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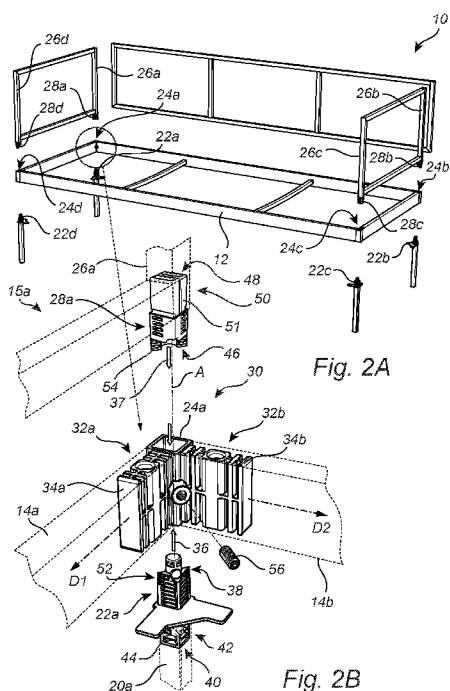
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(57) Abstract: A beam connector system (15a) for connecting a structural element (20a), such as a furniture leg, to a beam (14a-b), such as a metal tube, comprises a sleeve bracket (30) comprising a first sleeve bracket beam interface (32a) for holding a first beam (14a) in a first sleeve bracket beam direction (D1), and a sleeve (24a), which defines a guide extending along a sleeve axis (A) having a direction which is different from the first direction (D1); the beam connector system (15a) further comprising a first insert part (22a) having a sleeve insert end (38) which is insertable in the sleeve (24a) in a first insertion direction (36) along the sleeve axis (A), and further having, opposite to the sleeve insert end (38), a structural element interface end (40) comprising a first insert part structural element interface (44) for holding a first structural element (20a), such as a furniture leg; a second insert part (28a) having a sleeve insert end (46) which is insertable in the sleeve (24a) in a second insertion direction (37) along the sleeve axis (A), said second insertion direction (37) being opposite to the first insertion direction (36), wherein the sleeve insert ends (38, 46) of the first and second insert parts (22a, 28a) are insertable in the sleeve (24a) along their respective opposite insertion directions (36, 37) with a mutual overlap inside the sleeve (24a) to define a mutual overlap region; and a clamping arrangement (56) for clamping the mutually overlapping sleeve insert ends (38, 46) of the first and second insert parts (22a, 28a), when inserted in the sleeve (24a), against each other and against the sleeve (24a), so as to firmly lock the sleeve insert ends (38, 46) to each other and to the sleeve (24a).

BEAM CONNECTOR SYSTEM

Field of the invention

The present invention relates to a beam connector system for connecting a structural element, such as a furniture leg, to a beam, such as a metal tube. The invention also relates to a flat, rectangular furniture frame for use with such a connector system, a flat package comprising such a furniture frame and connector system, a modular furniture kit, and a method of assembling a piece of furniture.

Background of the invention

Upholstered seating furniture, such as upholstered sofas and upholstered armchairs, is a type of furniture that is often very heavy and very space consuming, also when the upholstered sofa is held in stock at a store, and when the upholstered sofa is transported from the store to somebody's home. EP 2374374 discloses a modular sofa having a frame made from aluminium beams interconnected in a rectangular configuration.

There is always a need for furniture that is lighter, easier to assemble, provides a greater degree of modularity and flexibility, consumes less space before assembly, and provides increased mechanical strength.

Summary of the invention

It is an object of the present invention to solve, or at least mitigate, parts or all of the above mentioned problems. To this end, there is provided a beam connector system for connecting a structural element, such as a furniture leg, to a beam, such as a metal tube, the beam connector system comprising

- i) a sleeve bracket comprising a first sleeve bracket beam interface for holding a first beam in a first sleeve bracket beam direction, and a sleeve, which defines a guide extending along a sleeve axis in a direction which is different from the first direction;
- ii) a first insert part having a sleeve insert end which is insertable in the sleeve in a first insertion direction along the sleeve axis, and further having,

opposite to the sleeve insert end, a structural element interface end comprising a first insert part structural element interface for holding a first structural element, such as a furniture leg;

- iii) a second insert part having a sleeve insert end which is insertable in
5 the sleeve in a second insertion direction along the sleeve axis, said second insertion direction being opposite to the first insertion direction, wherein the sleeve insert ends of the first and second insert parts are insertable in the sleeve along their respective opposite insertion directions with a mutual overlap inside the sleeve to define a mutual overlap region; and
- 10 iv) a clamping arrangement for clamping the mutually overlapping sleeve insert ends of the first and second insert parts, when inserted in the sleeve, against each other and against the sleeve, so as to firmly lock the sleeve insert ends to each other and to the sleeve.

Such a connector system facilitates the connection of a beam to
15 various structural elements, such as to other beam(s) of the same or another dimension, and may provide considerable mechanical strength. It facilitates the assembly of robust and strong furniture, using simple, inexpensive and lightweight components, in a home environment. Preferably, the sleeve insert ends of the insert parts are insertable in the sleeve along the sleeve axis in a
20 slidable manner. The sleeve insert ends may be shaped so as to permit bringing them into mutual overlap with each other by a mainly translational motion along their respective insertion directions. In particular, it may be desirable that they are not required to be screwed into threaded engagement along their respective insertion directions, as this would complicate assembly.

25 The overlapping sleeve insert ends may be configured to abut and engage with each other in the region of mutual overlap inside the sleeve. Preferably, the clamping arrangement is configured to clamp the overlapping sleeve insert ends against an inner wall portion of the sleeve. Clamping may advantageously be made in a clamping direction transversal to the sleeve
30 axis, and optimally perpendicular to the sleeve axis, in order to maximize the strength of the clamped engagement between the different parts. Such a clamping direction may be obtained by the clamping arrangement being configured to apply a clamping force onto the sleeve insert ends from a

direction transversal, and preferably substantially perpendicular, to the sleeve axis. Exemplary preferred beam materials are steel and aluminium, beams of which are typically strong and lightweight, even though the beam connector system does provide a great level of flexibility as regards beam material.

5 According to an embodiment, the sleeve insert end of the first insert part has an overlap engagement interface configured to face a mating overlap engagement interface of the sleeve insert end of the second insert part, when inserted into the sleeve in the respective first and second insertion directions, said overlap engagement interfaces being shaped to engage with each other
10 in a form-fitting engagement. Such form-fitting engagement provides strength to the clamped engagement.

 According to an embodiment, the overlap engagement interfaces of the first and second insert parts are provided with a mating groove-and-ridge arrangement with its grooves and ridges extending, when the overlap
15 engagement interfaces are overlapping inside the sleeve, in a direction transversal to the sleeve axis. Such form-fitting engagement provides particular strength in a load direction parallel to the sleeve axis.

 According to an embodiment, one of the sleeve insert end of the first insert part and the sleeve insert end of the second insert part is provided with
20 an axial stud, and the other of the sleeve insert end of the first insert part and the sleeve insert end of the second insert part is provided with an axial bore adapted for co-operating with the axial stud. Such a bore and stud arrangement may facilitate guiding the sleeve insert ends of the first and second insert parts relative to each other during insertion. Preferably, the
25 bore is, at least in the clamping direction, slightly wider than the stud to allow easy insertion and provide some degree of movement, thereby to allow the bore and stud to, when clamped, clampingly engage with each other at the same time as the overlap engagement interfaces clampingly engage. The stud and the bore may be of a circular cross-section, or of a non-circular
30 cross-section.

 According to an embodiment, an outer surface of at least one of the sleeve insert ends of the first and second insert parts is shaped to matingly abut an inner wall portion of the sleeve, preferably in a form-fitting manner.

Such a configuration will distribute the transversal load over a large surface of the inner wall, reducing the risk of damage to any of the components of the beam connector system.

According to an embodiment, said inner wall portion has a curved
5 shape, as seen in a section taken perpendicular to the sleeve axis, with a radius of curvature exceeding 4 mm.

According to an embodiment, at least one of the first and second insert parts is provided with a respective insert part shoulder for axially abutting a respective portion of the sleeve bracket, such as a circumferential edge of the
10 sleeve or a sleeve shoulder inside the sleeve, thereby defining an axial stop position for insertion of the respective insert part(s) along the sleeve axis. Such a shoulder facilitates insertion to a predetermined depth, and allows a precise alignment of the respective insert part(s) with the clamping arrangement. The insert part shoulder may also provide axial support against
15 the sleeve, allowing the beam connector system to withstand substantial loads on the insert part(s) along the insert direction(s).

According to an embodiment, the second insert part further comprises a structural element interface end comprising a second insert part structural element interface for holding a second structural element, such as a seating
20 furniture armrest, the structural element interface end of the second insert part being opposite to the sleeve insert end of the second insert part. Such a configuration allows the beam connector system to firmly connect two structural elements, extending in opposite directions, to the same sleeve, and thereby to the same beam.

25 According to an embodiment, the sleeve is elongate, and preferably has a length along the sleeve axis of at least twice its width perpendicular to the sleeve axis. Such a design increases the beam connector system's ability to withstand torsional loads transversal to the sleeve axis.

According to an embodiment, the sleeve bracket comprises a second
30 sleeve bracket beam interface for holding a second beam, such as a metal tube, in a second sleeve bracket beam direction. Such a sleeve bracket allows connecting a structural element to a junction between two beams.

According to an embodiment, said second sleeve bracket beam direction is essentially perpendicular to the first sleeve bracket beam direction. The beam connector system can thereby be used as a corner bracket for a rectangular frame, and allows easy and secure connection of
5 e.g. a furniture leg at the corner. As an alternative example, the second sleeve bracket beam direction may be opposite to the first sleeve bracket beam direction, thereby providing a straight beam joint provided with connecting means for connecting e.g. a perpendicular furniture leg.

According to an embodiment, the structural element interface of the
10 first insert part comprises an integrally formed support plate extending along a plane perpendicular to the sleeve axis, for providing torsional support to the first insert part and, optionally, for mounting of a structural element of dimensions substantially greater than the dimensions of the sleeve insert end of the first insert part thereto. Such a support- or mounting plate may, e.g., be
15 particularly useful for mounting a furniture leg of large cross section to an insert part of small cross section. The mounting plate may be configured to abut, and rest on, perpendicular beams, thereby distributing any external load on the first insert part, applied along the sleeve axis direction, over a large area.

20 According to an embodiment, the mounting plate is provided with protrusions configured to engage with mating recesses of beams connected to the sleeve bracket beam interfaces. As this engagement between recesses and protrusions will be located at a distance from the sleeve axis, such a configuration provides additional stability, particularly to shear loads on the
25 connector system. The protrusions may be formed as flanged through-holes in the mounting plate, the flanges of which may extend into holes or bores in the respective beams. If the beams are configured as e.g. metal tubes, connected to respective tube inserts of the sleeve bracket, mating screw guides may be provided in the respective tube inserts to facilitate the
30 mounting of screws for provision of even further stability.

According to an embodiment, the first sleeve bracket beam direction is essentially perpendicular to the sleeve axis. Such a beam connector system is particularly useful for forming perpendicular connections. It may be of

particular use in structures where a major part of the load will be applied in a direction essentially parallel with the sleeve axis. Any second sleeve bracket beam direction may also be essentially perpendicular to the sleeve axis to provide a beam connector system providing complete three-dimensional, rectilinear construction capabilities; in particular if both first and second insert parts are provided with respective structural element interfaces.

According to an embodiment, the clamping arrangement comprises a clamping screw hole in the sleeve, for receiving a clamping screw to clamp the first and second insert parts towards an inner sleeve wall portion opposite the hole. In order to maximize the engagement between the first and second insert parts, the clamping screw hole preferably faces the mutual overlap region of the first and second insert parts. The screw hole may be threaded or unthreaded. Preferably, the screw hole is arranged in a reinforcement of the sleeve to enable substantial clamping forces. On a sleeve bracket configured as a corner bracket, the clamping screw hole may preferably be located on the side of the sleeve that, when in use, will be located at the inner corner.

