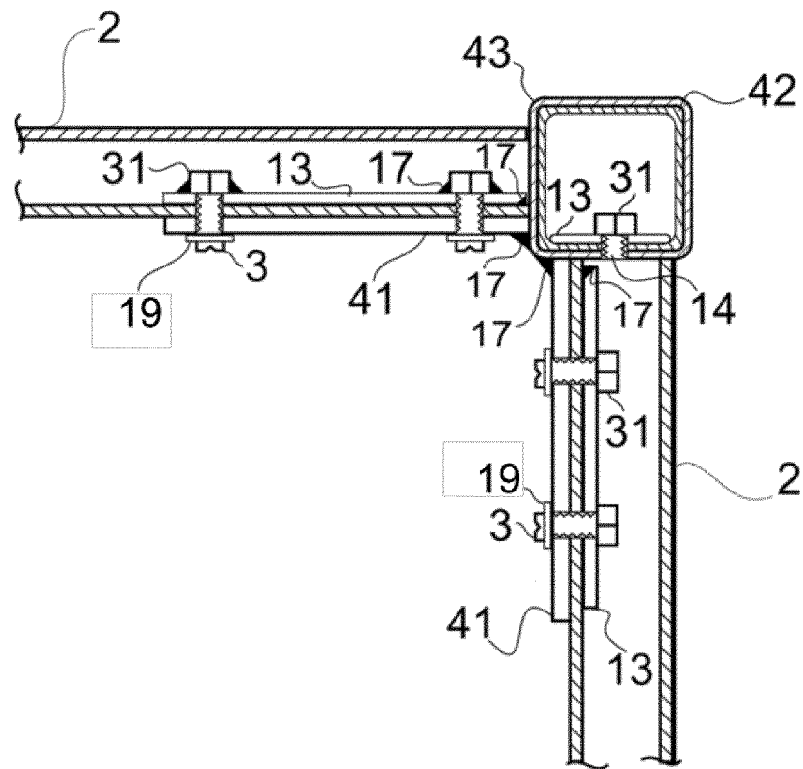


Fig. 6

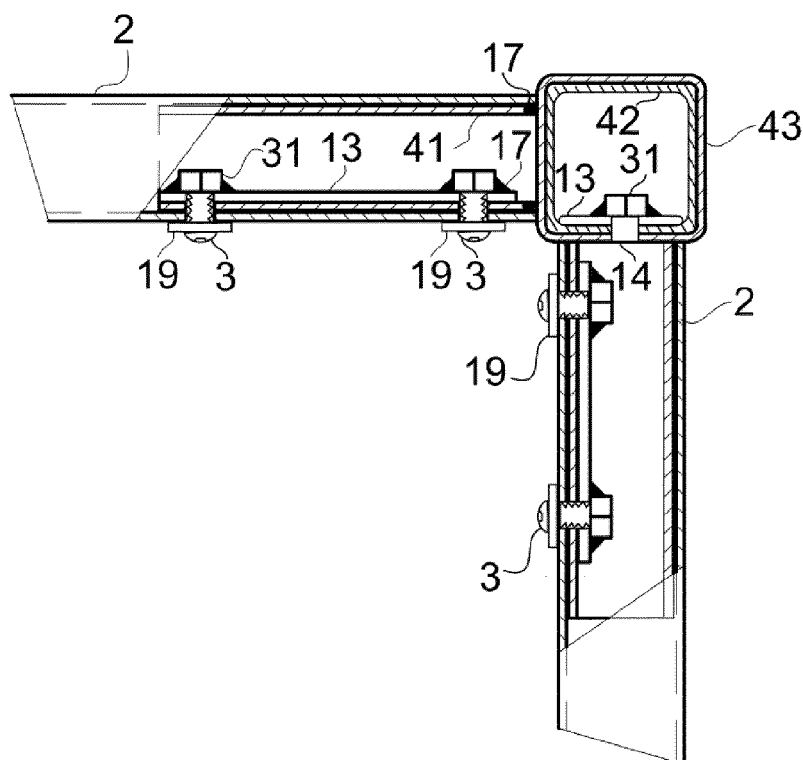


