



(51) International Patent Classification:

E04C 3/08 (2006.01) *B23K 33/00* (2006.01)
E04B 1/58 (2006.01) *E04C 3/04* (2006.01)

(21) International Application Number:

PCT/CZ2022/050118

(22) International Filing Date:

10 November 2022 (10.11.2022)

(25) Filing Language:

Czech

(26) Publication Language:

English

(30) Priority Data:

2021-520 11 November 2021 (11.11.2021) CZ

(71) Applicant: **AREA FOUR INDUSTRIES ČESKO S.R.O.**
[CZ/CZ]; Špindlerova třída 286, 41301 Roudnice nad
Labem (CZ).

(72) Inventors: **ZYKAN, František**; Na Terasě 2638, 41301
Roudnice nad Labem (CZ). **ŽÚBOR, Marek**; Hlavní 138,
41301 Klenec (CZ). **JURKA, Vladimír**; Štefánikova 1042,
27351 Unhošť (CZ).

(74) Agent: **PATENTENTER S.R.O.**; Koliště 1965/13a,
60200 Brno (CZ).

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

(54) Title: METHOD OF MANUFACTURING A TRUSS STRUCTURE ELEMENT AND A TRUSS STRUCTURE

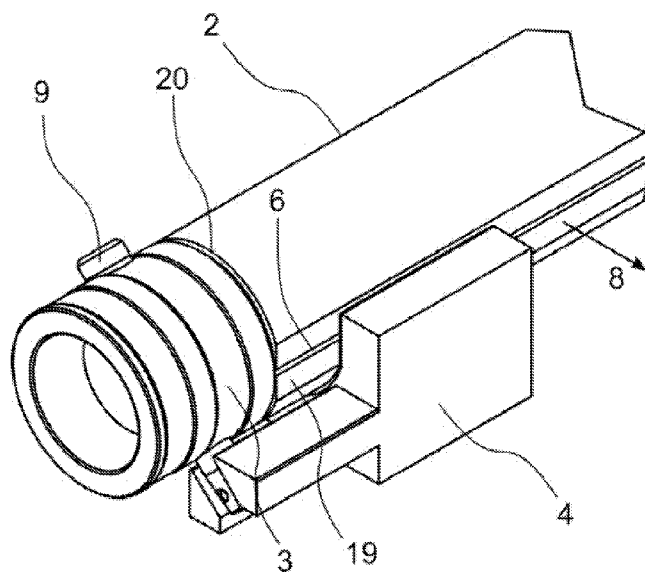


Fig. 2

(57) Abstract: The object of the invention is a method of manufacture of an element (1) of a truss structure. This method comprises providing at least two main rods (2), each with at least one plane surface (19) passing along its axis for the majority of its length. Furthermore, this method comprises, for each main rod (2), the steps of: • fixing the main rod (2) to the clamping jaw (4), wherein the clamping jaw (4) is engaged with at least one plane surface (19) of the main rod (2); and • forming or attaching a connecting member for connection to another element (1) of the truss structure. This connecting member or part of it is implemented in a preset location or orientation. Preferably, the connecting member at each end of the main rod (2) is composed of a housing (3) with a precisely defined rotation and a precisely defined mutual distance between the two housings (3) on each main rod (2). Furthermore, the method comprises a firm connection of the main rods (2) by cross rods (5) welded to the plane surfaces (19). Furthermore, the object of the invention is

TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS,
ZA, ZM, ZW.

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

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

— *with international search report (Art. 21(3))*
— *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

a truss structure with elements (1) formed in this method.

Method of manufacturing a truss structure element and a truss structure

Technical Field

5 The present invention is directed to manufacture of truss structures, in particular to precise placing of connecting members for connecting individual elements of the structure. Further, the invention is directed at a truss structure formed by a method of the invention.

Background of the Invention

10 Truss structures, sometimes also called rod or tube structures, typically comprise at least two main rods, which are interconnected by cross rods, which are usually thinner than the main rods and usually run perpendicular to them at the ends of the main rods and obliquely between the ends of the main rods. Most often the cross rods are attached to the main rods by welding. The individual elements of truss structures are then detachable connected, most often by means of pegs connecting the main rods of the two elements or by means of pins with connecting openings, which are located inside the rods
15 being connected on two different elements, wherein the pin is attached at each of its ends to one of the rods by a peg.

The cross-section of the main rods is usually round, which greatly complicates the welding of the cross rods, which tend to move or rotate when welded to a curved surface. A further complication of the manufacture of truss structures is that the connecting
20 members for connecting the individual elements must be placed with relatively high precision such that any two elements may be easily connected together. When forming connecting members, e.g., by drilling or milling, or when attaching them to the main rod,

there are thus considerable demands on precision, which are difficult to maintain, e.g., due to the rotation of the main rod during drilling.

Document EP 1 884 605 A1 describes an element of a truss structure whose main rods are provided with a plane surface with a groove, wherein cross rods are welded to this plane surface. The groove allows air to escape from the cross rods during welding, when the air expands due to the heat from welding and could damage the structure. This document therefore largely removes the complications of welding elements of a truss structure, but no consideration is given to connecting members and their difficult manufacture.

It would therefore be useful to come up with a solution for manufacture of truss structures that would facilitate the precise placing and formation of connecting members, thereby, for example, reducing inspection demands, reducing defect rate and/or enabling more efficient automation of manufacture.

Summary of the Invention

The disadvantages of the solutions known from the prior art are to some extent eliminated by a method of manufacture of an element of a truss structure comprising the provision of at least two main rods, wherein each main rod has a constant cross-section with a partly curved and partly straight circumference over the majority of its length. Such a main rod comprises at least one plane surface passing along the axis of the main rod over a majority of the length of the main rod, preferably over a predominant majority, e.g., at least 80 % of the length. The method of the invention consists in that for each of said main rods comprises the following steps:

- Fixing the main rod in a clamping jaw, wherein the clamping jaw is engaged with at least one plane surface of the main rod, i.e., even for main rods with multiple plane surfaces, the clamping jaw is engaged with at least one of the multiple surfaces, not necessarily engaged with all of them, and

- Forming or attaching a connecting member for connection to another element of the truss structure at at least one end of the main rod, wherein the connecting member or a part thereof is implemented at a preset location. In this step, the connecting member or a part thereof is preferably rotated relative to at least one plane surface on the main rod by a predetermined angle, wherein this angle is measured, for example, relative to the axis of the main rod when viewed in the direction of this axis.

The preset location may be determined by presetting this angle, i.e., by determining the angle between the connecting member and the plane surface. The connecting member could also be called a connecting mechanism or, in particular, a part of a connecting mechanism, since the connecting member is here particularly preferably a connecting opening, peg, and cotter pin, wherein the part of the connecting member with a defined placement on the main rod is the connecting opening, which subsequently also defines the placement of the peg after connecting the two elements by pegs. Preferably, therefore, the connecting member or a part thereof on each main rod is located in the same position relative to at least one of the plane surfaces. Thus, the preset location for the connecting member or a part thereof may be given by rotation around the axis of the main rod. It may be given alternatively or additionally by a move in the direction of this axis. Preferably, the preset location is determined both by rotating around the axis of the main rod and by moving along it.

Furthermore, the method comprises a firm connection of the main rods by cross rods welded to the main rods on the plane surfaces of the main rods being connected. The cross rods are thus additional rods, usually thinner, passing between the main rods. Said preset location is preferably the same for forming all the connecting members, or at least some part of all connecting members, on a given main rod, on all main rods included in a given element and preferably on all elements that are or are to be part of a given truss structure. Furthermore, preferably, the connecting elements on the different main rods on the same element and preferably on all elements that are to form the truss structure together are realised in the same way. For example, this preset location means that a drill or milling cutter or other tool for forming at least part of the connecting member is positioned in a preset orientation relative to the clamping jaw / relative to the main profile such that it is not necessary to precisely reorient it for each connecting member or main profile or element. Similarly, a device for attaching the connecting member, e.g., a handler for housing placement, a welding tool, etc., may be placed in the preset

orientation. This, e.g., also greatly facilitates the robotisation of the method where some or all of the steps are performed automatically, e.g., using a CNC machine and/or a welding robot.

Particularly preferably, the cross-section of the main rods is a circular cross-section with two flat surfaces. Welding on plane surfaces greatly simplifies the manufacture method because on a plane surface the end of the cross rod being welded does not slip and rotate and its position is largely determined. This makes it easier to keep the cross rods in one line or one plane, for cross rods where this is desired, and makes it possible to weld the elements of the truss structure even using a welding robot.

Another advantage of the method of the invention is that on the resulting element, or on each main rod of the resulting element, the rotation of the connecting member with respect to the plane surface(s) is determined. This ensures that the connecting members on all elements and/or on all main rods or on both ends of the main rods are equally rotated and therefore easily removable. Due to the fact that the main rod is at least partially fixed in the clamping jaw by the plane surface, its rotation during clamping is also clearly defined, i.e., when viewed in the axis of the main rod, the rotation of the plane surface with respect to the clamping jaw or some part thereof is given. This makes it much easier to ensure and check the correct rotation of the connecting members, which must be determined quite accurately in truss structures such that any two elements may be connected together. The tool forming the connecting member or a part thereof, for example a drill, may also be in a defined position relative to the clamping jaw, such that when drilling it may be sufficient to adjust the movement of the main rod in the axis or the movement of the tool along the axis of the main rod, and the position of the connecting member is clearly determined and is the same on all the main rods so manufactured. Said predetermined angle or predetermined location depends mainly on the number of plane surfaces and the type of connecting member.

For example, if the main rod comprises two plane surfaces, said preset location for the formation of the connecting member is preferably located between these surfaces. In other words, preferably all the plane surfaces of the main rod (i.e., at least said one) are symmetrical about a common plane of symmetry preferably passing through the axis of the main rod, wherein said at least part of the connecting member (e.g., the connecting opening) is also symmetrical about the same plane of symmetry. Particularly preferably,

the orientation of the connecting openings is chosen such that their axes are directed to the centre of the resulting element of the truss structure, or that the axes of the connecting openings are perpendicular to the axis of the element, which is parallel to the axes of the main rods and passes through the centre of the structure, i.e. in the space defined by the main rods.