According to an embodiment, a side of a sleeve insert end of at least one of the first and second insert parts comprises a flat or concave clamping screw engagement surface. Such a shape of the engagement surface may prevent the clamping screw from slipping off the engagement surface when tightened. The clamping screw engagement surface may be provided in a recess in the sleeve insert end. Such a recess may be provided in an otherwise convex surface portion. The clamping screw engagement surface may also be reinforced to withstand the highly localized load of a clamping screw.

According to an embodiment, the sleeve bracket is symmetric about each of at least two perpendicular planes. Such a sleeve bracket is easy to manufacture, is forgiving with respect to its orientation during assembly thereby reducing the risk for mistakes, and can be mounted in any direction, providing for a high degree of versatility.

According to an embodiment, said first and/or second insert part structural element interface are/is an interface for holding a metal tube, and preferably configured as a respective metal tube insert for form-fitting

engagement inside a respective metal tube. A tube insert may form a very tight connection to a metal tube.

According to an embodiment, /at least one of/ the sleeve bracket beam interface(s) is a metal tube interface, and preferably comprises a metal tube
5 insert for form-fitting engagement inside a respective metal tube.

According to an embodiment, said metal tube interface(s) of the sleeve bracket is/are shaped for mating with a metal tube of larger cross-section than the metal tube interface(s) of the insert part(s). Such a configuration is particularly well suited for structures wherein a major part of any external load
10 may be expected to be applied on the beam connector system along a direction parallel to the sleeve axis.

According to an embodiment, the metal tube insert(s) of said sleeve bracket are/is configured for form-fitting engagement inside a respective metal tube of rectangular cross-section, a side of said rectangular cross-
15 section being essentially parallel to the sleeve axis. A rectangular cross-section tube provides extra strength in load directions parallel to the surfaces of the rectangular tubes. In an embodiment, the rectangular cross-section area of a metal tube connected to the beam interface of the sleeve bracket may be larger than the rectangular cross-section area of a metal tube
20 connected to the metal tube interface of an insert part. Such an embodiment may be particularly well suited for an embodiment wherein a major part of any external load may be expected to be applied on the beam connector system along a direction parallel with the sleeve axis.

According to an embodiment, the metal tube insert(s) of at least one of
25 said insert part(s) and/or of said sleeve bracket are/is longitudinally split and provided with a respective longitudinal screw guide extending into the respective metal tube insert in a screw guide direction into the respective tube, thereby to define a slotted expansion plug arrangement for firmly attaching the respective metal tube by expansion of the respective metal tube
30 insert, by screwing a screw into the screw guide. Such an arrangement provides an inexpensive and strong engagement between a metal tube insert and a respective metal tube. A particularly well suited location for such a slotted expansion plug arrangement may, for example, be at the bottom of an

axial bore in the sleeve insert end of the first or second insert part. Preferably, the screw guide may be tapering in a direction into the tube, and/or a tapering screw may be used.

According to an embodiment, said insert part metal tube insert(s)
5 and/or said sleeve bracket metal tube insert(s) are/is provided with a respective metal tube abutment shoulder. Such a shoulder will, during assembly, facilitate inserting the metal tube insert(s) into the respective metal tube(s) to a predetermined and accurate depth. It may also serve as a load carrying structure for axial loads along the respective tube(s).

10 According to an embodiment, said sleeve bracket metal tube interface(s) and/or insert part metal tube interface(s) are/is permanently attached to the respective metal tube. Particularly for flat-pack furniture to be assembled by an end consumer, it is desirable that as much as possible of the furniture has been pre-assembled prior to delivery to the end consumer.
15 Moreover, the resources of an industrial workshop typically enables forming a stronger and tighter permanent connection than what may typically be obtained using the tools and machinery found in a typical household.

According to an embodiment, said respective metal tube is riveted, flanged, upset, welded, brazed, and/or press-fit to the respective metal tube
20 insert. The forming of such a connection may be facilitated by a metal tube insert provided with a recess for receiving an upsetting or deformation of the metal tube wall.

According to an embodiment, at least one of said respective insert parts is integrally formed, and/or said sleeve bracket is integrally formed, and
25 preferably cast or moulded in zinc-aluminium alloy or plastic. Such components are relatively inexpensive and easy to manufacture. Alternatively, e.g. the sleeve bracket may be of steel, and may be integrally formed with the sleeve bracket beam(s).

Either or both of the sleeve insert ends of the insert parts may be
30 formed of a rigid material such as metal or plastic. The rigid material may have a Shore D hardness of at least 50 on the ASTM D2240 type D scale.

According to another aspect of the invention, parts or all of the above mentioned problems are solved, or at least mitigated, by a flat, rectangular

furniture frame comprising four straight beams, preferably metal tubes, interconnected by the sleeve brackets of four beam connector systems of a type described hereinbefore. Such a frame fits into a flat package. Thanks to the sleeve brackets at the corners, the frame can easily be provided with e.g.
5 furniture legs, arm rests, and/or back rests by an end consumer.

According to an embodiment, said furniture frame is a seat frame for a piece of seating furniture, such as a piece of upholstered seating furniture, e.g. an upholstered sofa. In particular, upholstered furniture, such as upholstered sofas, are typically bulky and heavy, and cannot be transported
10 as flat packs. The present seat frame provides the possibility to transport e.g. sofas as flat-packs.

According to another aspect of the invention, there is also provided a flat package, such as a cardboard box, comprising a permanently joined rectangular furniture frame as described above; and, for each of said sleeve
15 brackets, a respective first insert part having a sleeve insert end which is insertable in the respective sleeve in a first insertion direction along the respective sleeve axis, and further having, opposite to the sleeve insert end, a furniture leg interface for holding a respective furniture leg; a respective second insert part having a sleeve insert end which is insertable in the
20 respective sleeve in a second insertion direction along the respective sleeve axis, said second insertion direction being opposite to the first insertion direction, wherein the sleeve insert ends of the first and second insert parts are insertable in the sleeve along their respective opposite insertion directions with a mutual overlap inside the respective sleeve to define a mutual overlap
25 region; and a respective clamping arrangement for clamping the mutually overlapping sleeve insert ends of the respective first and second insert parts, when inserted in the respective sleeve, against each other and against the respective sleeve, so as to firmly lock the sleeve insert ends to each other and to the respective sleeve.

30 According to another aspect of the invention, parts or all of the above mentioned problems are solved, or at least mitigated, by a modular furniture kit comprising a plurality of beam connector systems as described hereinbefore, a plurality of beams such as metal tubes, and building

instructions for building a piece of furniture of a first type using at least a portion of said beams and beam connector systems. In an embodiment, the sleeve brackets of a plurality of said beam connector systems may be permanently joined with a plurality of said beams to form a pre-assembled flat
5 frame subassembly, which may be rectangular.

According to an embodiment, the modular furniture kit further comprises building instructions for building a piece of furniture of a second type using at least a portion of said beams and beam connector systems. Different types of furniture may be, e.g., tables, two-seat sofas, three-seat
10 sofas, armchairs, pouffes, stools, etc. Thanks to the invention, true modularity may be obtained in the sense that different types of furniture may be obtained using (subsets of) the same set of furniture frame elements.

According to another aspect of the invention, parts or all of the above
15 mentioned problems are solved, or at least mitigated, by a method of assembling a piece of furniture, the method comprising providing a sleeve bracket comprising a beam interface, such as a metal tube interface, and a sleeve; inserting a sleeve insert end of a first insert part, which comprises a structural element interface such as a furniture leg interface, into the sleeve
20 along a first insertion direction; inserting a sleeve insert end of a second insert part into the sleeve along a second, opposite insertion direction until the sleeve insert ends of the first and second insert parts overlap in a mutual overlap region inside the sleeve; and clamping the mutually overlapping sleeve insert ends of the first and second insert parts against each other, and
25 against the sleeve, so as to firmly lock the beam interface to the structural element interface. Such a method may be used in the assembly of a piece of furniture using any of the beam connector systems, furniture frames, flat packages, or modular furniture kits describes hereinbefore.

Brief description of the drawings

30 The above, as well as additional objects, features and advantages of the present invention, will be better understood through the following illustrative and non-limiting detailed description of preferred embodiments of

the present invention, with reference to the appended drawings, where the same reference numerals will be used for similar elements, wherein:

Fig. 1 is a diagrammatic view in perspective of a modular steel frame for an upholstered sofa;

5 Fig. 2A is an exploded view of the modular steel frame of Fig. 1;

Fig. 2B is a magnified view of a beam connector system of the modular steel frame of Figs 1 and 2A;

Fig. 3A is a diagrammatic view in perspective of a sleeve bracket of the beam connector system of Fig. 2B, as seen from a first perspective;

10 Fig. 3B is a diagrammatic view in perspective of the sleeve bracket of Fig. 3A, as seen from a second perspective;

Fig. 4A is a diagrammatic view in perspective of a first insert part of the beam connector system of Fig. 2B, as seen from a first perspective;

15 Fig. 4B is a diagrammatic view in perspective of the first insert part of Fig. 4A, as seen from a second perspective;

Fig. 5A is a diagrammatic view in perspective of a second insert part of the beam connector system of Fig. 2B, as seen from a first perspective;

Fig. 5B is a diagrammatic view in perspective of the second insert part of Fig. 5A, as seen from a second perspective;

20 Fig. 6A is a diagrammatic view in perspective, partly in section, of the second insert part of Figs 5A-B when in an unexpanded state;

Fig. 6B is a diagrammatic view in perspective, partly in section, of the second insert part of Fig. 6A when in an expanded state;

25 Fig. 7 is a schematic three-dimensional view of the beam connector system of Fig. 2B, illustrating the sleeve bracket of Figs 3A-B when interconnected with the first and second insert parts of Figs 4A-B and 5A-B;

Fig. 8 is a section of the beam connector system when in an assembled state;

30 Fig. 9 is a diagrammatic exploded view in perspective of a second embodiment of a first insert part in a beam connector system; and

Fig. 10 is a diagrammatic view in perspective of a flat-pack for distributing the furniture frame of Fig. 1.

Detailed description of the exemplary embodiments

Fig. 1 illustrates a steel tube sofa frame 10 for an upholstered three-seat sofa. The steel tube frame 10 may be provided with upholstery in a non-illustrated manner, e.g. using hook-and-loop fastener strips attached to the frame. The sofa frame 10 comprises a flat, rectangular sofa seat frame 12 comprising four substantially horizontal, straight, hollow steel tubes 14a-d of rectangular cross-section, which are permanently joined at right angles by means of respective steel tube connector systems 15a-d to be described further below, to form the rectangular seat frame 12. The sofa frame 10 further comprises a backrest 16, two armrests 18a-b, and four furniture legs 20a-d, each of which is made of a steel tube of, for example, rectangular cross-section, and as a special case of rectangular, square cross-section. It may be desirable that the beam be of a strong material such as steel, since it allows the beam dimensions to be minimized. In particular for a sofa, it may be desirable to have a dimension of the beams 14a-b that does not add too much to the sofa's height, allowing a substantial layer of upholstery to be added on top of the seat frame 12 as well as a substantial storage space below the seat frame 12 within the constraints of a preferred seating height of about 40 cm.

Turning now to the exploded view of Fig. 2A, the legs 20a-d (Fig. 1) are attached to the seat frame 12 by means of respective leg connectors configured as insert parts 22a-d, which are inserted from below into respective vertical sleeves 24a-d arranged at each corner of the seat frame 12. Each armrest 18a-b is formed of four steel tubes which are permanently joined in a rectangular shape, and comprises a respective pair of vertical posts 26a, 26d and 26b, 26c. The armrests are attached to the seat frame 12 by means of armrest connectors configured as insert parts 28a-d, which are attached to the vertical posts 26a-d and inserted into the vertical sleeves 24a-d from above. The backrest 16 (Fig. 1) is attached to the armrests 18a-b and the steel tube 14b in a non-illustrated manner.