Fig. 7

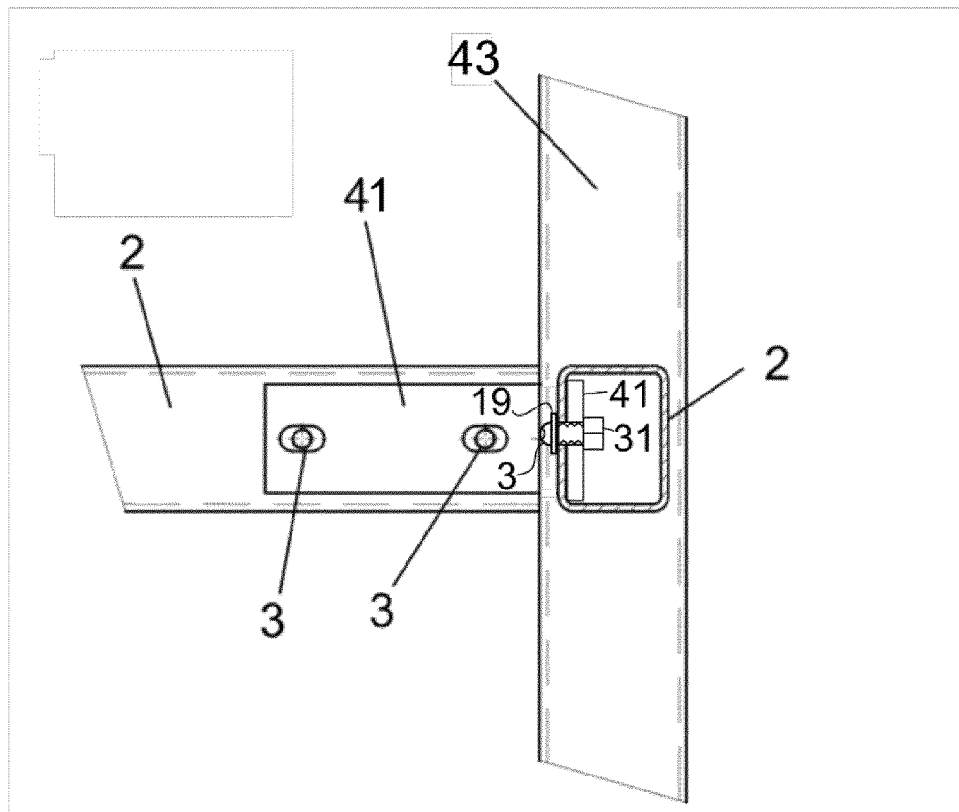


Fig. 8