Preferably, forming or attaching a connecting member comprises providing a housing with a connecting opening, fixing the housing in the clamping jaw, and attaching the housing to the main rod, wherein the preset location for implementing (here, attaching) the connecting member or a part thereof is realised as a preset angle between the axis of the connecting opening and the normal of at least one plane surface projected into a plane perpendicular to the axis of the main rod. Preferably, the housing is fixed in the clamping jaw, for example, by threading a peg through the connecting opening and fixing this peg in the clamping jaw.

The housing may be realised as a tubular part, with a cross-sectional shape corresponding to the cross-sectional shape of the main rod, which is intended to be attached, for example welded, pressed, riveted, etc., to the end, preferably both ends, of each main rod. Usually such a housing comprises a connecting opening for a peg, which then ensures the connection of the elements, but it is in principle also possible to use housings without connecting openings. Most preferably, all elements of a given structure have housings with connecting openings at both ends of all main rods and pins are used to connect the elements. Each pin is usually cylindrical in shape, adapted for partial insertion into the housing, and has two connecting openings. The pin is inserted on one side into the housing on the main rod of one element and on the other side into the housing of the other element and is secured in both housings by a peg passing through the connecting openings on both the housing and the pin.

Said partially curved circumference of the cross-section of the main rod may have the shape of a part of a circle or ellipse. Said plane surface appears in cross-section as a line segment, possibly with a depression at the location of the vent groove, as will be described below. Preferably, the plane surfaces and any grooves are formed during the manufacture of the main rod, e.g., during extrusion. For example, on a 40–50 mm diameter main rod, the width of the plane surface may be 10–20 mm, e.g., 14 or 16 mm. The cross rods may then have a diameter of, e.g., 14–20 mm.

Preferably, at least one plane surface is provided with a groove passing along the axis of the main rod. Such a groove allows the expanding air to escape when welding the cross rods such that e.g. tearing of the cross rod by this air is prevented. It is also possible to provide such a vent groove in any other orientation, e.g., perpendicular to the axis of the main rod.

The method may further comprise a step of forming at least one vent opening, wherein the at least one vent opening is formed in a groove. This opening may therefore pass through the wall of the main rod and may allow even more reliable hot air evacuation. The groove makes it easier to guide, e.g., a drill to the right place to form the vent opening.

Preferably the step of forming the connecting member comprises forming a connecting opening in the main rod, wherein the axis of the connecting opening is perpendicular to the axis of the main rod. The preset location for implementing the connecting member or a part thereof is realised as a preset angle between the axis of the connecting opening and the normal of at least one plane surface projected into a plane perpendicular to the axis of the main rod.

In the case of a main rod with multiple plane surfaces, the angle of the axis of the connecting opening relative to one of them, more of them, or each of them, or to their normals, may be preset for both connecting openings formed directly in the main rod and for connecting openings preferably formed in the housings. E.g., in the case of three plane surfaces the connecting opening may be extended through the middle plane surface, in the case of two plane surfaces it is preferably extended symmetrically between them. Such an orientation of the connecting openings allows the corresponding members, e.g., pegs, to be easily inserted into the openings on the resulting element without the cross rods interfering with the insertion or driving in or out of the pegs.

Particularly preferably, the main rod comprises two plane surfaces, wherein the angle between their normals is $90^\circ \pm 3^\circ$ (i.e., 87° to 93°), preferably $90^\circ \pm 1^\circ$. The angle between the part of the connecting member, especially preferably between the axis of the connecting opening and the two normals is then preferably half of the angle between the normals $\pm 0.5^\circ$, more preferably $\pm 0.25^\circ$. Preferably the plane surface or surfaces pass over at least 80 % of the length of the main rod. The connecting openings or otherwise realised connecting members may be realised on the remaining part of the main rod, in

particular on the ends thereof, e.g. max. 5 to 10 cm from the complete end of the main rod, or they are preferably realised on housings as described above.

At least one connecting opening may be an opening for the passage of a peg passing through the entire width of the main rod. Openings for the passage of a peg passing through only part of the width of the main rod, i.e., in particular through the wall in one location instead of in two opposite locations, are also possible. Further, the connecting opening may be an elongated opening for the passage of a handling protrusion of a sliding member, as will be described below, wherein the axis of this elongated opening is a perpendicular line to the axis of the main rod passing through this elongated opening. As a result, the cross rods on the resulting element do not interfere with said handling.

The step of forming the connecting member may also comprise forming a cutout at the first end of the main rod, wherein the cutout is defined by at least two opposite parallel surfaces, and wherein the preset location for implementing the connecting member or a part thereof is realised as a predetermined angle between the normal of at least one plane surface and the normal of the opposite parallel surfaces projected into a plane perpendicular to the axis of the main rod. It is therefore a so-called forked connecting member, where the end of one element is inserted into the cutouts at the end of another element during connecting, and preferably further secured by pegs in the connecting openings extended through this cutout.

The method then for example further comprises a step of forming a complementary connecting member at the other end of the main rod, wherein the complementary connecting member comprises a protrusion defined by at least two parallel surfaces, wherein the protrusion is adapted to be inserted into the cutout at the first end of another element of the truss structure. This protrusion is then also a part of the connecting member formed in the preset location, therefore especially its opposite surfaces complementary to the cutout have normals in a specified orientation with respect to the normal or normals of the plane surface or surfaces. This forked link is also preferably realised by means of housings, thus the cutouts and protrusions are then formed on the housings, which are subsequently attached to the main rods.

The step of forming the connecting member may also comprise providing at least one end of the main rod with a sliding member placed inside the main rod, preferably

inside the housing on the main rod, wherein the sliding direction is parallel to the axis of the main rod. The sliding member comprises a handling protrusion passing outwardly from the main rod through the elongated opening in the wall of the main rod, wherein the elongated opening is symmetrical for a part of its length about the plane of symmetry of the elongated opening and wherein the axis of the main rod lies in the plane of symmetry of the elongated opening. Thus the elongated opening is, e.g., partly formed by a groove passing through the wall of the main rod along its axis. The preset location for the implementation of the connecting member or a part thereof is then preferably defined by presetting the angle between the plane of symmetry of the elongated opening and the normal of at least one plane surface. On the resulting element of the truss structure, the handling protrusion is then, e.g., directed to the centre of the element. Similarly to other types of connecting members, this connecting member with a sliding member and a member complementary to it with an opening for the sliding member may also preferably be formed by means of housings attached in the method of the invention to the ends of the main rods.

In other words, for elements with connecting members realised in any manner, the main rod may be formed from multiple parts, where the end part with the connecting member may be made separately from the remainder of the main rod. This remainder may have a constant cross-section along its entire length and thus be, e.g., manufactured by extrusion, wherein the end parts, i.e. e.g. the housings described above, may be welded, pressed, riveted, etc. to it. The most preferable method of attachment is welding.

Furthermore, the disadvantages of the prior art solutions are to some extent eliminated by a truss structure which comprises at least two elements of a truss structure manufactured in the method described above.

Description of Drawings

A summary of the invention is further clarified using exemplary embodiments thereof, which are described with reference to the accompanying drawings, in which:

fig. 1 shows schematically a view of a main rod for an element of a truss structure manufactured in the method of the invention, wherein the view is in the direction of the axis of the main rod and this main rod is secured in a fixing jaw along with a connecting peg,

5 fig. 2 is a perspective view of the main rod with the fixing jaw from fig. 1,

fig. 3 is a perspective view of a plane surface of the main rod of fig. 1,

10 fig. 4 is a view in A–A section of the main rod of fig. 3, wherein this section is perpendicular to the axis of the main rod, wherein it can be seen that this main rod has two plane surfaces and the angles between the normals of the main surfaces and the axis of the connecting peg and opening are indicated,

fig. 5 is a view in the axis of the main rod of the fixing jaw with the main rod fixed and with a housing fixed in a precisely given position by a peg threaded through its connecting openings, thereby making the housing ready to be welded to the main rod,

15 fig. 6 is a perspective exploded view of a truss structure of the invention, wherein connecting members of this structure comprise connecting openings, pins, and pegs,

fig. 7 is a detailed view of the connecting member of fig. 6,

20 fig. 8 is a perspective exploded view of a truss structure of the invention, wherein connecting members of this structure comprise connecting cutouts and protrusions,

fig. 9 is a detailed view of the connecting members of fig. 8,

fig. 10 is a perspective view of a bayonet connecting member and its counterpart with an opening for a sliding member,

25 fig. 11 is a perspective view of a truss structure of the invention with bayonet connecting members before the elements are connected, and

fig. 12 is a detailed view of the structure of fig. 11 in the location of the connecting members, that is, a sliding member with an extended end on one element and

a complementarily shaped opening for the sliding member on the other element.

Exemplary Embodiments of the Invention

5 The invention will be further clarified using exemplary embodiments with reference to the respective drawings.

The object of the invention is a method of manufacture of an element 1 of a truss structure. In this method, main rods 2 for the given element 1 are provided, that is at least two main rods 2. Each main rod 2 has a constant cross-section for the majority of its length, and this cross-section is curved for a part of its circumference, for example it is
10 oval or preferably circular for a part of its circumference, as shown in figs. 4 to 5. However, any other curved shape is also possible. Preferably the main rod 2 comprises two end parts and a central part, wherein the central part has said constant cross-section and the end parts, for example shorter than 10 cm, have a different cross-section, may be of a different piece of material, and are adapted for connecting the elements 1. Particularly
15 preferably, these end parts take the form of separate housings 3 which are attached to the central part of the main rod 2 in a precisely defined position during the method of the invention. Preferably, the precisely defined position is given as the rotation about the axis of the main rod and as the distance of the opposite housings 3 on the given main rod 2, thus ensuring the assemblability of the structure of the resulting elements 1. Further, each
20 main rod 2 comprises at least one plane surface 19 that passes along the axis of the main rod 2 over a majority of its length, preferably over said central part in its entirety. Further, the method of the invention comprises the following steps, wherein these steps are applied to each main rod 2:

- a step of fixing the main rod 2 in a clamping jaw 4, and
- 25 • a step of forming or attaching a connecting member for connection to another element 1.

In the step of fixing, a clamping jaw 4 adapted complementarily to the shape of the given main rod 2 is used, in particular in that it is engaged with said at least one plane

surface 19 such that rotation of the main rod 2 in the following step is prevented. The rotation of the main rod 2 about its axis with respect to the clamping jaw 4 is unambiguously determined in the step of fixing, such that the connecting member may be formed or attached in an unambiguous position in the subsequent step based on this rotation.