Fig. 2B illustrates a first steel tube connector system 15a in greater detail. It will be appreciated that the other steel tube connector systems 15b-d (Fig. 1) may be identical. The steel tube connector system 15a comprises a

sleeve bracket 30 comprising a first beam interface configured as a sleeve bracket steel tube interface 32a for holding a first steel tube 14a in a substantially horizontal first sleeve bracket steel tube direction D1. The first sleeve bracket steel tube interface 32a is configured as a steel tube insert 5 34a, mating with the interior of the respective steel tube 14a. The sleeve bracket 30 further comprises a second sleeve bracket beam interface, also configured as a steel tube interface 32b, for holding a second steel tube 14b in a substantially horizontal second sleeve bracket steel tube direction D2, which is substantially perpendicular to the first sleeve bracket steel tube 10 direction D1. Also the second sleeve bracket steel tube interface 32b is configured as a steel tube insert 34b, mating with the interior of the respective steel tube 14b. The two steel tube inserts 34a-b are joined at the sleeve 24a, which defines a substantially vertical guide extending along a sleeve axis A in a direction substantially perpendicular to the steel tube directions D1, D2.

15 The steel tube connector system 15a further comprises the first insert part 22a, which has a sleeve insert end 38 which is insertable in the sleeve 24a in a first insertion direction 36 along the sleeve axis A from below, and a structural element interface, configured as a furniture leg interface 42, provided at a furniture leg interface end 40 opposite to the sleeve insert end 20 38. The furniture leg interface 42 is configured as a steel tube insert 44, mating with the interior of the steel tube of the respective furniture leg 20a.

The steel tube connector system 15a further comprises the second insert part 28a, which has a sleeve insert end 46 which is insertable in the sleeve 24a in a second insertion direction 37 along the sleeve axis A from 25 above, and a structural element interface configured as an armrest interface 50, which is provided at an armrest interface end 48 opposite to the sleeve insert end 46. The armrest interface 50 is configured as a steel tube insert 51, mating with the interior of a vertical steel tube post 26a of the respective armrest 18a.

30 The sleeve insert end 38 of the first insert part 22a has an overlap engagement interface 52 facing in a radial, with respect to the sleeve axis A, direction. The overlap engagement interface 52 of the first insert part 22a is configured to overlap with a similar radially facing overlap engagement

interface 54 of the sleeve insert end 46 of the second insert part 28a when the insert parts have been inserted into the sleeve 24a from opposite directions along the sleeve axis A. Once inserted, the overlap engagement interfaces 52, 54 are to be clamped together, and clamped against an inner wall portion of the sleeve, by applying a clamping force to the sleeve insert ends 38, 46 pressing the overlap engagement surfaces 52, 54 together in a radial direction towards the sleeve wall. In the illustrated example, the clamping force is to be provided by a clamping screw 56 in threaded engagement with the sleeve 24a.

Fig. 3A illustrates the sleeve bracket 30. Each of the steel tube inserts 34a-b has a rectangular shape for mating with the respective rectangular steel tubes 14a-b (Fig. 2B) with a tight fit – preferably with a press-fit tightness. An upper face 58a-b of each steel tube insert 34a-b is provided with a respective recess 60a-b for receiving an upset of the respective steel tube 14a-b. The steel tubes 14a-b may be upset by pressing or striking a portion of the steel tube wall into the recess 60a-b, to even further strengthen the permanent joints between the steel tubes 14a-b and the sleeve bracket 30. At the bottom of each recess 60a-b, a respective vertical screw guide 62a-b is integrally formed. The screw guides 62a-b provide an alternative or complement to upsetting – the steel tubes 14a-b may be provided with mating holes (not shown) in the tube walls, allowing the steel tubes 14a-b to be secured to the steel tube inserts 34a-b by means of locking screws through the mating holes, into the screw guides 62a-b. Similar recesses and screw guides are arranged at the bottom faces 64a-b (Fig. 3B) of the steel tube inserts 34a-b. Returning to Fig. 3A, an outer surface of the sleeve 24a forms an abutment shoulder 66, which acts as an axial stop for the tube 14a when pressed onto the steel tube insert 34a. The sleeve 24a also forms an axial stop for the tube 14b in the same manner.

A threaded screw hole 68 for receiving the clamping screw 56 is arranged on an inner corner side 70 of the sleeve 24a, between the steel tube inserts 34a-b. Thereby, the clamping screw 56 will not be visible when the sofa frame 10 (Fig. 1) is in use, and/or need not be covered by any upholstery, which allows access thereto when the sofa frame 10 has been

covered with said upholstery. The screw hole 68 is arranged in a screw hole reinforcement 72 protruding from the sleeve 24a, adding to the length of the threaded engagement between the clamping screw 56 and the screw hole 68.

The interior of the sleeve 24a is provided with an inner wall portion 74, 5 opposite the screw hole 68, against which inner wall portion 74 the first and second insert parts 22a, 28a are to be clamped by the clamping screw 56. The inner wall portion 74 has a curved shape, as seen in a section taken perpendicular to the sleeve axis, with a radius of curvature preferably exceeding about 4 mm, and more preferred, exceeding about 7 mm. The 10 curved wall portion 74 also defines an inner abutment shoulder 76, which serves as an axial stop for facilitating inserting the second insert part 28a to a well-defined axial position inside the sleeve 24a.

Fig. 3B illustrates the interior of the sleeve 24a from a different perspective. In Fig. 3B, the clamping screw 56 has been screwed into the 15 screw hole 68 such that it protrudes into the sleeve 24a. In this position, the screw 56 would have clamped the insert parts 22a, 28a, if they had been inserted in the sleeve 24a, against each other and against the wall portion 74 (Fig. 3A). Preferably, the sleeve 24a has a rectangular cross-section; in the embodiment of Figs 3A-B the sleeve 24a has a square cross-section, which 20 may be a particularly preferred special case of rectangular cross-section. Preferably, the sleeve is elongate, i.e. has an axial length L, as measured along the sleeve axis A (the latter illustrated in Fig. 2B), exceeding its inner width W. In the illustrated embodiment, the sleeve's length L is about three times its inner width W. A suitable length L is, by way of example, between 40 25 mm and 120 mm, and more preferred, between 50 mm and 90 mm. A suitable width W is, by way of example, between 10 mm and 40 mm, and more preferred, between 15 mm and 30 mm. As can be seen in Figs 3A-3B, the sleeve bracket 30 is symmetric about a plane perpendicular to the sleeve axis A. The sleeve bracket 30 is also symmetric about a plane containing the 30 sleeve axis A and the centre axis of the screw hole 68.

Fig. 4A illustrates the first insert part 22a from a first perspective. The steel tube insert 44 has a rectangular cross-section, and in this specific example a square cross-section, mating with the interior of the furniture leg

20a (Fig. 2B), and may preferably be press-fit to the furniture leg 20a. The first insert part 22a has been given a slotted structure, comprising a plurality of slots 78 extending into the first insert part 22a, for lighting and material-saving purposes. A notch 80 is arranged in the slotted structure for receiving
5 e.g. an upset of the steel tube wall of the furniture leg 20a, thereby adding to the strength of the engagement between the first insert part 22a and the furniture leg 20a. An integrally formed support plate 82 extends along a plane perpendicular to the sleeve axis A, when inserted into the sleeve 24a (Fig. 2A), and has a lower surface 85 (Fig. 4B) defining an axial stop position for
10 press-fitting the furniture leg 20a to the steel tube insert 44 from below. An upper surface 83 of the support plate 82 is configured to abut an axial edge 84 (Fig. 3B) of the sleeve 24a, and defines an axial stop position when axially inserting the sleeve insert end 38 of the insert part 22a into the sleeve 24a from below. The upper surface 83 is also configured to abut the lower sides of
15 the steel tubes 14a, 14b from below, and thereby also adds support for any torsional loads about any axis parallel with the plane of the support plate 82. A flat clamping screw engagement surface 86, configured to face the clamping screw hole 68 (Fig. 3A) when inserted into the sleeve 24a, and to receive the clamping screw 56, is arranged in a recess 88 of the sleeve insert
20 end 38. An axial stud 90 is shaped to be inserted into a mating bore, described hereinafter with reference to Fig. 5A, of the second insert part 28a (Fig. 2A) when the two insert parts 22a, 28a meet and overlap inside the sleeve 24a.

Fig. 4B illustrates the first insert part 22a from a different perspective. A
25 curved outer surface 92 of the sleeve insert end 38 is shaped to matingly abut the curved inner wall portion 74 (Fig. 3A) of the sleeve 24a. The curved outer surface 92 is formed by a cut-away of the sleeve insert end's 38 otherwise square cross-section, thereby defining an axial shoulder 94 configured to abut a downwards axial shoulder, similar to the upwards facing axial shoulder 76
30 of Fig. 3A, inside the sleeve 24a. The shoulders 94, 76 assist in defining, together with the support plate 82 (Fig. 4A) and sleeve edge 84 (Fig. 3B), an axial stop position in the first insertion direction 36, and add to the beam connector system's ability to withstand axial loads.

The overlap engagement interface 52 of the first insert part's 22a sleeve insert end 38 is provided with a set of parallel grooves 96 and ridges 98 extending in a direction transversal, and more precisely, perpendicular to the sleeve axis A (Fig. 4A). The grooves 96 and ridges 98 are configured to
5 mate with similar grooves and ridges of the second insert part 28a.

Turning now to Fig. 5A, the overlap engagement interface 54 of the sleeve insert end 46 of the second insert part 28a is provided with a similar set of parallel grooves 100 and ridges 102, which extend in a direction perpendicular to the sleeve axis A and are configured to mate with the
10 grooves 96 and ridges 98 of the overlap engagement interface 52 of the first insert part 22a in a form-fitting engagement.

The steel tube insert 51 is axially split into two tabs 51a, 51b. An axial bore 104, mating with the axial stud 90 of the first insert part 22a (Fig. 4A), tapers into an axial screw guide 106, as is best shown in Fig. 5B, extending
15 into the steel tube insert 51, between the tabs 51a, 51b. The screw guide 106 is adapted to receive a screw 107 for locking the steel tube insert 51 to the vertical post 26a (Fig. 2A) of the armrest 18a (Fig 1). A curved outer surface 108 of the sleeve insert end 46 is shaped to matingly abut the curved inner wall portion 74 (Fig. 3A) of the sleeve 24a. The curved outer surface 108 is
20 formed by a cut-away of the insert part's otherwise rectangular cross-section, thereby defining an axial shoulder 110 configured to abut the axial shoulder 76 (Fig. 3A) inside the sleeve 24a. Once the first and second insert parts 22a, 28a have firmly interlocked with each other inside the sleeve 24a, the shoulders 94 (Fig. 4B) and 110 (Fig. 5B) will define a form-fitting engagement
25 with the wall portion 74 (Fig. 3A), locking the insert parts 22a, 28a to the sleeve 24a in the axial direction. A circumferential shoulder 112 about the second insert part 28a defines an axial stop position for inserting the steel tube insert 51 into the vertical post 26a (Fig. 2B) of the armrest 18a from below. The bore 104 and/or the axial stud 90 (Fig. 4A) may have an oval-
30 cylindrical cross-section to leave some level of radial play in the clamping direction, thereby to allow some movement in the clamping direction when clamping the two insert parts 22a, 28a together.

Figs 6A-6B illustrate the function of the screw guide 106 (Fig. 5B), which has a tapering shape in the axial direction looking in the direction of the vertical post 26a, when inserting the steel tube insert 51 (Fig. 5B) into the vertical post 26a. The width of the steel tube insert 51 (Fig. 5B) allows, when
5 in an unexpanded state (Fig. 6A), insertion into the vertical post 26a of the armrest 18a (Fig. 1). Screwing the screw 107 into the screw guide 106 will press the steel tube insert tabs 51a, 51b apart, pressing them against the inner walls of the vertical post 26a, thereby firmly locking the second insert part 28a to the vertical post 26a. In this respect, the split steel tube insert 51
10 of the second insert part 28a functions in the same manner as a slotted expansion plug generally used for attaching, e.g., a painting to a wall. The slotted expansion plug arrangement facilitates firmly attaching the second insert part 28a to the vertical armrest post 26a without press tools, e.g. at home.