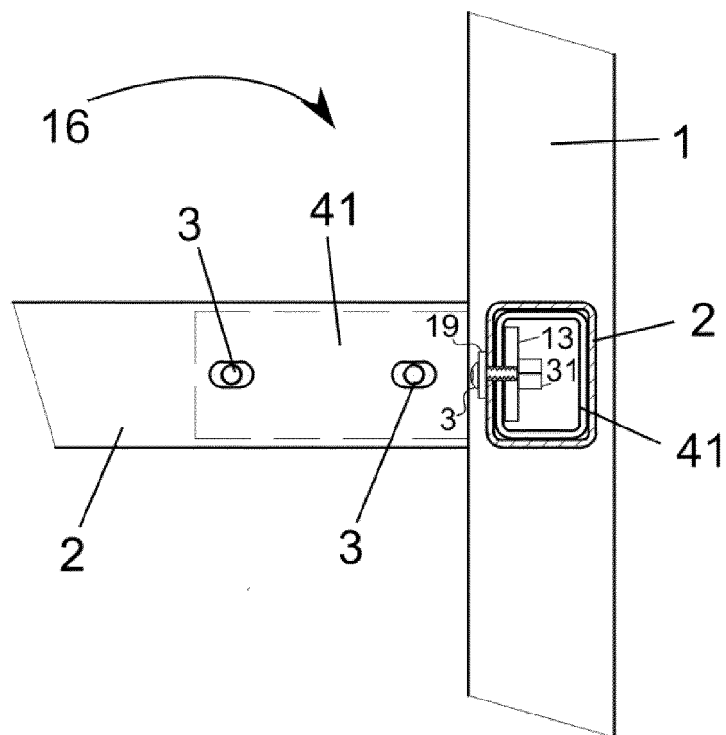
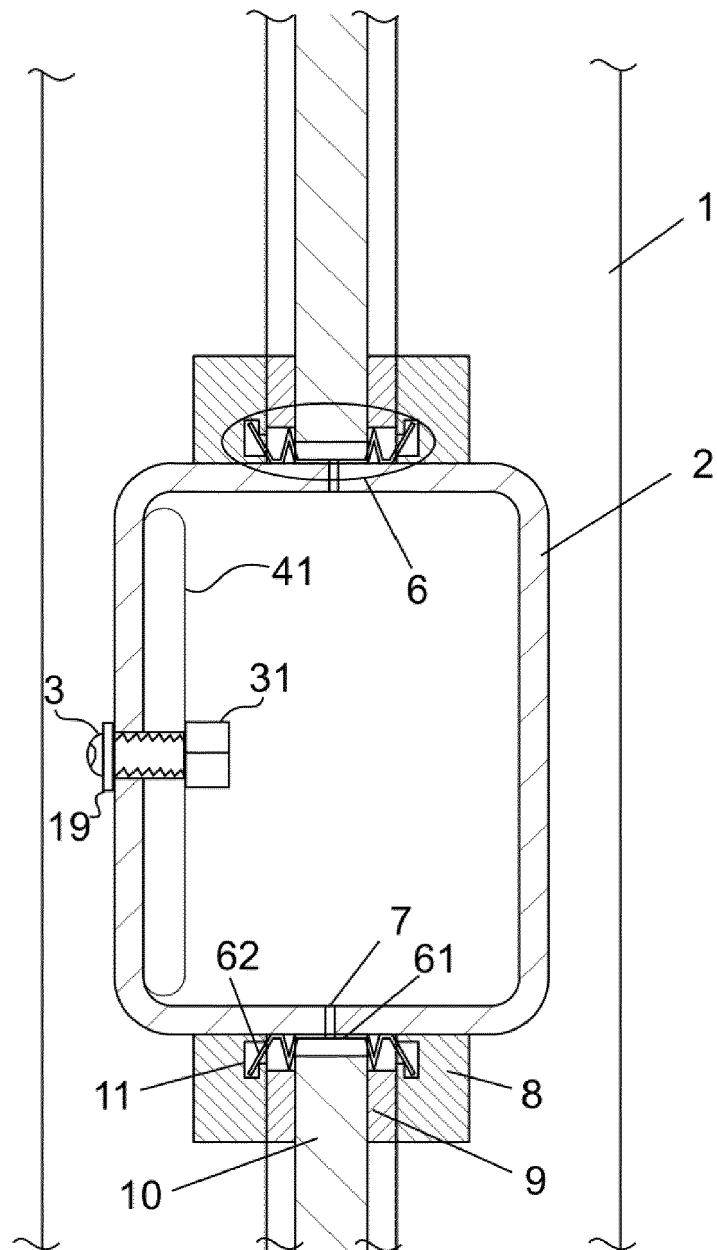