This rotation, as well as the position or rotation of the connecting member described below, is preferably the same for all the main rods 2 of all the elements 1 forming the resulting truss structure. Thus, the method of the invention may be not only a method of manufacture of the element 1 but also a method of manufacture of a truss structure that comprises a plurality of elements 1, wherein for each element 1 the same location for forming the connecting member or a part thereof is preset for each main rod 2. Thus, the position of the connecting members, or certain parts thereof, is identical on all the main rods 2 in the manufactured structure, in particular this position is determined relative to some plane surface 19 on each main rod 2 or more preferably to all plane surfaces 19 on each main rod 2. Such a method may be applied to the manufacture of any elements 1 with a plane surface 19 on the main rods 2, in particular, therefore, regardless of the realisation of the other features described in the specific embodiments below, e.g., the specific form of the connecting member.

Preferably, in the step of forming or attaching the connecting member, a part of the connecting member, namely the housing 3, is attached at at least one end of the main rod 2, preferably at said end part. In this step, the main rod 2 is still fixed in the clamping jaw 4 and, as indicated in figs. 1 and 2, the peg 9, which is also fixed in the connecting jaw 4, is threaded through the housing 3, and thanks to the unambiguously determined rotation of the main rod 2 and the housing 3, the rotation of the connecting member (i.e. the housing 3 and in particular its connecting opening 7) is also unambiguously determined with respect to at least one plane surface 19, i.e. the location where the connecting member is placed is preset for each connecting member. Preferably not only the rotation between the housing 3 and the main rod 2 is determined, which is therefore secured by the clamping jaw 4 before the start of e.g. welding of the housing 3 to the main rod 2 at a location 20 of attachment of the housing to the main rod but also the position of the housing 3, or both housings 3 on the main rod 2 in the direction of the axis of the main rod 2 is determined. As a result, the distance of the housings 3 and thus also their connecting openings 7 is substantially the same on all the main rods 2 such that

complications due to manufacturing inaccuracies and different lengths of the main rods 2 with the housings 3 do not arise when assembling the truss structure.

The welding of the housing 3 to the main rod 2 does not have to take place when it is fixed in the clamping jaw 4. Preferably, after placing the housing 3 or both housings 3 on the given main rod 2, this main rod 2 and the housings 3 are clamped in the axial direction and offset from the clamping jaw 4, or the clamping jaw 4 is offset from the main rod 2. Subsequently, the welding tool may weld the housings 3 at the location 20 of attachment of the housing to the main rod. The welding tool may be, for example, a welding robot movable in multiple axes, but it may also be located in a single location and the welding around the entire circumference is ensured by rotating the main rod 2 about an axis, e.g. by means of the same, preferably pneumatic, device which clamps the main rod 2 in the direction of the axis and thus holds the housings 3 in the correct position determined by the clamping jaw 4.

Alternatively, it is also possible to form the connecting member directly on the main rod 2, i.e., for example, after fixing it in the clamping jaw 4, to drill connecting openings 7 at its end parts. Thus, forming or attaching the connecting member may, in any embodiment, include forming (drilling, milling, etc.) an opening or cutout or protrusion, welding the housing 3, pressing the housing 3, riveting the housing 3, etc. In any embodiment, the connecting member may be referred to as part of the connecting mechanism, i.e. only e.g. one member of the plurality of members necessary for connecting the elements 1 is attached or formed, for example, it may particularly preferably be a connecting opening 7 (in the housing 3 or the main rod 2) which is part of the connecting mechanism further comprising a peg 9, a pin 13, and a cotter pin, a forked shape of the end of the main rod 2, or a sliding member 14. The opposite end of the main rod 2 from that on which said connecting member or mechanism is provided preferably comprises a complementary connecting member to allow the connection of the resulting elements 1. Thus it e.g. comprises a protrusion 11 for fixing in a fork-shaped cutout 10 or an opening 16 for the sliding member.

Furthermore, the method comprises a step of firmly connecting the main rods 2 by means of cross rods 5, each of which is welded with one end thereof to some plane surface 19 of the main rod 2 and with the other end thereof to the plane surface 19 of another main rod 2. Preferably, the plane surfaces 19 are provided with grooves 6, preferably passing in the middle of the given plane surface 19 parallel to the axis of the

main rod 2, for the escape of expanding air during welding. It is also possible to provide the grooves 6, for example, perpendicular to the axis of the main rod 2, or at any other angle to the axis. However, the grooves 6 running parallel to the axis are the most preferable from the point of view of the method of manufacture, because the plane surfaces 19 along with the grooves 6 may then be on the main rod 2 already since manufacture, for example the main rods 2 are extruded already with the plane surfaces 19 and preferably also with the grooves 6. The cross rods 5 may have, for example, a circular or oval cross-section, but an angular, e.g., square or hexagonal, cross-section is also possible. At the ends, the cross rods 5 may be obliquely cut off, especially if they are to pass obliquely (i.e., not perpendicularly) to the main rods 2 after welding. However, the elements 1 may also comprise perpendicularly extending cross rods 5 or a combination of perpendicular and oblique, e.g., inclined 40–50° to the axes of the main rods 2 being connected.

In some embodiments, the method of the invention may further preferably comprise a step of forming vent openings extended through the wall of the main rod 2, for improved escaping of air during welding. Preferably, the openings are formed in the grooves 6 to facilitate guiding the drill to the correct location.

In the embodiment shown in figs. 1–7, the connecting member comprises connecting openings 7 formed in the housings 3 attached to the ends of the main rods 2 and comprises pegs 9 for passing through these openings. In some embodiments without the use of the housings 3, the ends of the main rods 2 of one element 1 may be tapered and/or the ends of the main rods 2 of the other element 1 may be widened such that the ends may be inserted when the elements 1 are being connected together and, after alignment of the connecting openings 7, the connection of the elements 1 may be secured by inserting the peg 9. In preferred embodiments, the connecting member further comprises a cylindrical pin 13 that also comprises connecting openings 7 at both ends and is adapted to be inserted into the main rods 2, i.e., preferably into the housings 3 which are part of the main rods 2. For the connection, the pins 13 are then partially inserted into the main rods 2 of one element 1 and the main rods 2 of the other element 1 are mounted thereon. The connecting openings 7 on the pins 13 are aligned with the connecting openings 7 on the main rods 2 of the two elements 1 and the pegs 9 may be inserted therein. Preferably, the pegs 9 are secured against spontaneous falling out after

the connection of the elements 1, e.g., by cotter pins 12. This connection is shown in detail in fig. 7.

Said unambiguous rotation between the connecting member and the at least one plane surface 19, which determines the location of the formation or attachment of the connecting member, is preferably determined as the angle α between the projection of the normal 8 of the given plane surface 19 in a plane perpendicular to the axis of the main rod 2 and the projection of the axis of the connecting opening 7 formed at the end of the given main rod 2 or in the housing 3 in the same plane. For example, as indicated in fig. 4, the main rod 2 comprises two plane surfaces 19, wherein the axis of the connecting opening 7 passes symmetrically between them when viewed in the axis of the main rod 2. The plane surfaces 19 shown are perpendicular to each other such that the connecting opening 7 is rotated relative thereto by $\alpha = 45^\circ \pm 1^\circ$, preferably $45^\circ \pm 0.5^\circ$, more preferably $45^\circ \pm 0.25^\circ$. In an embodiment with a different size of angle β between the pair of plane surfaces 19, the angle α between the axis of the connecting member and the normal 8 of the plane surface may be equal to $\beta/2 \pm 1^\circ$, preferably $\pm 0.5^\circ$, more preferably $\pm 0.25^\circ$. In a further embodiment with at least three plane surfaces 19, if they are arranged in such a way that there is a plane passing through the axis of the main rod 2, around which the cross-section of the main rod extending perpendicular to the axis through all three plane surfaces 19 is symmetrical, preferably also the connecting opening 7 is symmetrical around this plane such that its axis lies therein.

In a further embodiment where the three plane surfaces 19 do not have a plane of symmetry, the axis of the connecting opening 7 may, for example, lie in the plane of symmetry for two of the three plane surfaces 19 and/or may be parallel to the normal of one of the three plane surfaces 19. In embodiments with a single plane surface 19, the axis of the connecting opening 7 may preferably be parallel to the normal 8 of the plane surface. The rotation of the connecting opening 7 may then, in any embodiment, also determine the rotation of the pin 13 relative to the plane surface 19 or the multiple plane surfaces 19.

The connecting opening(s) 7 may pass across the entire width of the main rod 2. Typically, the main rod 2 is hollow and the connecting opening then passes through its wall (e.g., the wall of the housing 3) in two locations opposite each other. However, an embodiment is also possible where the connecting opening 7 passes through the wall of

the main rod 2 only once. One end of the peg 9 may then be placed inside either or both of the elements 1 and the pin 13 after the elements 1 have been dismounted.

Fig. 5 shows the fixation of the main rod 2 with two plane faces 19 in the clamping jaw 4, for example for realising the step of firmly connecting, preferably welding, the cross rods 5 to the given main rod 2. In the embodiment of fig. 5, only one plane surface 19 is in contact with the bottom frame, wherein the top clamping part is engaged with the other one. In the embodiment of fig. 6, each element 1 of the truss structure comprises four main rods 2 and a series of cross rods 5, wherein at the ends of the main rods 2 the cross rods 5 are perpendicular thereto and for the remainder of the length they are oblique, e.g., at an angle of 45°. In this embodiment, each main rod 2 has two plane surfaces 19 on which the cross rods 5 are welded, wherein each plane surface 19 comprises a groove 6 along its entire length. In some embodiments, three plane surfaces 19 for each main rod 2 may be used for four-rod elements 1. In some embodiments, a part of the cross rods 5 may also be welded to a curved part of the main rods 2.