15 Having now described exemplary embodiments of the components of the first steel tube connector system 15a, it should be apparent how the sleeve bracket 30 (Figs 3A-B) can be firmly connected to the first insert part 22a (Figs 4A-B) and the second insert part 28a (Figs 5A-B) by inserting the sleeve insert end 38 of the first insert part 22a into the sleeve 24a of the
20 sleeve bracket 30 to an axial stop from below; inserting the sleeve insert end 46 of the second insert part 28a into the sleeve 24a to an axial stop from above; and clamping the overlapping sleeve insert ends 38, 46 of the first and second insert parts 22a, 28a against each other, and against the inner wall portion 74 of the sleeve 24a, by screwing the clamping screw 56 onto the
25 clamping screw engagement surface 86. From a stability point of view it may be preferable that the sleeve insert ends 38, 46 of the insert parts 22a, 28a are shaped to, when inserted, fill the entire cross-section of the interior of the sleeve 24a as much as possible, leaving only a gap just wide enough to allow the grooves and ridges of the engagement interfaces 52, 54 to meet and
30 overlap.

Fig. 7 illustrates the entire steel tube connector system 15a after such assembly. The overlap engagement interfaces 52, 54 (Figs 4B, 5A) of the first and second insert parts 22a, 28a define, when overlapping, a mutual overlap

region 114, in which they overlap and engage with each other. The grooves and ridges 96, 98, 100, 102 of the overlap engagement interfaces 52, 54 form a mating groove-and-ridge arrangement 116 at the mutual overlap region 114. The steel tube connector system 15a firmly interconnects four
5 perpendicular steel tube interfaces 32a, 32b, 42, 50, wherein the two horizontal steel tube interfaces 32a, 32b mate with tubes 14a, 14b of larger cross-section than the vertical steel tube interfaces 42, 50 of the insert parts 22a, 28a do.

Preferred materials for the respective insert parts 22a-d, 28a-d and the
10 sleeve bracket 30 are zinc-aluminium alloys, i.e. alloys whose main constituents are zinc and aluminium, such as Zamak, of which Zamak 5 is a preferred variant. Other preferred materials for the purpose are plastic and steel. The respective insert parts 22a-d, 28a-d and the sleeve bracket 30 are preferably integrally formed, and may be cast or moulded in e.g. zinc-
15 aluminium alloy or plastic.

Fig. 8 illustrates the very same situation as Fig. 7, as seen in a cross-section taken along the plane defined by the sleeve axis A (Fig. 2B) and the screw axis (Fig. 3A). Thus, Fig. 8 illustrates how the clamping screw 56 presses onto the clamping screw engagement surface 86, and thereby exerts
20 a pressure on the sleeve insert ends 38, 46, and thereby at the mating groove-and-ridge arrangement 116 at the mutual overlap region 114, and the screw 56 also presses the sleeve insert ends 38, 46 towards the inner wall portion 74 of the sleeve 24a.

Fig. 9 illustrates a second embodiment 122a of the first insert part.
25 According to the illustrated second embodiment, the first insert part 122a is provided with a support plate 182 extending along a plane perpendicular to the sleeve axis (Fig. 2B). The support plate 182 provides, similar to the support plate 82 (Fig. 4A), torsional support to the steel tube connector system 115a. However, the support plate 182 also serves as a mounting plate
30 for mounting a structural element, such as a furniture wheel 120, thereto. For the purpose, the mounting plate 182 is provided with mounting holes 113a-b, allowing attaching the wheel 120 to the mounting plate 182 using a screwed engagement via the mounting holes 113a-b. Being adapted for connecting to

the wheel 120, the structural element interface of the first insert part 122a does not need, and does not have, any steel tube insert 44 of the type illustrated in Fig. 4A.

Even though illustrated apart in Fig. 9, the tubes 14a-b, which are
5 illustrated partly in section, are firmly press-fit to the respective steel tube inserts 34a-b (compare principle of Fig. 3A). Through-holes 111a-b through the lower walls of the steel tubes 14a-b face the respective screw guides 62a-b (Fig. 3B) of the steel tube inserts 34a-b, and the edges of the through-holes 111a-b are upset to form flanges extending into the respective recesses 64a-
10 b of the of the steel tube inserts 34a-b. The mounting plate 182 is provided with protrusions 117a-b mating with, and configured to extend into and engage with, the respective through-holes 111a-b of the steel tubes 14a-b as well as the recesses 64a-b of the steel tube inserts 34a-b. The protrusions 117a-b are configured as flanged through-holes, allowing additional screws
15 121a-b to be screwed from below, through the mounting plate 182 and the steel tubes 14a-b, into the screw guides 62a-b, adding to the stability of the steel tube connector system 115a. The screws 121a-b may also be used for attaching structural elements to the steel tube connector system 115a from below. It will be appreciated that the mounting plate 182 can be made even
20 larger than the one illustrated, facilitating the attachment of a structural element of dimensions even greater than the dimensions of the illustrated wheel 120 thereto.

Referring back again to Fig. 2A, the sofa frame 10, before assembly, fits into a flat package, such as the cardboard box 3 illustrated in Fig. 10, and
25 can thereby be conveniently transported and assembled at home. A subset of the components of the sofa frame 10 may also be used for assembling a frame for other types of furniture, such as for a table. This may easily be achieved by attaching the second insert parts 28a-d to a tabletop (not illustrated) instead of to armrests 18a-b (Fig. 1). Instructions 1, 2 for
30 assembling a plurality of different furniture types using the same frame components may be included in the same package 3.

The invention has mainly been described above with reference to a few embodiments. However, as is readily appreciated by a person skilled in the art, other embodiments than the ones disclosed above are equally possible within the scope of the invention, as defined by the appended patent claims.

5 For example, while the beam interfaces of the sleeve bracket 30 have been illustrated as steel tube inserts 34a-b (Fig. 2B), they may equally well be configured as e.g. screw brackets for attaching, or sleeves for receiving, wooden beams. The structural element interfaces of the first and second insert parts 22a-d, 122a, 28a-d need not be configured for attaching
10 specifically to a furniture leg, an armrest or a wheel; the interfaces may be used for connecting any other suitable component, and particularly any other suitable furniture component. Moreover, the structural elements need not be separate or separable from the respective insert parts 22a-d, 122a, 28a-d; by way of example, the furniture legs 20a-d may be integrally formed with the
15 first insert parts 22a-d, and may be moulded in e.g. Zamak 5.

It is further not necessary to have structural element interfaces on both first and second insert parts 22a-d; 28a-d – by way of example, the first insert part may be provided with e.g. a steel tube interface, and the second may be used only as a locking element used, together with the clamping
20 arrangement, for locking the first insert part to the sleeve 24a.

The clamping arrangement need not comprise a clamping screw 56 in a screw hole 68 in the sleeve 24a. For example, other per se known elements, such as snap-in connectors and wedges, could be used instead of a clamping screw. In a further alternative embodiment, the clamping
25 arrangement need not clamp the insert parts 22a, 28a against an inner wall portion 74 of the sleeve – as an exemplary alternative, the insert parts 22a, 28a can be clamped from two or more directions, such as two opposite directions, using two or more clamping screws through the sleeve wall, such that the insert parts 22a, 28a will be clamped between the screws instead of
30 between a screw 56 and a wall 74. In such an alternative clamping arrangement, it will be understood that the insert parts are clamped against the sleeve via the plurality of clamping screws.

The sleeve bracket 30 need not be provided with two beam interfaces. One is enough. Alternatively, it may be provided with e.g. four beam interfaces for interconnecting four beams, such as four steel tubes, extending in four perpendicular directions in a plane. It is also not necessary that the

5 sleeve bracket beams 14a-b form perpendicular angles with each other, or with steel tubes attached to the first and second insert parts 22a, 28a; other angles may be better suited for certain applications. The sleeve bracket beams 14a-d need not be made from steel material, but other materials are possible as well. Hence, the sleeve bracket beams 14a-d could, for example,

10 be made from metal, such as steel or aluminium, plastic materials, wood, wood fibre material, and composite material, meaning a material made from at least two components. The composite material could, for example, be fibre reinforced polymers, for example carbon and/or glass fibre reinforced plastic, wooden particle reinforced plastic, etc. Preferably, the sleeve bracket beams

15 14a-d are all made from hollow tubes.

The invention is not limited to steel frame sofas or to steel frame furniture; it can be used also for other applications. However, it may be particularly useful for rectangular frames extending in the horizontal plane which need to be provided with vertical legs, such as seat frames for any type

20 of seating furniture, or table frames for carrying a table top, or beds for sleeping.

Claims

1. A beam connector system (15a; 115a) for connecting a structural element (20a-d; 26a-d; 120), such as a furniture leg, to a beam (14a), such as a metal tube, the beam connector system being **characterized in** comprising
- 5 a sleeve bracket (30) comprising
- a first sleeve bracket beam interface (32a) for holding a first beam (14a) in a first sleeve bracket beam direction (D1), and
- a sleeve (24a), which defines a guide extending along a sleeve axis (A) having a direction which is different from the first direction (D1);
- 10 the beam connector system (15a; 115a) further comprising
- a first insert part (22a; 122a) having a sleeve insert end (38) which is insertable in the sleeve (24a) in a first insertion direction (36) along the sleeve axis (A), and further having, opposite to the sleeve insert end (38), a structural element interface end (40) comprising a first insert part structural
- 15 element interface (44; 182) for holding a first structural element (20a; 120), such as a furniture leg;
- a second insert part (28a) having a sleeve insert end (46) which is insertable in the sleeve (24a) in a second insertion direction (37) along the sleeve axis (A), said second insertion direction (37) being opposite to the first
- 20 insertion direction (36), wherein the sleeve insert ends (38, 46) of the first and second insert parts (22a; 122a, 28a) are insertable in the sleeve (24a) along their respective opposite insertion directions (36, 37) with a mutual overlap inside the sleeve (24a) to define a mutual overlap region (114); and
- a clamping arrangement (56, 68) for clamping the mutually overlapping
- 25 sleeve insert ends (38, 46) of the first and second insert parts (22a; 122a, 28a), when inserted in the sleeve (24a), against each other and against the sleeve (24a), so as to firmly lock the sleeve insert ends (38, 46) to each other and to the sleeve (24a).
- 30 2. The beam connector system according to claim 1, wherein the sleeve insert end (38) of the first insert part (22a; 122a) has an overlap engagement interface (52) configured to face a mating overlap engagement interface (54) of the sleeve insert end (46) of the second insert part (28a), when inserted

into the sleeve (24a) in the respective first and second insertion directions (36, 37), said overlap engagement interfaces (52, 54) being shaped to engage with each other in a form-fitting engagement.

5 3. The beam connector system according to claim 2, wherein the overlap engagement interfaces of the first and second insert parts (22a; 122a, 28a) are provided with a mating groove-and-ridge arrangement (116) with its grooves (96, 100) and ridges (98, 102) extending, when the overlap engagement interfaces (52, 54) are overlapping inside the sleeve (24a), in a
10 direction transversal to the sleeve axis (A).

4. The beam connector system according to any of the previous claims, wherein one of the sleeve insert end (38) of the first insert part (22a; 122a) and the sleeve insert end (46) of the second insert part (28a) is provided with
15 an axial stud (90), and the other of the sleeve insert end (38) of the first insert part (22a; 122a) and the sleeve insert end (46) of the second insert part (28a) is provided with an axial bore (104) adapted for co-operating with the axial stud (90).

20 5. The beam connector system according to any of the previous claims, wherein an outer surface (92, 108) of at least one of the sleeve insert ends (38, 46) of the first and second insert parts (22a; 122a, 28a) is shaped to matingly abut an inner wall portion (74) of the sleeve (24a), preferably in a form-fitting manner.

25

6. The beam connector system according to claim 5, said inner wall portion (74) having a curved shape, as seen in a section taken perpendicular to the sleeve axis (A), with a radius of curvature exceeding 4 mm.