Fig. 9



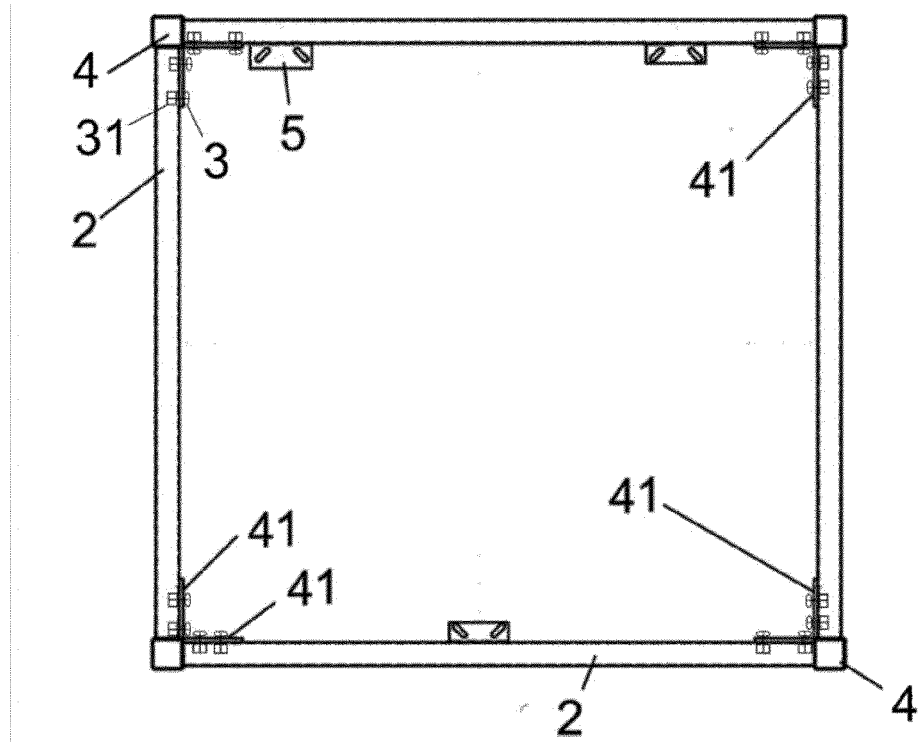


Fig. 11

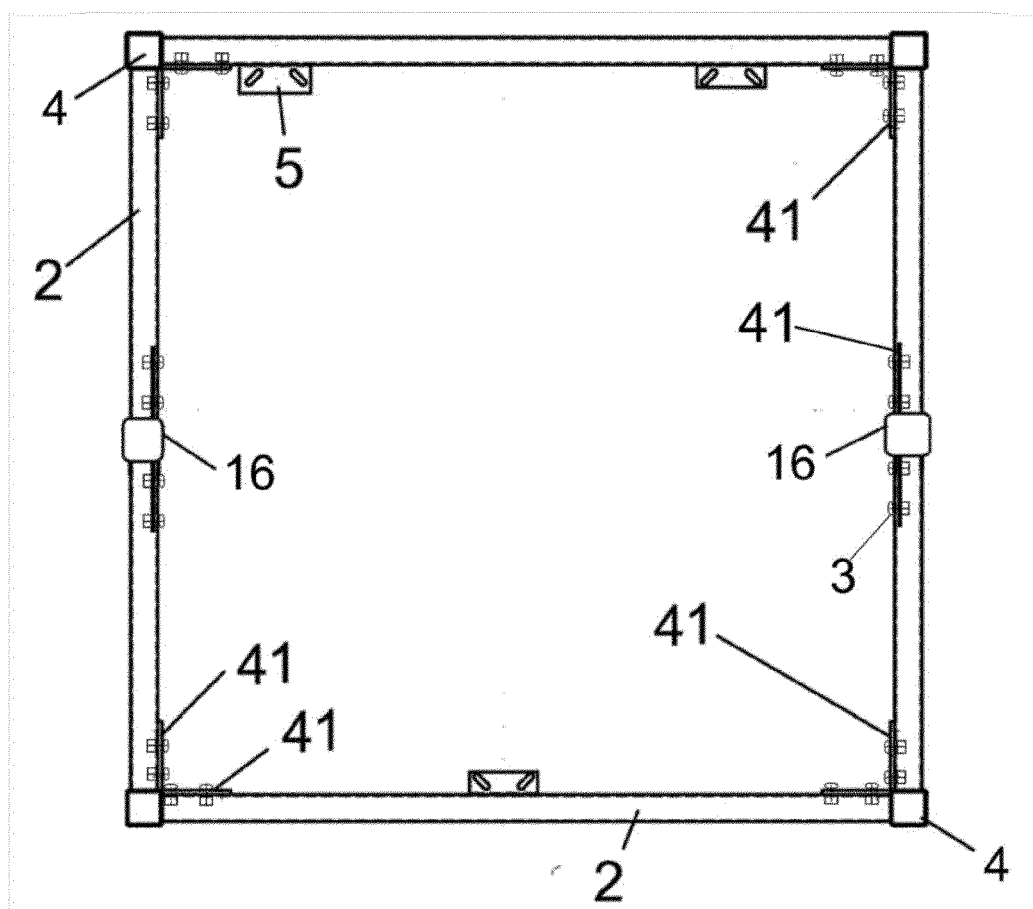