In the embodiment of figs. 8, 9, instead of connecting by means of pins 13 secured by pegs 9, an alternative connection by means of so-called forks is used. In this embodiment, the connecting members at one end of the element 1 are different from those at the other end, complementary to them. The main rods 2 forming such an element 1 all have a cutout 10 formed at their first end, and have a protrusion 11 at their other end adapted to be inserted into the cutout 10 on the other element 1. Preferably, these cutouts 10 and protrusions 11 are part of the housings 3, which are attached to the main rod 2. Some elements 1 in the structure may then be provided with a connecting member at one end only, e.g., elements 1 intended to be anchored to the ground at one end. Furthermore, the connecting openings 7 pass through the protrusions 11 and the recesses 10 for securing them with the peg 9. The recesses 10 in the embodiment shown have the form of a cuboidal cutout formed from the given end of the main rod 2 parallel to the axis. The recess 10 is thus defined by a pair of opposite parallel surfaces and a bottom, wherein the connecting opening 7 passes between these parallel surfaces. Said unambiguous rotation of the connecting member defining the location of its formation is then given as the angle between said opposite parallel surfaces and the normal 8 of the plane surface, or the normals of all plane surfaces 19. At the same time, the angle between the connecting opening 7 and the normal 8 of the plane surface is thus also unambiguously determined. Preferably, this placement of the connecting members is

secured analogously to the embodiment of figs. 1 and 2, i.e. the recesses 10 and protrusions 11 are formed on the housings 3 together with the connecting openings 7, and the position of the housing 3 relative to the main rod 2 is secured by fixing the main rod 2 and the peg 9 passing through the connecting opening 7 in the housing 3 to the clamping jaw 4. Subsequently, the entire main rod 2, i.e., including the housings 3 at one or both ends, may again be axially compressed, the clamping jaw 4 may be removed and the entire circumference at the location 20 of attachment of the housing to the main rod may be welded. In the embodiment shown, with a pair of mutually perpendicular plane surfaces 19, the normal of one of the plane surfaces is perpendicular to the parallel surfaces and the normal of the other is parallel to them. However, an embodiment is also possible where, for example, the angle of the two normals to the parallel surfaces is 45°.

The protrusions 11 are realised in a complementary manner, so that they also have a cuboidal shape and in particular a pair of opposite parallel surfaces, through which the connecting opening 7 passes. The protrusions 11 on all the main rods 2 of the given element 1 may thus be inserted into the cutouts 10 of the other element 1 being connected, wherein after insertion the connecting openings 7 are aligned and the pegs 9 may be threaded through them. The angle between the parallel surfaces and the normals 8 of the plane surfaces is also determined complementarily to the cutouts 10. In alternative embodiments, the value of the angles between the parallel surfaces and the normals may be different. In some embodiments, these surfaces defining the cutouts 10 and the protrusions 11 need not be parallel to each other, but in some direction may be convergent or curved. The rotation of the connecting member may then be determined, e.g., relative to the connecting opening 7, which may further be, for example, extended perpendicular to one plane surface 19 and parallel to the other, or relative to a plane of mirror symmetry for such converging opposite surfaces of the protrusions 11 and the recesses 10.

Alternatively or additionally, the unambiguous rotation may be determined as the angle between the plane of symmetry of the given end of the main rod 2 with the cutout 10 or protrusion 11 and the normal of the plane surface 19 or surfaces. For example, in an embodiment with a single plane surface 19, this axis of symmetry may be perpendicular or parallel to this plane surface 19. In the case of multiple plane surfaces 19, the axis of symmetry of the protrusion 11 / cutout 10 may be perpendicular, parallel, or otherwise unambiguously rotated with respect to the axis of symmetry of the plane

surfaces 19 or some of them, or to the normal of the selected plane surface 19. In some embodiments, two types of elements 1 for constructing a truss structure may be formed, ones with cutouts 10 at each end and the others with protrusions 11 at both ends. The rotation of the connecting members is analogous to the embodiments described above.

5 In another exemplary embodiment, the connecting member may be realised as a so-called bayonet connecting member. This connecting member is usually also formed only at one end of the elements 1, wherein the other end of the elements 1 is provided with a complementary member, wherein preferably both have the form of a housing 3, i.e. are formed separately and subsequently attached to the main rod 2, but it is also possible
10 to form them directly at the ends of the main rod 2 formed from one piece. The bayonet connecting member comprises a sliding member 14 fixed inside the main rod 2, at the end thereof. In the embodiment shown, this end is a separate part of the main rod 2 – the housing 3, but it is also possible to form the elongated opening 18 shown directly into the extruded wall of the main rod 2. Similarly, the entire counter piece with the opening 16 for
15 the sliding member may be incorporated inside the main rod 2 (at the opposite end) or it may be formed such that it also forms part of the wall of the main rod 2 at its end, i.e., it will be realised as a housing 3.

Thus, the sliding member 14 may be moved in a closed interval, parallel to the axis of the main rod 2, and at the same time it may be rotated, preferably also in a closed
20 interval, e.g. less than 90°, in the embodiment shown less than 30°, about this axis. The range of rotation is defined by the asymmetrical ends of the elongated opening 18, as can be seen in fig. 10. This sliding member 14 is formed at least at its one end 15 asymmetrically about the axis of the main rod 2, this end 15 is thus not circular in shape. For example, it may have the shape of a rectangle, or it may include a series of
25 protrusions arranged uniformly around its circumference, as in fig. 10. The sliding member 14 may be partially slid out of the main rod 2 by sliding. The sliding member 14 is adjustable to at least three positions, in the first of which it is slid out of the main rod 2, in the second of which it is also slid out of the main rod 2 and is rotated with respect to the first position, and in the third position it is slid out of the main rod less than in the first two
30 positions, that is, it is moved towards the opposite end of the given main rod 2, wherein it may or may not continue to protrude from the main rod 2. A truss structure with these bayonet connecting members is shown in fig. 11 and in detail in fig. 12. In this detail, it can be seen how the connecting members, i.e., the housings 3 of fig. 10 are connected

to the main rods 2. As can be seen in this figure, the axis of the elongated opening 18 lies in the plane of symmetry of the pair of plane surfaces 19 shown such that the handling protrusion 17, when moved through the symmetrical central part of the elongated opening 18, faces the centre of the element 1, symmetrically between the plane surfaces 19 and the cross rods 5 protruding therefrom.

The complementary connecting member on the another element 1, or on the opposite end of the same element 1, comprises an opening 16 for the sliding member with an axis parallel to the axis of the main rod 2. This opening 16 for the sliding member is asymmetrical about this axis, complementarily to the shape of the end 15 of the sliding member 14 described above. When viewed in the axis of the main rod 2, in one of the first and second positions of the sliding member 14, the projection of said asymmetrical end 15 of the sliding member 14 is entirely overlapped by the projection of the opening 16 for the sliding member and in the second of these positions it exceeds it, wherein in both of these positions the sliding member 14 passes through the opening 16 for the sliding member, and in the third position it does not pass through it. Thus, by rotating between the first and second positions or vice versa, the sliding member 14 in the opening 16 for the sliding member prevents subsequent distancing of the elements 1 being connected. The bayonet connecting member may further comprise a securing member to prevent the sliding member from rotating spontaneously, for example, this may be a securing nut or a spring increasing by its force action the friction between the sliding member 14 and another component, such that this friction needs to be overcome to rotate the sliding member 14 between its positions.

To allow the sliding member 14 to be slid by the user, the sliding member is provided with a handling protrusion 17 that protrudes outwardly from the main rod 2 through the elongated opening 18 provided in the wall of the main rod 2. The elongated opening 18 may thus limit the movement and rotation of the sliding member 14, and thanks to the handling protrusion 17, the sliding member 14 may be fixed and handled, i.e., slid and rotated. The unambiguous rotation between at least one of the plane surfaces 19 and the connecting member, or the location of formation of the connecting member, may then be defined as the unambiguous rotation between the elongated opening 18 and the normal 8 of the plane surface. Preferably, the elongated opening 18 is formed, for example, by a groove passing through the wall of the main rod 2 parallel to its axis, wherein at one or both ends such groove is widened to allow rotation of the sliding

member 14 in addition to its sliding. The central part of the groove, that is the part without extension allowing only sliding movement, then has its plane of symmetry, in which the axis of the main rod 2 also lies, and the rotation of this plane of symmetry with respect to the normal 8 of the plane surface may then unambiguously determine the desired rotation or placement of the connecting member.

Alternatively or additionally, this unambiguous rotation may be determined, for example, as an axis between the handling protrusion 17, e.g. one of its walls, its axis if cylindrical, etc., and the normal 8 of the plane surface in some position of the sliding member 14, preferably in a position where the projection of the asymmetrical end 15 of the sliding member 14 is entirely within the projection of the opening 16 for the sliding member. In particular, the chosen rotation of the elongated opening 18 or the handling protrusion 17 is particularly such that, after welding the element 1, the cross rods 5 and the other main rods 2 do not prevent the handling of the sliding member 14. For example, said plane of symmetry of a part of the elongated opening 18 may also be the plane of symmetry of the plane surfaces 19 of the given main rod 2, regardless of the number of plane surfaces 19 on the given main rod 2. Preferably, for example, the handling protrusions 17 in the above described position of the sliding member 14, which defines the rotation of the connecting member 14, are all directed towards the centre of the element 1 or, on the contrary, are directed in the opposite direction, away from the centre of the element 1. The direction towards the centre is more preferable as the risk of the protruding part of the handling protrusions 17 interfering or being inadvertently damaged or slid or rotated is reduced.

Analogously to the embodiments described above, the elongated opening 18 for the bayonet connecting member may be considered a special case of the connecting opening 7. The required rotation of the connecting member with respect to at least one of the plane surfaces 19, defining the location of implementation of the connecting member, may then be determined as the rotation of the connecting opening 7 with respect to the plane surface 19 or multiple plane surfaces 19, in particular their normals, for all three main types of connecting members mentioned, that is for peg connecting members, with or without pin 13, fork connecting members, and bayonet connecting members. Thus, in any embodiment, the rotation of the connecting member may be defined as the rotation of the connecting opening 7 relative to the normal of at least one plane surface 19. Preferably, the connecting opening 7, or a certain part thereof (in particular the

symmetrical part of the groove in the case of a bayonet connection), is symmetrical about the same plane containing the axis of the main rod 2 about which the plane surfaces 19 of the given main rod 2 are symmetrical, if these plane surfaces 19 are arranged symmetrically about some such plane. If the plane surfaces 19 are not arranged
5 symmetrically about any plane in which the longitudinal axis of the main rod 2 lies, the plane of symmetry (part) of the connecting opening 7 may be the plane of symmetry of the selected plane surfaces 19 or one of them.