30 7. The beam connector system according to any of the previous claims, wherein at least one of the first and second insert parts (22a; 122a, 28a) is provided with a respective insert part shoulder (83, 94, 110) for axially abutting a respective portion of the sleeve bracket (30), such as a

circumferential edge (84) of the sleeve (24a) or a sleeve shoulder (76) inside the sleeve (24a), thereby defining an axial stop position for insertion of the respective insert part(s) (22a; 122a, 28a) along the sleeve axis (A).

5 8. The beam connector system according to any of the previous claims, wherein the second insert part (28a) further comprises a structural element interface end (48) comprising a second insert part structural element interface (51) for holding a second structural element (26a), such as a seating furniture armrest (18a), the structural element interface end (48) of the second insert
10 part (28a) being opposite to the sleeve insert end (46) of the second insert part (28a).

9. The beam connector system according to any of the previous claims, wherein the sleeve (24a) is elongate, and preferably has a length (L) along
15 the sleeve axis (A) of at least twice its width (W) perpendicular to the sleeve axis (A).

10. The beam connector system according to any of the previous claims, wherein the sleeve bracket (30) comprises a second sleeve bracket beam
20 interface (32b) for holding a second beam (14b), such as a metal tube, in a second sleeve bracket beam direction (D2).

11. The beam connector system according to claim 10, said second sleeve bracket beam direction (D2) being essentially perpendicular to the first sleeve
25 bracket beam direction (D1).

12. The beam connector system according to claim 11, wherein the structural element interface (44) of the first insert part (22a; 122a) comprises an integrally formed support plate (82, 182) extending along a plane
30 perpendicular to the sleeve axis (A), for providing torsional support to the first insert part (22a; 122a) and, optionally, for mounting of a structural element (120) of dimensions substantially greater than the dimensions of the insert

end of the first insert part (122a) thereto.

13. The beam connector system according to claim 12, wherein the mounting plate (182) is provided with protrusions (117a-b) configured to
5 engage with mating recesses (111a) of beams (14a-b) connected to the sleeve bracket beam interfaces (32a-b).
14. The beam connector system according to any of the previous claims, wherein the first sleeve bracket beam direction (D1) is essentially
10 perpendicular to the sleeve axis (A).
15. The beam connector system according to any of the previous claims, wherein the clamping arrangement comprises a clamping screw hole (68) in the sleeve (24a), for receiving a clamping screw (56) to clamp the first and
15 second insert parts (22a; 122a, 28a) towards an inner sleeve wall portion (74) opposite the hole (68).
16. The beam connector system according to claim 15, wherein a side of a sleeve insert end (38) of at least one of the first and second insert parts (22a;
20 122a, 28a) comprises a flat or concave clamping screw engagement surface (86).
17. The beam connector system according to any of the previous claims, wherein the sleeve bracket (30) is symmetric about each of at least two
25 perpendicular planes.
18. The beam connector system according to any of the previous claims, said first and/or second insert part structural element interface (44, 51) being an interface for holding a metal tube (20a, 26a), and preferably configured as
30 a respective metal tube insert (44, 51) for form-fitting engagement inside a respective metal tube (20a, 26a).

19. The beam connector system according to any of the previous claims, wherein /at least one of/ the sleeve bracket beam interface(s) (32a-b) is a metal tube interface, and preferably comprises a metal tube insert (34a-b) for form-fitting engagement inside a respective metal tube (14a-b).

5

20. The beam connector system according to claims 18 and 19, said metal tube interface(s) (34a-b) of the sleeve bracket (30) being shaped for mating with a metal tube (14a-b) of larger cross-section than the metal tube interface(s) (44, 51) of the insert part(s) (22a, 28a).

10

21. The beam connector system according to any of the claims 18-20, the metal tube insert(s) (34a-b) of said sleeve bracket (30) being configured for form-fitting engagement inside a respective metal tube (14a-b) of rectangular cross-section, a side of said rectangular cross-section being essentially

15 parallel to the sleeve axis (A).

22. The beam connector system according to any of the claims 18-21, the metal tube insert(s) (44, 51, 34a-b) of at least one of said insert part(s) (22a; 122a, 28a) and/or of said sleeve bracket (30) being longitudinally split and provided with a respective longitudinal screw guide (106) extending into the respective metal tube insert (51) in a screw guide direction into the respective tube (26a), thereby to define a slotted expansion plug arrangement for firmly attaching the respective metal tube (26a) by expansion of the respective metal tube insert (51), by screwing a screw (107) into the screw guide (106).

25

23. The beam connector system according to any of the claims 18-22, said insert part metal tube insert(s) (44) and/or said sleeve bracket metal tube insert(s) (34a-b) being provided with a respective metal tube abutment shoulder (85, 66).

30

24. The beam connector system according to any of the claims 18-23, said sleeve bracket metal tube interface(s) (34a-b) and/or insert part metal tube

interface(s) (44) being permanently attached to the respective metal tube.

25. The beam connector system according to claim 24, wherein said
respective metal tube (14a-b, 20a) is riveted, flanged, upset, welded, brazed,
5 and/or press-fit to the respective metal tube insert (44, 34a-b).

26. The beam connector system according to any of the previous claims,
wherein at least one of said respective insert parts (22a; 122a, 28a) is
integrally formed, and/or said sleeve bracket (30) is integrally formed, and
10 preferably cast or moulded in zinc-aluminium alloy or plastic.

27. A flat, rectangular furniture frame comprising four straight beams (14a-
d), preferably metal tubes, interconnected by the sleeve brackets (30) of four
beam connector systems (15a-d) according to claim 11 taken in combination
15 with claim 10 and any one of claims 1-9 and 12-26.

28. The furniture frame according to claim 27, wherein said furniture frame
is a seat frame (12) for a piece of seating furniture (10), such as a piece of
upholstered seating furniture, e.g. an upholstered sofa.
20

29. A flat package (3), such as a cardboard box, comprising
a permanently joined furniture frame (12) according to any of the
claims 27-28; and, for each of said sleeve brackets (30),
a respective first insert part (22a-d; 122a) having a sleeve insert end
25 (38) which is insertable in the respective sleeve (24a) in a first insertion
direction (36) along the respective sleeve axis (A), and further having,
opposite to the sleeve insert end (38), a furniture leg interface (42) for holding
a respective furniture leg (20a);
a respective second insert part (28a-d) having a sleeve insert end (46)
30 which is insertable in the respective sleeve (24a) in a second insertion
direction (37) along the respective sleeve axis (A), said second insertion
direction (37) being opposite to the first insertion direction (36), wherein the
sleeve insert ends (38, 46) of the first and second insert parts (22a-d; 122a,

28a-d) are insertable in the sleeve (24a) along their respective opposite insertion directions (36, 37) with a mutual overlap inside the respective sleeve to define a mutual overlap region (114); and

5 a respective clamping arrangement (56, 68) for clamping the mutually overlapping sleeve insert ends (38, 46) of the respective first and second insert parts (22a-d; 122a, 28a-d), when inserted in the respective sleeve (24a), against each other and against the respective sleeve (24a), so as to firmly lock the sleeve insert ends (38, 46) to each other and to the respective sleeve (24a).

10

30. A modular furniture kit comprising a plurality of beam connector systems (15a-d; 115a) according to any of the claims 1-26, a plurality of beams (14a-d) such as metal tubes, and building instructions (1) for building a piece of furniture of a first type using at least a portion of said beams (14a-d)
15 and beam connector systems (15a-d, 115a).

31. The modular furniture kit according to claim 30, further comprising building instructions (2) for building a piece of furniture of a second type using at least a portion of said beams (14a-d) and beam connector systems (15a-d;
20 115a).

32. A method of assembling a piece of furniture, comprising providing a sleeve bracket (30) comprising a beam interface (32a-b), such as a metal tube interface, and a sleeve (24a);
25 inserting a sleeve insert end (38) of a first insert part (22a; 122a), which comprises a structural element interface (42) such as a furniture leg interface, into the sleeve (24a) along a first insertion direction (36); inserting a sleeve insert end (46) of a second insert part (28a) into the sleeve (24a) along a second, opposite insertion direction (37) until the sleeve
30 insert ends (38, 46) of the first and second insert parts (22a; 122a, 28a) overlap in a mutual overlap region (114) inside the sleeve (24a); and clamping the mutually overlapping sleeve insert ends (38, 46) of the first and second insert parts (22a; 122a, 28a) against each other, and against

30

the sleeve (24a), so as to firmly lock the beam interface (32a-b) to the structural element interface (42).