Fig. 12

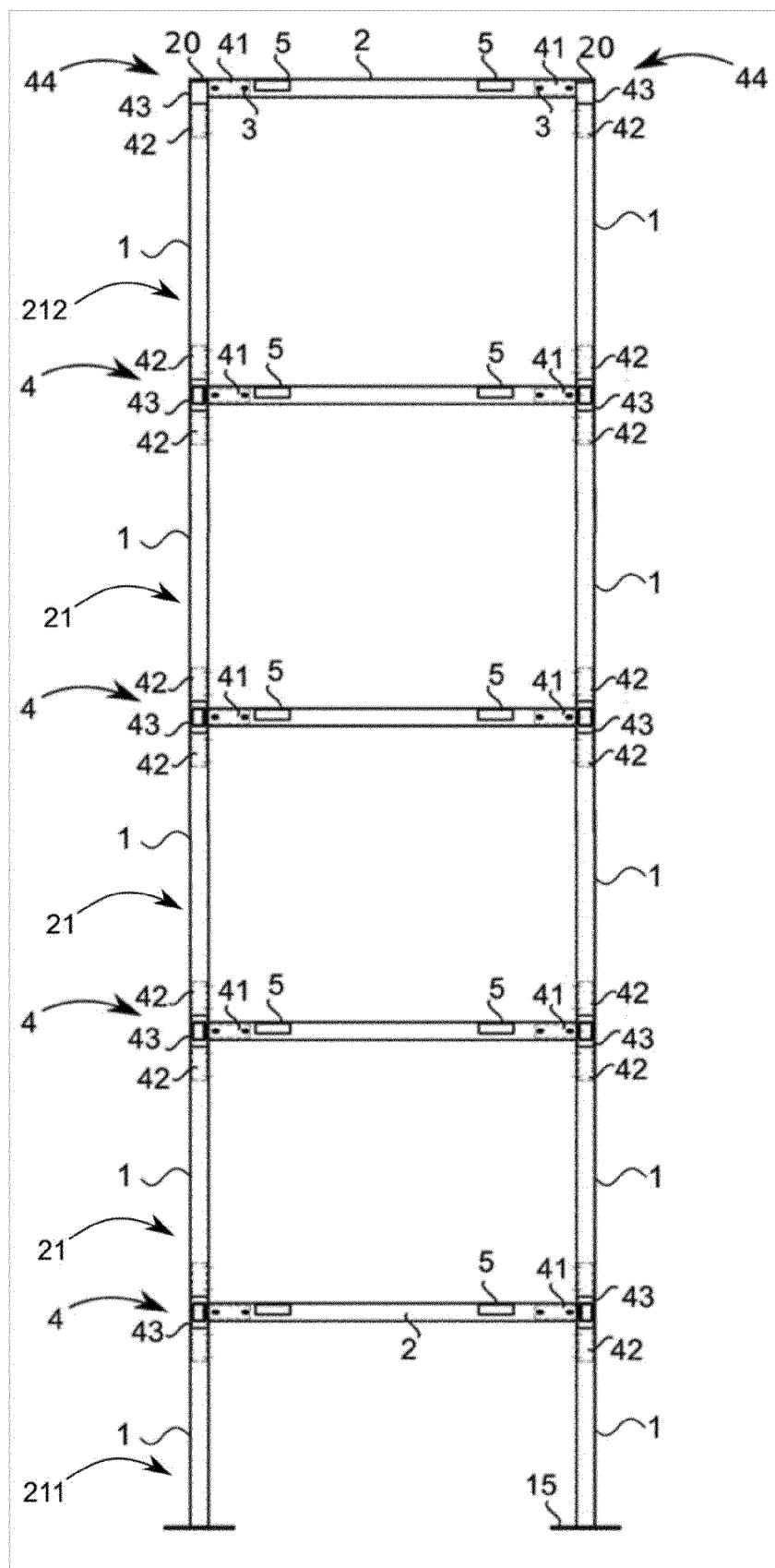


Fig. 13