The object of the invention is further any truss structure which comprises elements 1 made by the method of the invention. Thus, for example, a truss structure comprising
10 at least two elements 1, comprising at least two main rods 2 with at least one plane surface 19, wherein each main rod 2 comprises a connecting member, in which the placement or rotation of the connecting member or a part thereof is unambiguously determined relative to at least one plane surface 19 during manufacture. In particular, as
15 described in the preceding paragraph, the given part of the connecting member for which the rotation is unambiguously defined may be the connecting opening 7, for any type of connecting members. Preferably, its rotation is determined by the rotation of its plane of symmetry or the plane of symmetry of its part with respect to the normal of some plane surface 19. Preferably, this plane of symmetry is also a plane of symmetry of the plane surfaces 19, of some of the plane surfaces 19, or of one plane surface 19, particularly
20 preferably of all of the plane surfaces 19. This plane of symmetry is preferably the plane in which the axis of the considered main rod 2 lies.

List of Reference Numerals

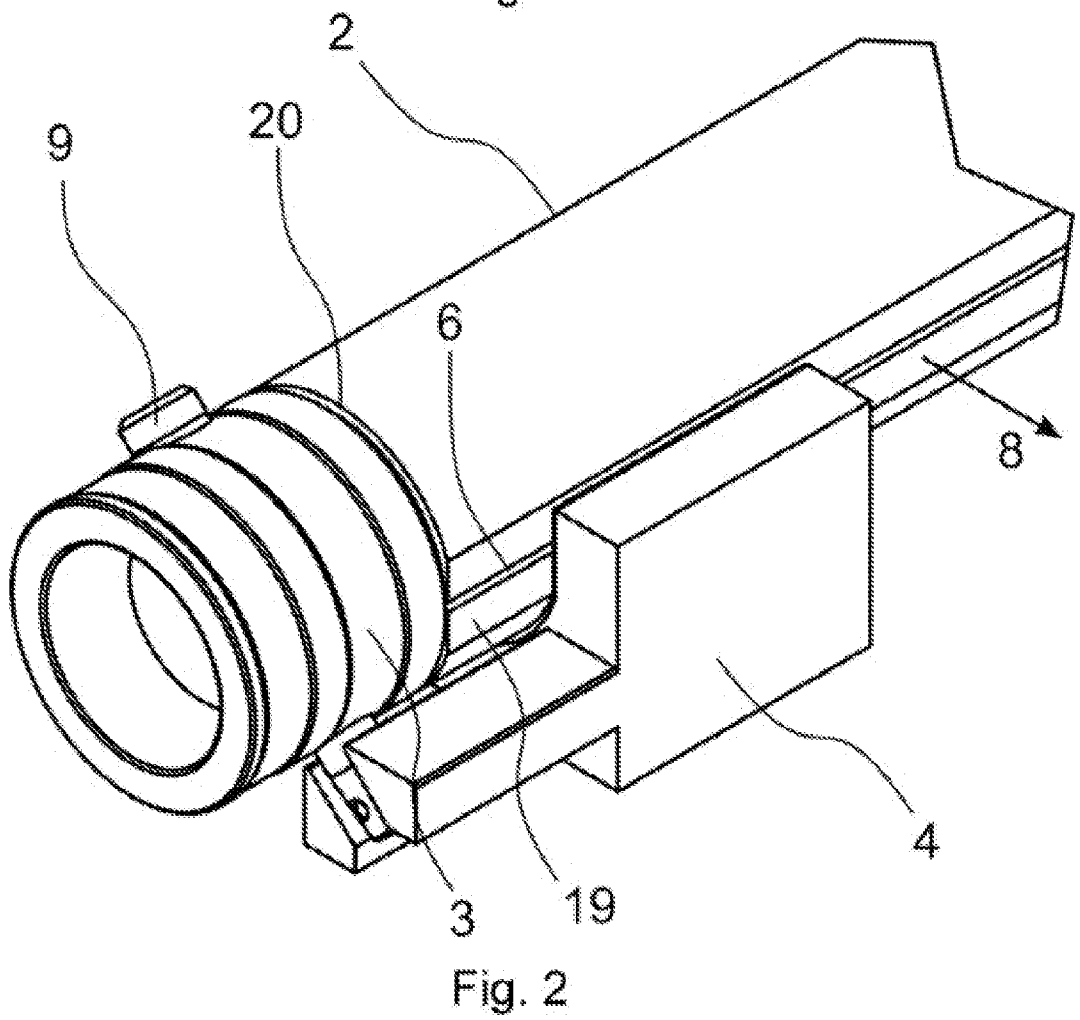
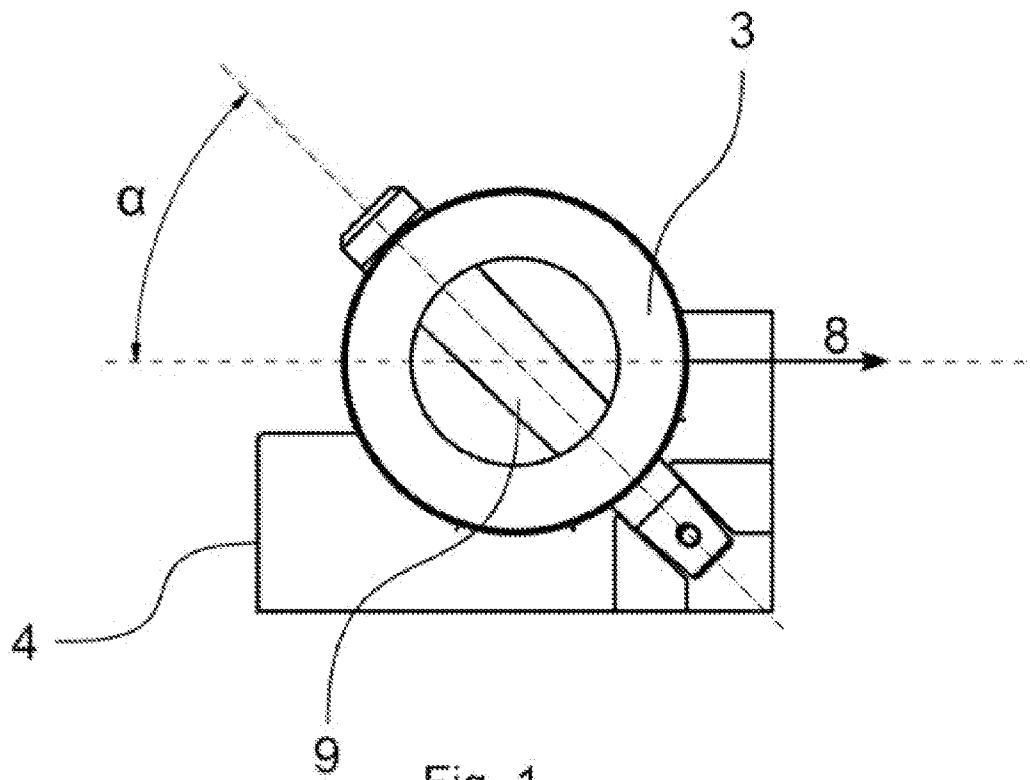
- 1 - Element
- 2 - Main rod
- 3 - Housing
- 4 - Clamping jaw
- 5 - Cross rod
- 6 - Groove
- 7 - Connecting opening
- 8 - Normal of the plane surface
- 9 - Peg
- 10 - Cutout
- 11 - Protrusion
- 12 - Cotter pin
- 13 - Pin
- 14 - Sliding member
- 15 - End
- 16 - Opening for the sliding member
- 17 - Handling protrusion
- 18 - Elongated opening
- 19 - Plane surface
- 20 - Location of attachment of the housing to the main rod

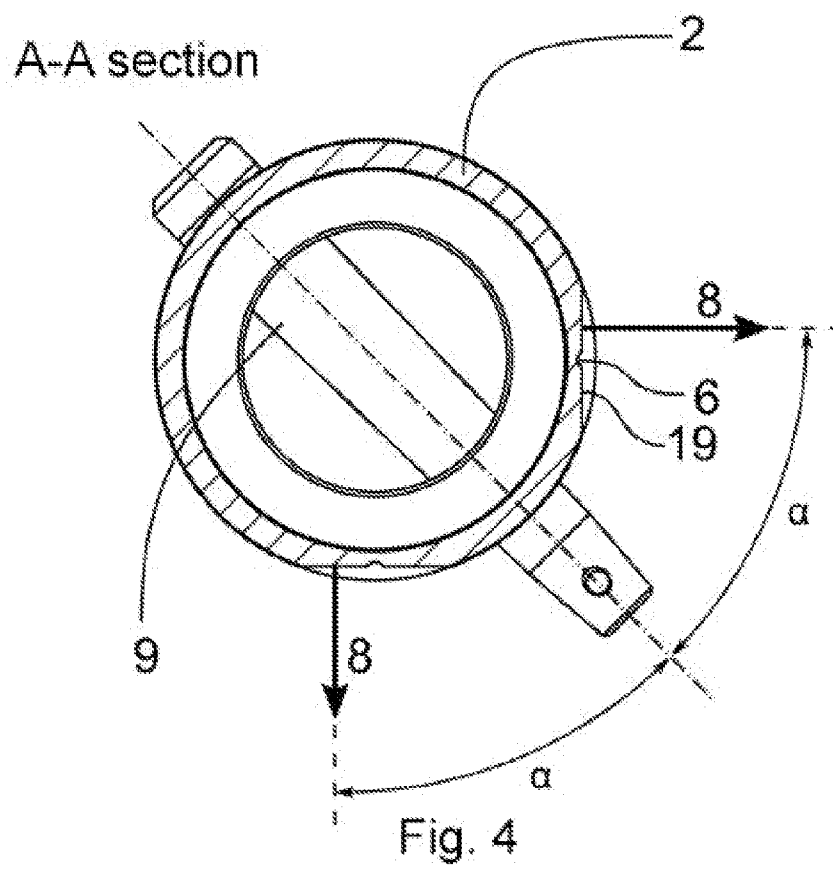
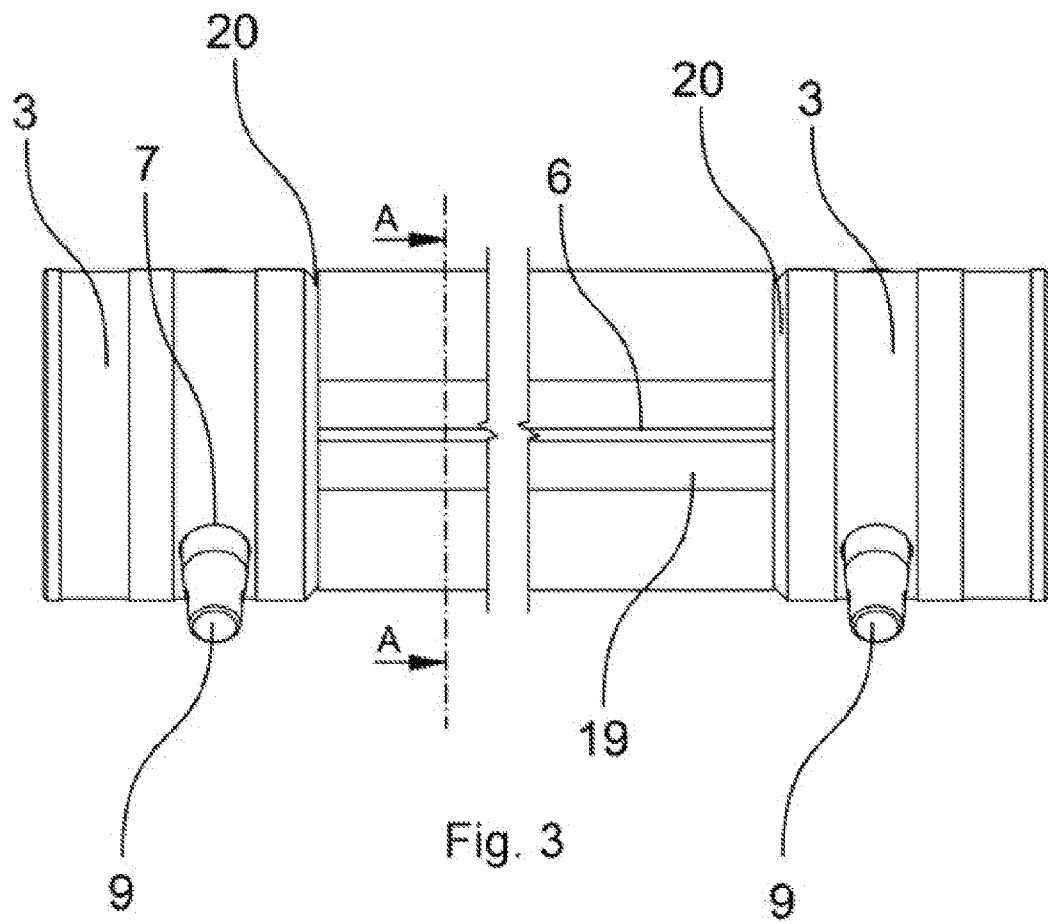
CLAIMS