5

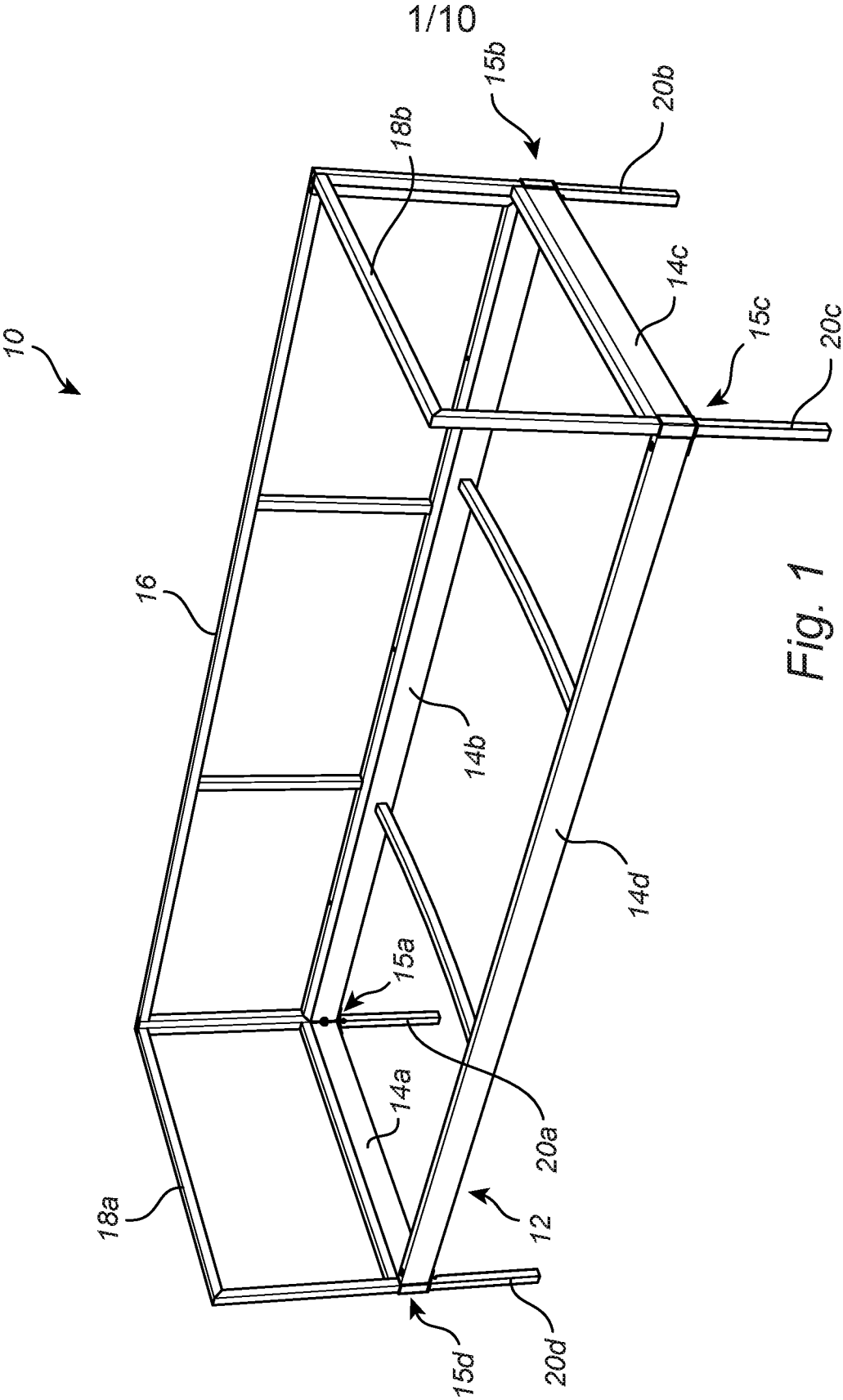


Fig. 1

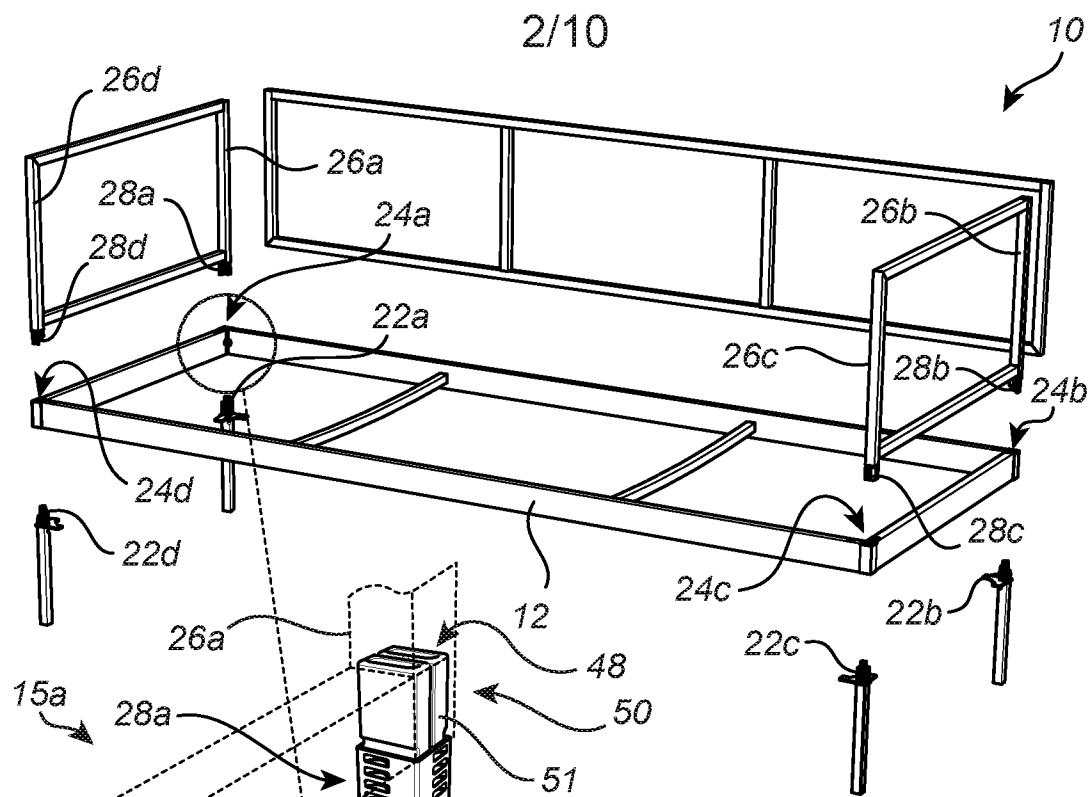


Fig. 2A

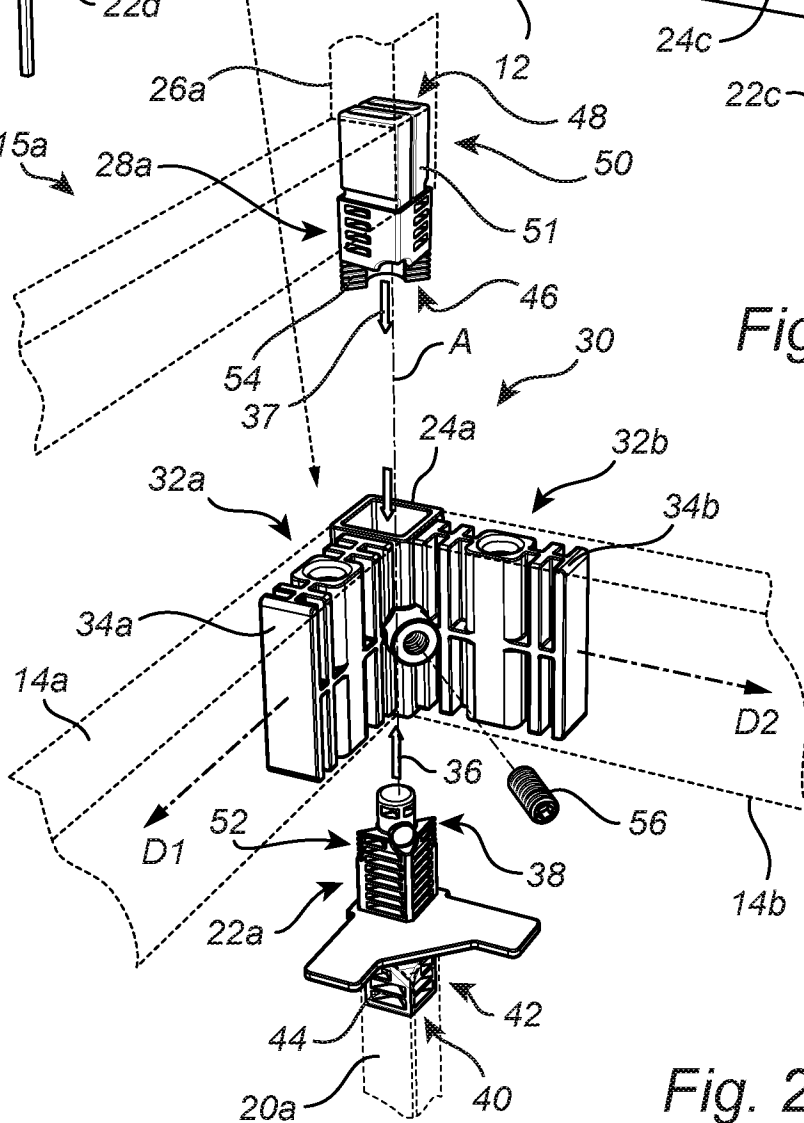


Fig. 2B

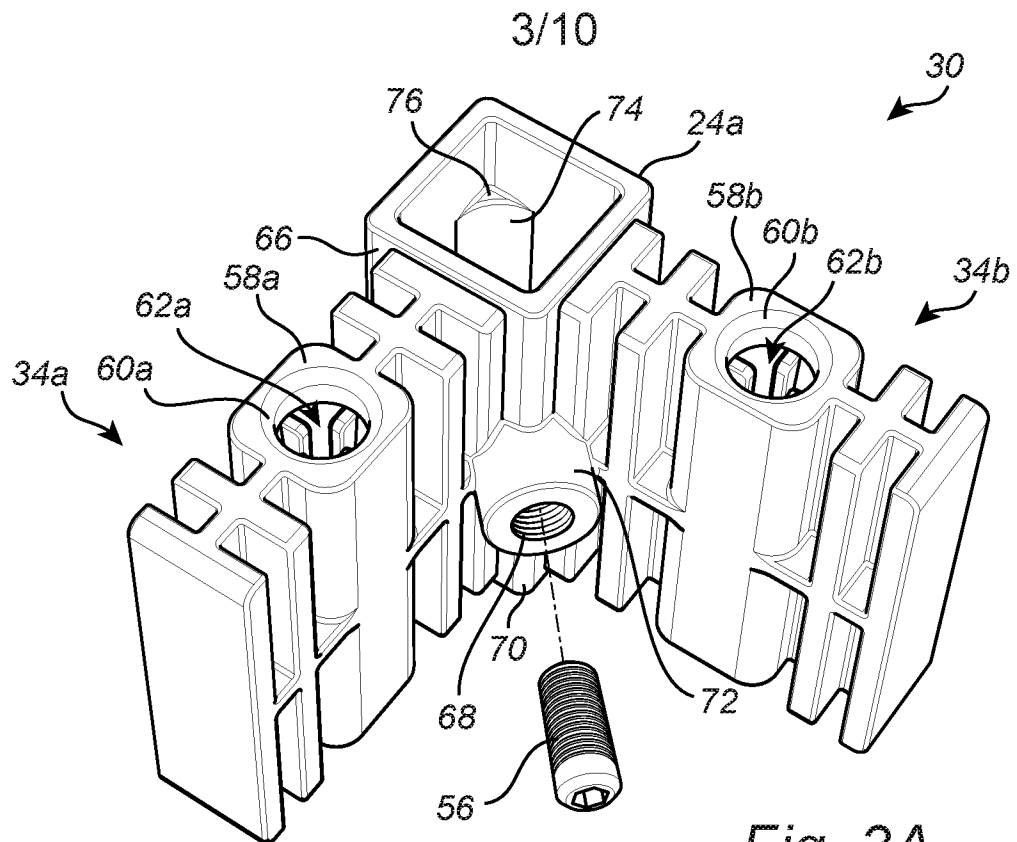


Fig. 3A

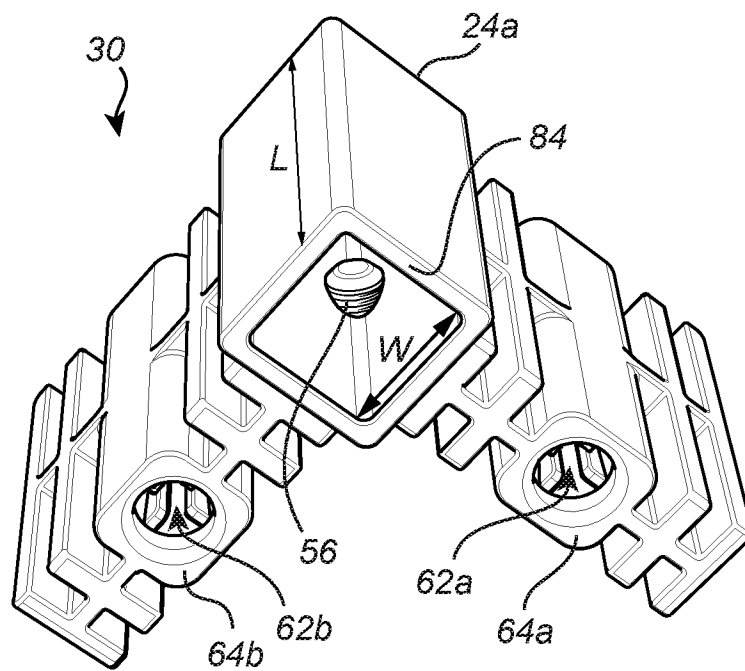
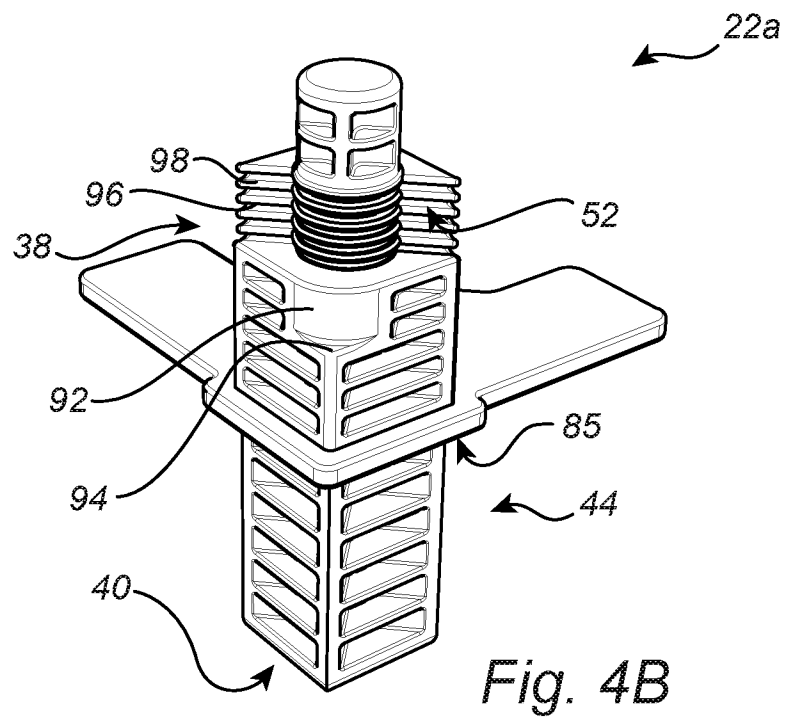
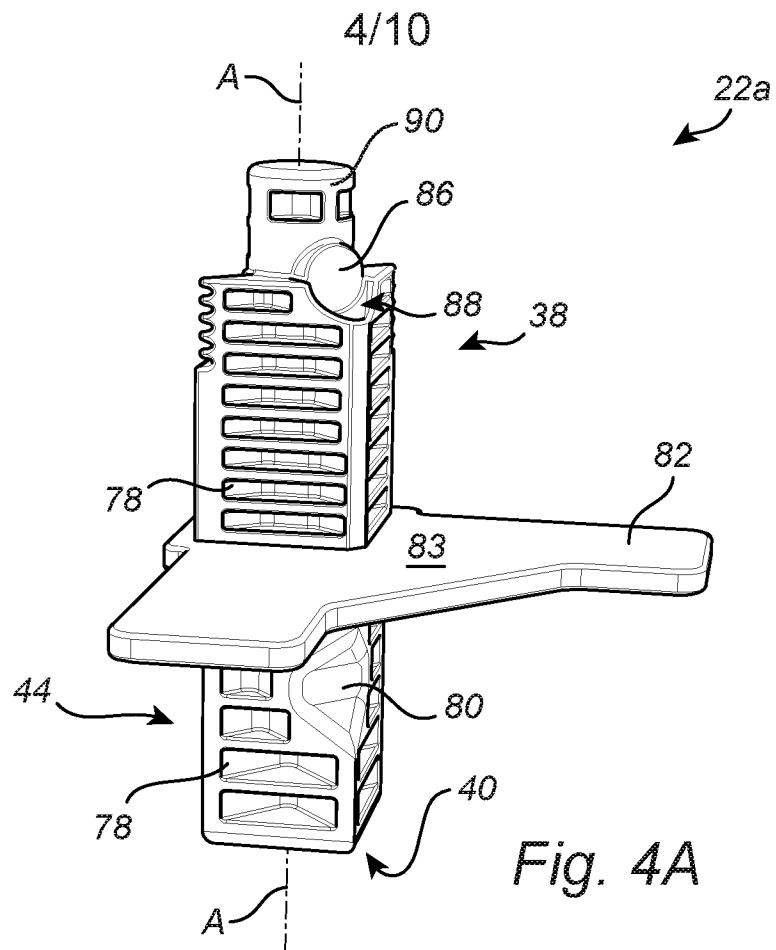