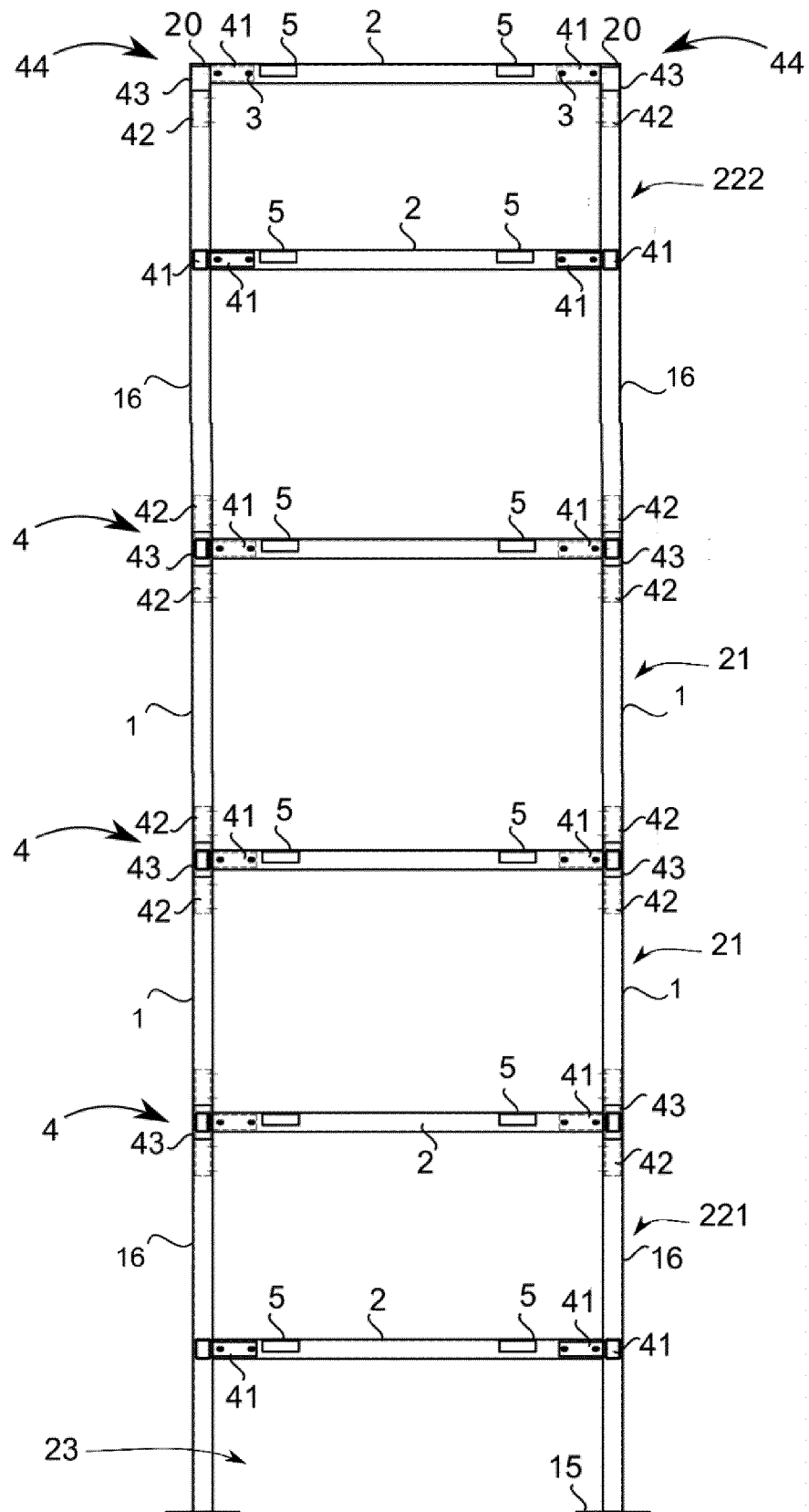


Fig. 14

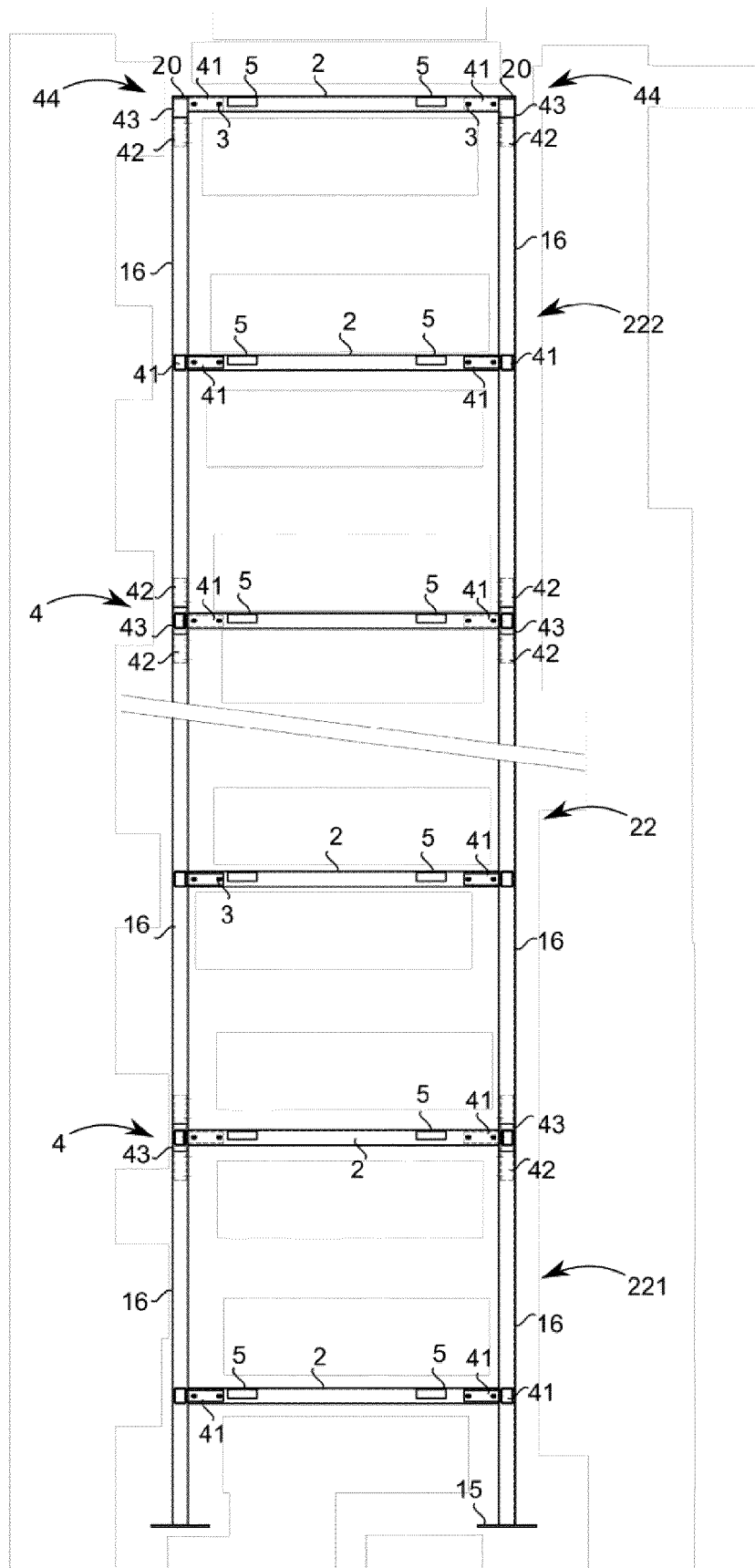


Fig. 15

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CZ 30697 U1 [0004]