1. A method of manufacture of an element (1) of a truss structure, this method comprising providing at least two main rods (2), wherein each main rod (2) has a constant cross-section with a partially curved circumference over the majority of its length and comprises at least one plane surface (19) passing along the axis of the main rod (2) over the majority of the length of the given main rod (2), **characterised in that** the method further comprises, for each main rod (2), the steps of:
- fixing the main rod (2) in a clamping jaw (4), wherein the clamping jaw (4) is engaged with at least one plane surface (19) of the main rod (2); and
 - forming or attaching a connecting member for connection to another element (1) of the truss structure at at least one end of the main rod (2) while the main rod (2) is fixed in the clamping jaw (4), wherein the connecting member or a part thereof is implemented in a preset location;
- and wherein the method further comprises a firm connection of the main rods (2) by cross rods (5) welded to the main rods (2) on the plane surfaces (19) of the main rods (2) being connected.
2. The method of manufacture of an element (1) of a truss structure of claim 1, **characterised in that** forming or attaching the connecting member comprises providing a housing (3) with a connecting opening (7), fixing the housing (3) in the clamping jaw, and attaching the housing (3) to the main rod (2), wherein the preset location for implementing the connecting member or a part thereof is realised as a preset angle between axis of the connecting opening (7) and a normal (8) of at least one plane surface (19) in projection into a plane perpendicular to the axis of the main rod (2).
3. The method of manufacture of an element (1) of a truss structure of any one of claims 1 to 2, **characterised in that** the partially curved circumference of the cross-section of the main rod (2) has the shape of a part of circle or ellipse.

4. The method of manufacture of an element (1) of a truss structure of any one of claims 1 to 3, **characterised in that** at least one plane surface (19) is provided with a groove (6) passing along the axis of the main rod (2).
5. The method of manufacture of an element (1) of a truss structure of claim 4,
5 **characterised in that** it further comprises a step of forming at least one vent opening, wherein the at least one vent opening is formed in the groove (6).
6. The method of manufacture of an element (1) of a truss structure of any one of claims 1 to 5, **characterised in that** the step of forming the connecting member comprises forming a connecting opening (7) in the main rod (2), wherein the axis
10 of the connecting opening (7) is perpendicular to the axis of the main rod (2), and wherein the preset location for implementing the connecting member or a part thereof is realised as a preset angle between the axis of the connecting opening (7) and a normal (8) of at least one plane surface (19) in projection into a plane perpendicular to the axis of the main rod (2).
- 15 7. The method of manufacture of an element (1) of a truss structure of claim 6, **characterised in that** the at least one connecting opening (7) is an opening for the passage of a peg (9) passing through the entire width of the main rod (2).
8. The method of manufacture of an element (1) of a truss structure of any one of claims 1 to 7, **characterised in that** the step of forming the connecting member
20 comprises forming a cutout (10) at the first end of the main rod (2), wherein the cutout (10) is defined by at least two opposite parallel surfaces, and wherein the preset location for implementing the connecting member or a part thereof is realised as a predetermined angle between a normal (8) of at least one plane surface (19) and a normal of the opposite parallel surfaces in projection into a
25 plane perpendicular to the axis of the main rod (2).
9. The method of manufacture of an element (1) of a truss structure of claim 8, **characterised in that** the method further comprises a step of forming a complementary connecting member at the other end of the main rod (2), wherein the complementary connecting member comprises a protrusion (11) defined by at
30 least two parallel surfaces, wherein the protrusion is adapted to be inserted into the cutout (10) at the first end of another element (1) of the truss structure.

10. The method of manufacture of an element (1) of a truss structure of any one of claims 1 to 5, **characterised in that** the step of forming the connecting member comprises providing at least one end of the main rod (2) with a sliding member placed inside the main rod (2), wherein the direction of the sliding is parallel to the axis of the main rod (2), wherein the sliding member comprises a handling protrusion passing outwardly from the main rod (2) through an elongated opening in the wall of the main rod (2), wherein the elongated opening is symmetrical for a part of its length about a plane of symmetry of the elongated opening and wherein the axis of the main rod (2) lies in the plane of symmetry of the elongated opening, wherein the preset location for the implementation of the connecting member or a part thereof is realised as a predetermined angle between the plane of symmetry of the elongated opening and a normal (8) of at least one plane surface (19).
11. A truss structure **characterised in that** it comprises at least two elements (1) of a truss structure manufactured by the method of any one of claims 1 to 10.