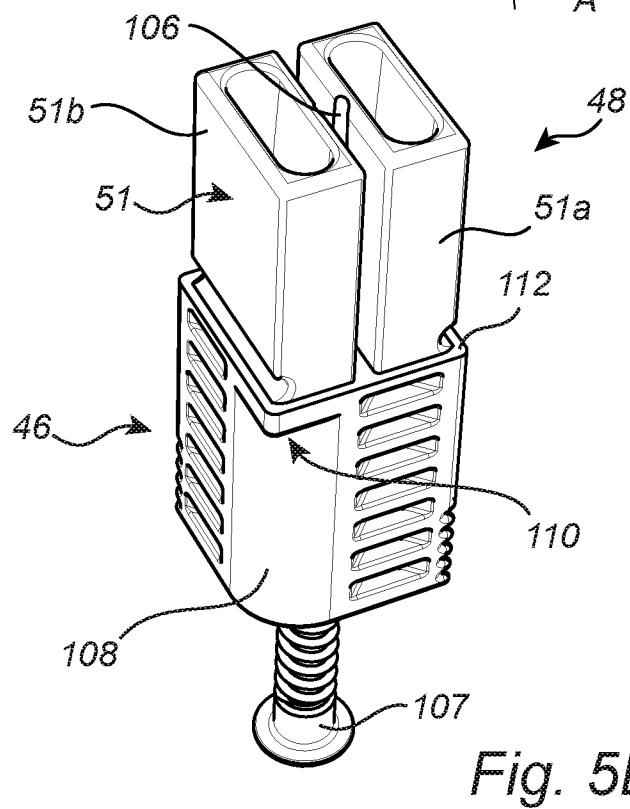
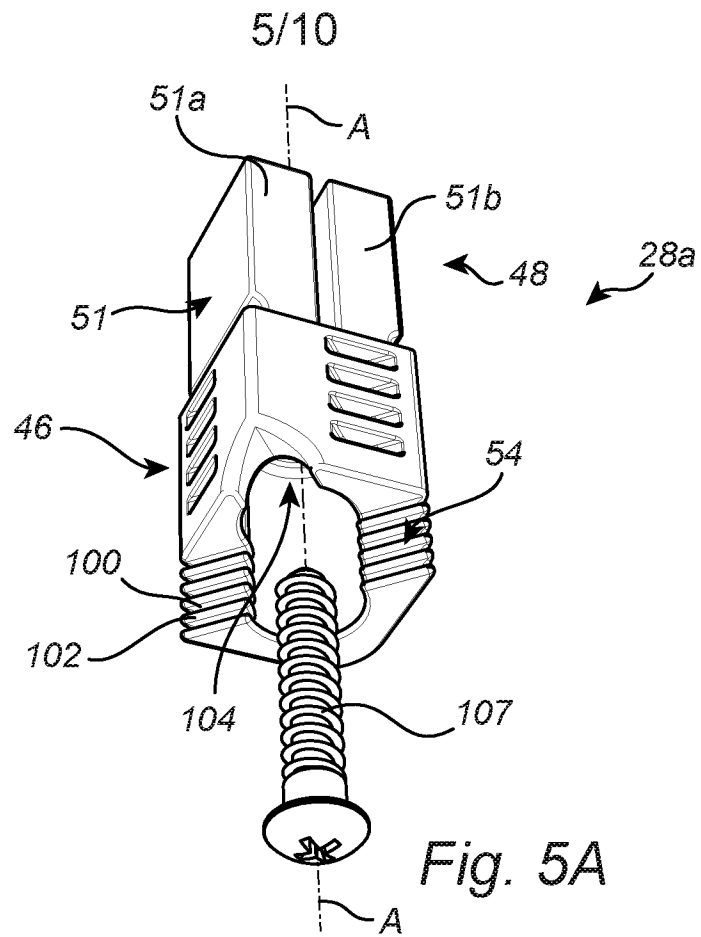


Fig. 3B





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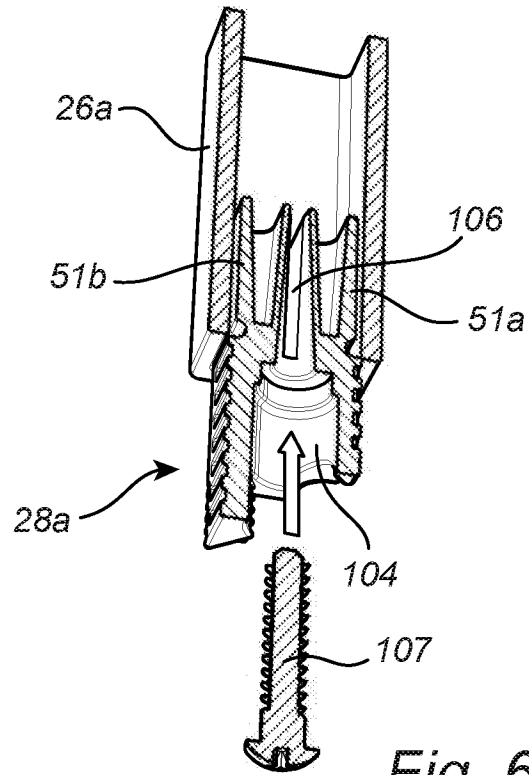


Fig. 6A

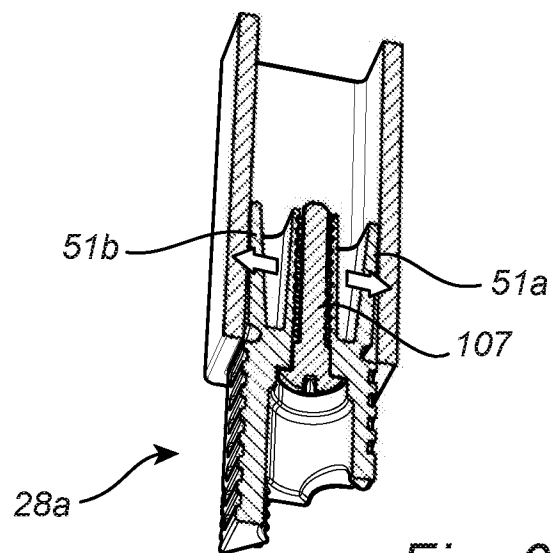


Fig. 6B

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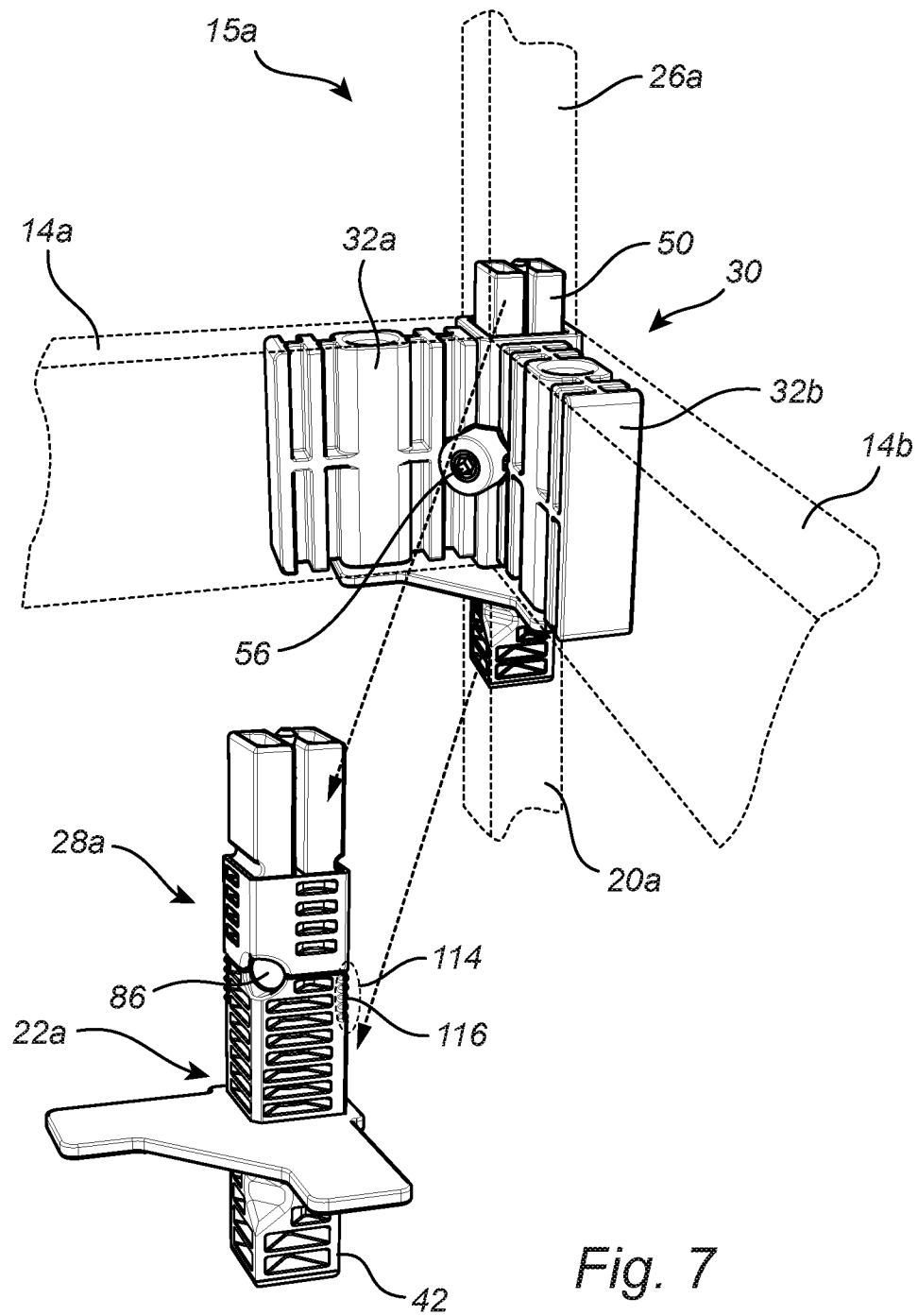