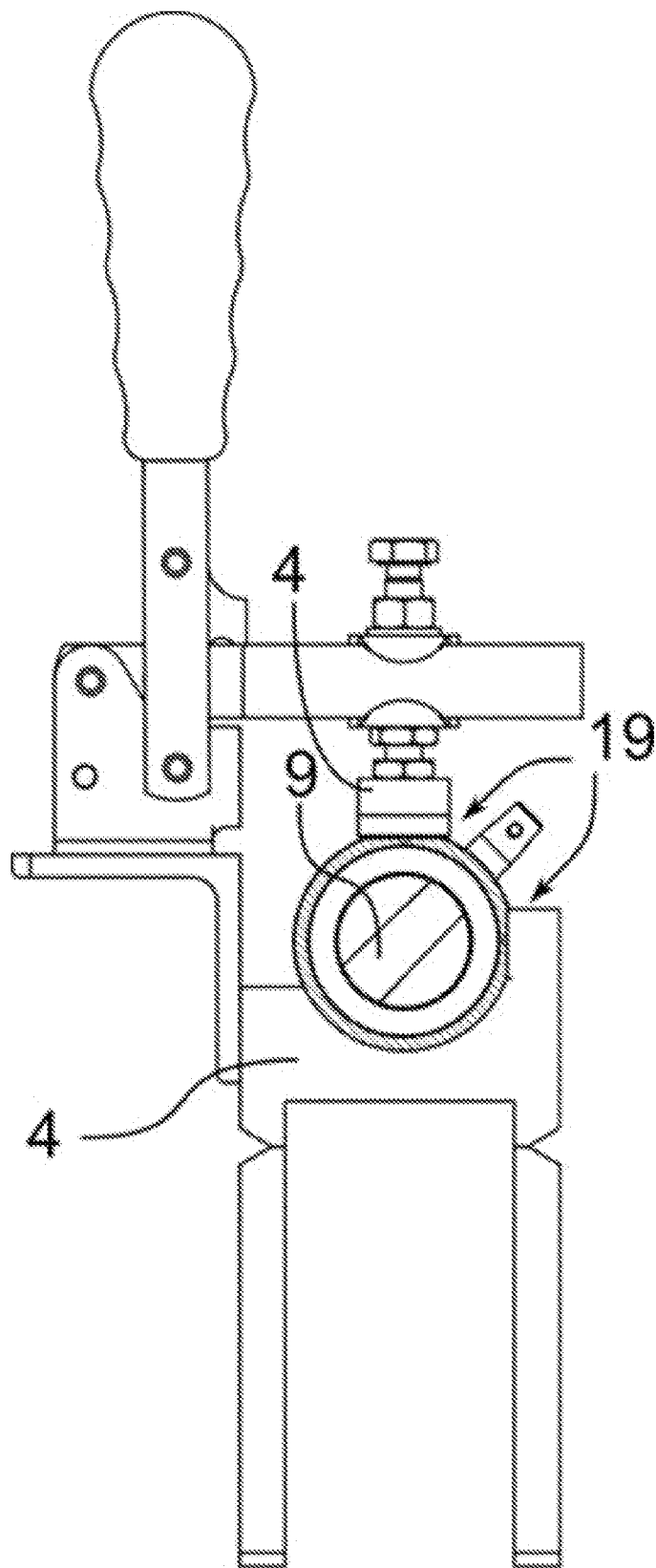
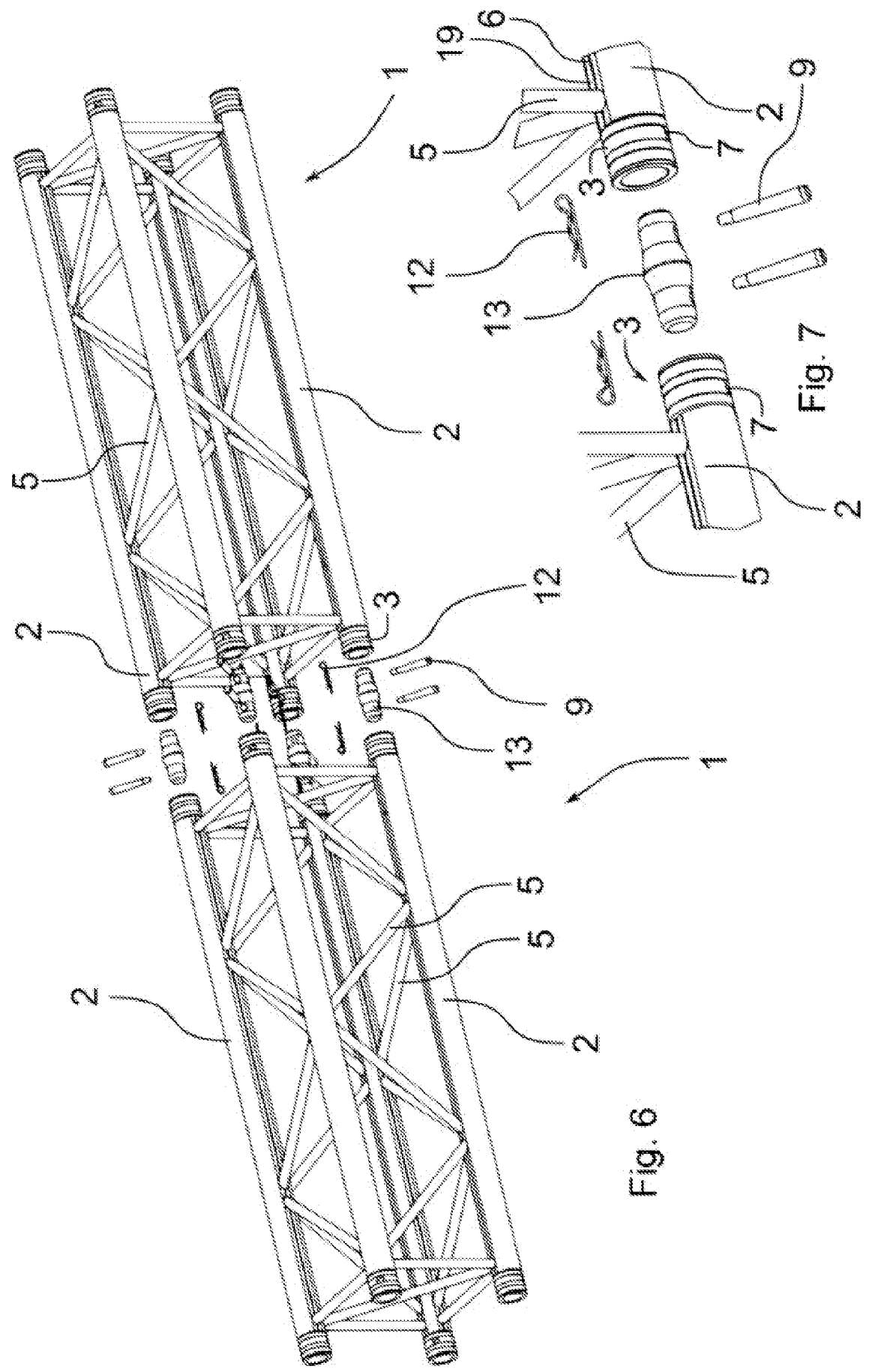


Fig. 5



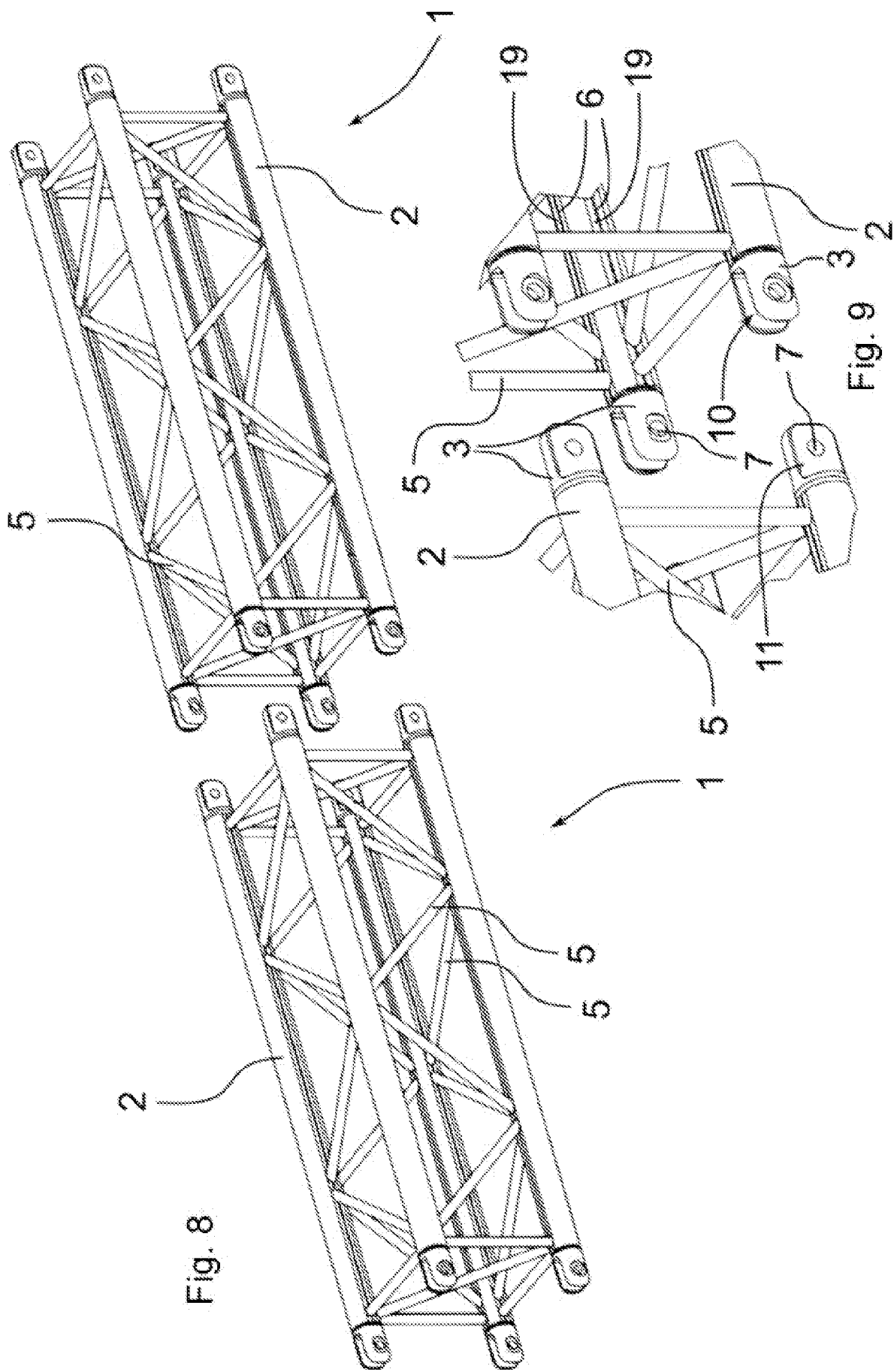


Fig. 8

Fig. 9

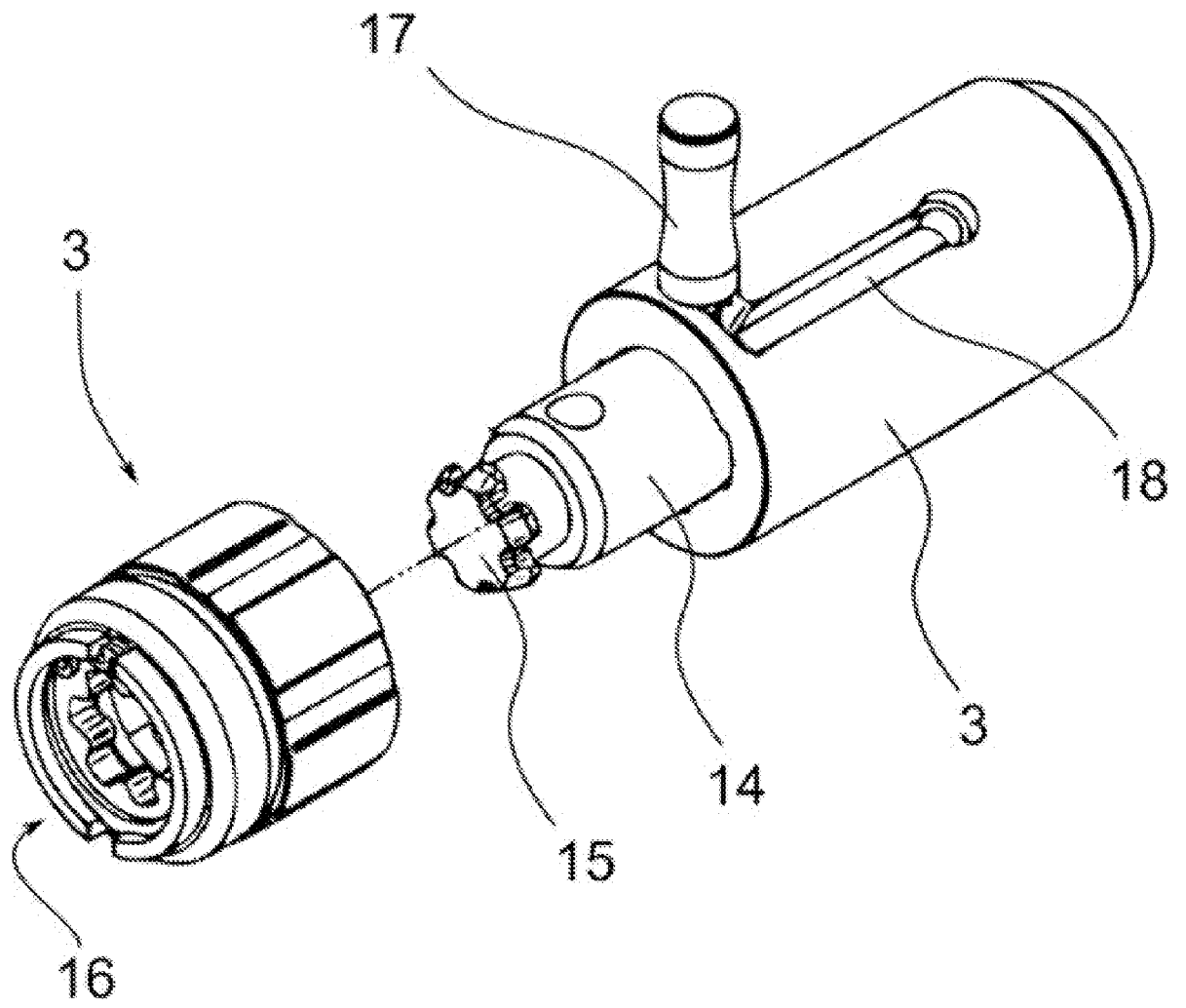


Fig. 10

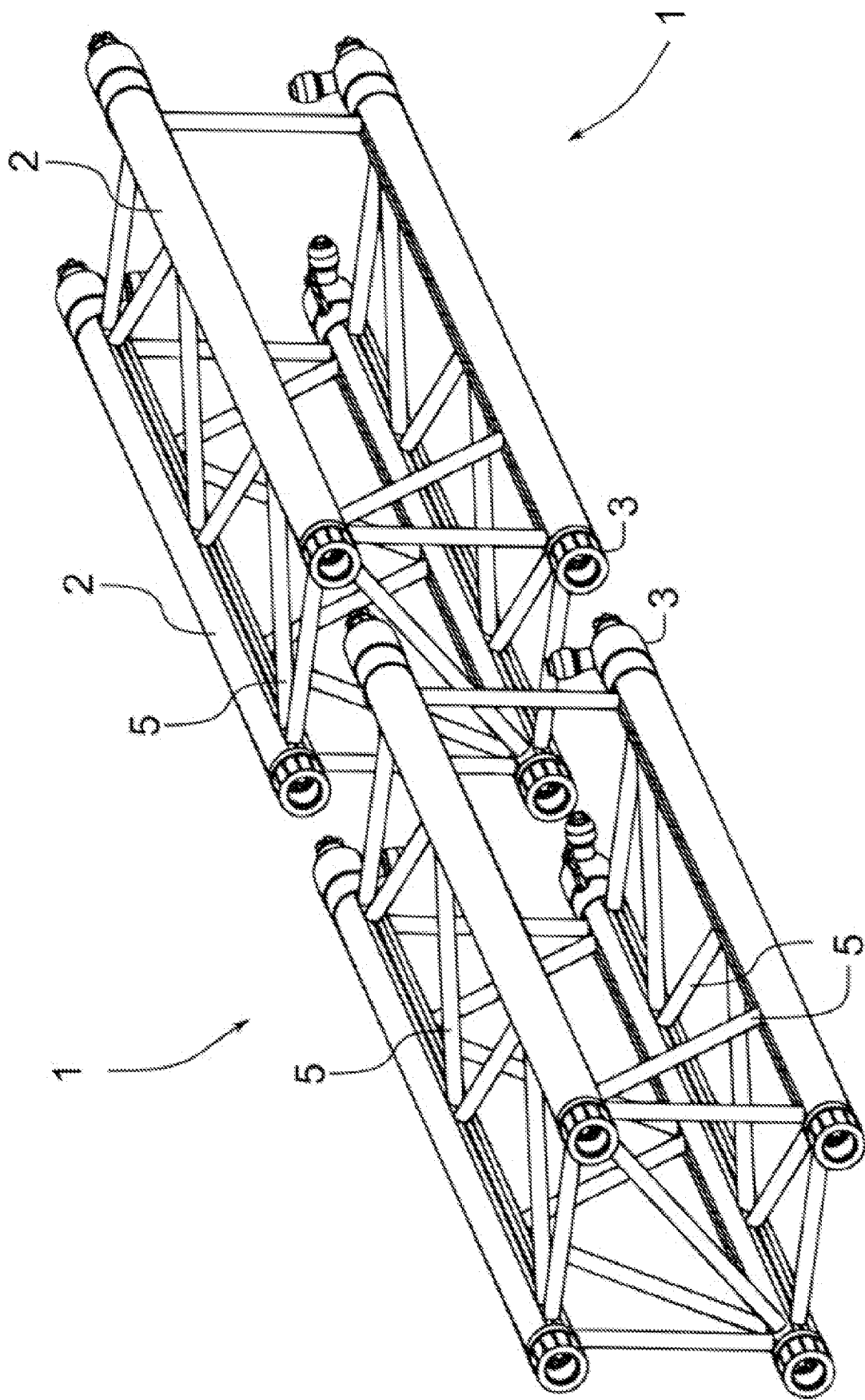


Fig. 11

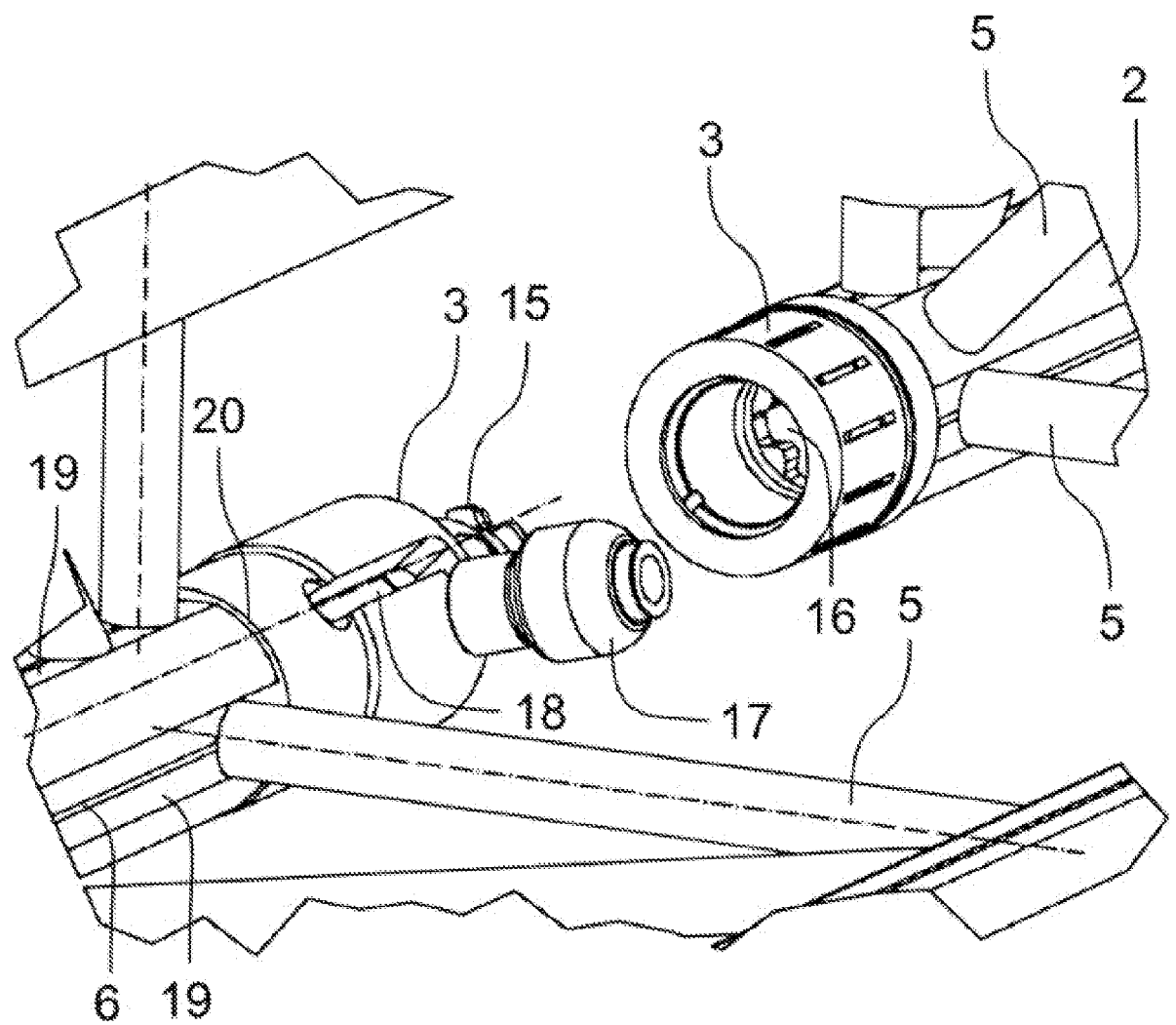


Fig. 12

INTERNATIONAL SEARCH REPORT

International application No

PCT/CZ2022/050118

A. CLASSIFICATION OF SUBJECT MATTER

INV. E04C3/08 E04B1/58 B23K33/00
 ADD. E04C3/04

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)

E04C E04B B23K

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 102 168 857 B1 (BANG YUN SEONG [KR]) 22 October 2020 (2020-10-22) figures 1-16 paragraph [0033] -----	1-9, 11
X	EP 1 884 605 A1 (PROLYTE BEHEER B V [NL]) 6 February 2008 (2008-02-06) figures 1-2 -----	1-9, 11
Y		10
Y	US 2 863 533 A (CLEVETT JR MERTON L) 9 December 1958 (1958-12-09) figures 1-8 -----	10



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search

2 February 2023

Date of mailing of the international search report

10/02/2023

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040,
 Fax: (+31-70) 340-3016

Authorized officer

Petrinja, Etjel

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/CZ2022/050118

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 102168857	B1	22-10-2020	NONE
EP 1884605	A1	06-02-2008	AT 426071 T 15-04-2009
		EP 1884605 A1	06-02-2008
		ES 2324559 T3	10-08-2009
		NL 1032270 C2	05-02-2008
US 2863533	A	09-12-1958	NONE