Fig. 7

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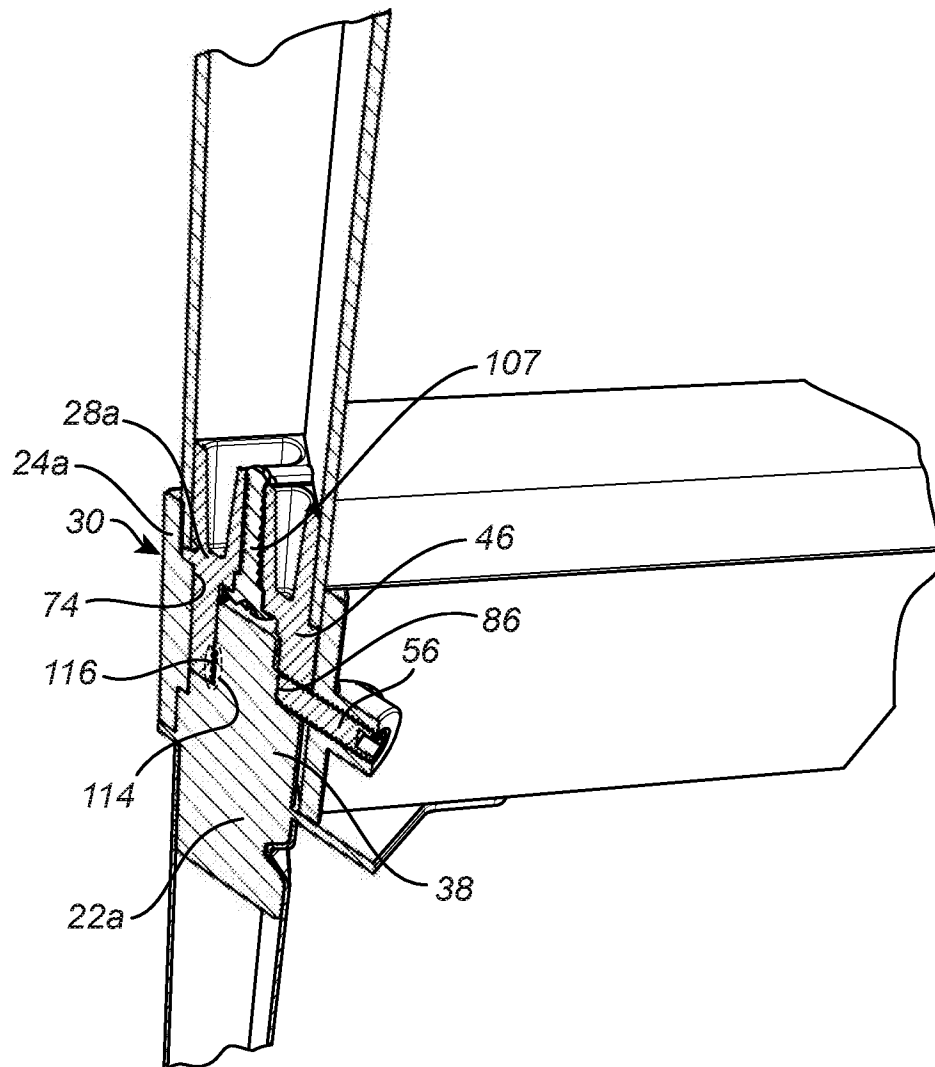
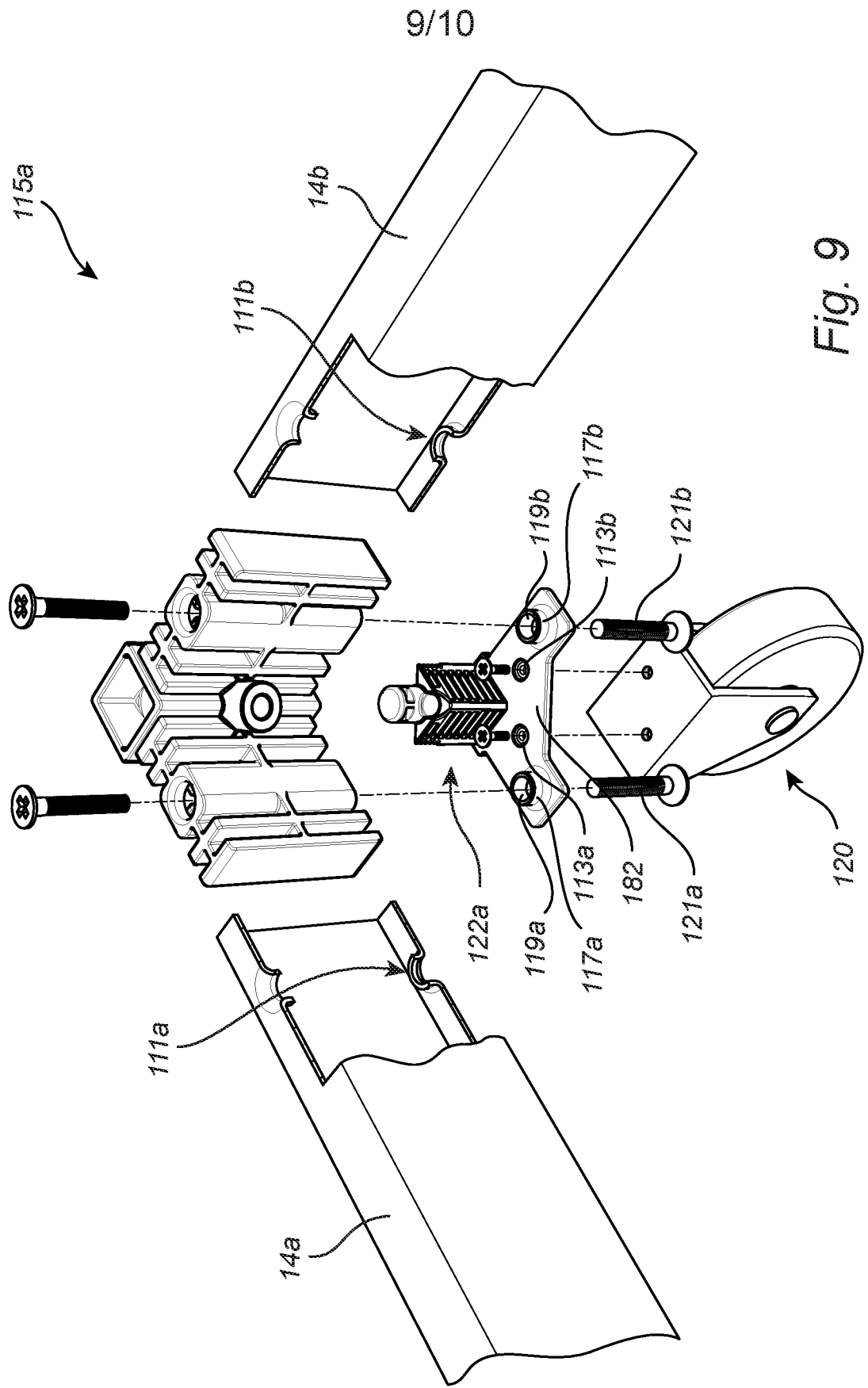


Fig. 8



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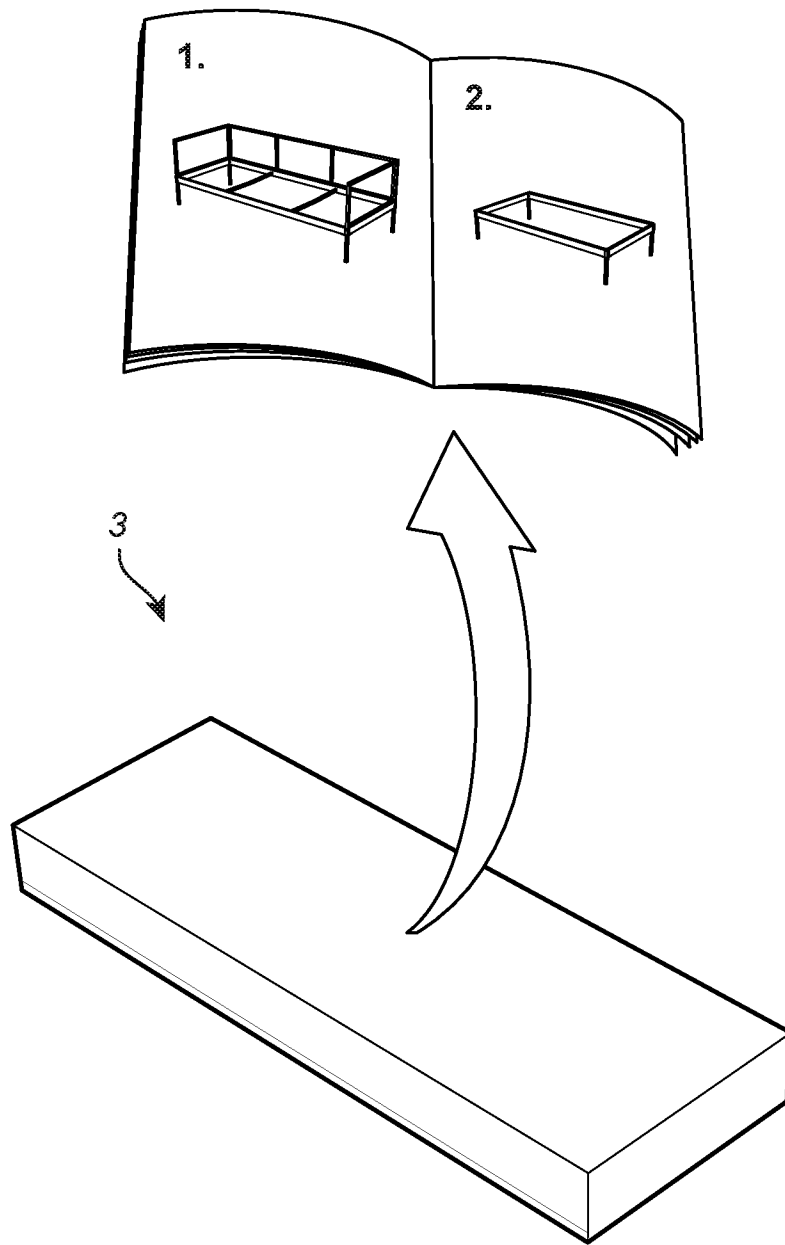


Fig. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2016/050674

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: F16B

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

SE, DK, FI, NO classes as above

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

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 1285411 A (BRITISH ALUMINIUM CO LTD), 16 August 1972 (1972-08-16); abstract; page 1, line 73 - page 2, line 116; figures 1-3; claims 1,17 --	1-26, 30-32
A	DE 2155234 A1 (VOELKLE ROLF), 10 May 1973 (1973-05-10); page 3, paragraph [0005] - page 5, paragraph [0001]; figures 1,2,4 --	1-32
A	US 20110309046 A1 (LEE YUNG-YU), 22 December 2011 (2011-12-22); whole document --	1-32



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

19-09-2016

Date of mailing of the international search report

19-09-2016

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2016/050674

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2441349 A1 (SINETICA IND SRL), 18 April 2012 (2012-04-18); whole document --	1-32
A	US 20100314982 A1 (LUO CUN NENG), 16 December 2010 (2010-12-16); whole document -- -----	1-32

Continuation of: second sheet

International Patent Classification (IPC)

F16B 12/40 (2006.01)

F16B 12/50 (2006.01)

F16B 12/52 (2006.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE2016/050674

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			TW	I365731 B	11/06/2012	
			US	8196758 B2	12/06/2012	
EP	2441349 A1	18/04/2012	IT	UD20100187 A1	16/04/2012	
			IT	1402258 B1	28/08/2013	
US	20100314982 A1	16/12/2010	US	8365929 B2	05/02/2013	