(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 January 2010 (14.01.2010)

PCT

(10) International Publication Number
WO 2010/004085 A1

(51) International Patent Classification:
*E04H 12/18* (2006.01) *E04H 12/34* (2006.01)

(21) International Application Number:
PCT/FI2009/050576

(22) International Filing Date:
26 June 2009 (26.06.2009)

(25) Filing Language: Finnish

(26) Publication Language: English

(30) Priority Data:
20080435 10 July 2008 (10.07.2008) FI

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(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, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR),

*[Continued on next page]*

(54) Title: COLUMN STRUCTURE

(57) Abstract: Column structure, which is formed from a column (1, 2) that is of regular polygonal cross-sectional shape and from a pedestal that is fixed to a base (25), into which the column can be fitted, which pedestal comprises two vertical metal profile parts (6) at distance of the outer diameter of the column from each other as well as two horizontal pin parts (7, 8) fitted into the metal profile parts at a different height such that the column can be fitted between the metal profile parts and can be fixed with the pin parts (7, 8) fitted into the holes in them such that the straight outer surfaces (17) of the cross-section of the column are supported on the inner surfaces (18) of the vertical profiles (6).

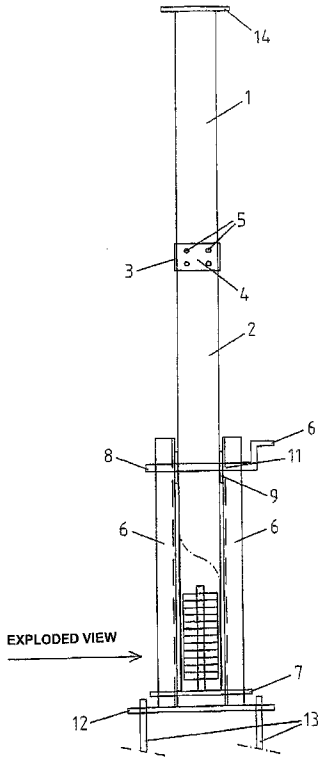


Fig. 1

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OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Declarations under Rule 4.17**:

— *of inventorship (Rule 4.17(iv))*

**Published**:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

# COLUMN STRUCTURE

The object of the invention is a column structure as defined in the preamble of claim 1.

Columns and masts have in recent years been developed mainly for the needs of road traffic and telecommunications, e.g. utility models FI 3075 (U970231, Passively safe, box-structured, lighting column), and FI 3698 (U990078, Telecommunications mast for mobile communications network). Manufacturability, transportability, ease of installation and safety are aspects that have been developed. A common factor to all solutions has been the professional use of a column or mast.

The widening use of new energy sources now places column structures and mast structures in everyman's use, whereas earlier the only familiar mast structure was a flagpole, if even that. In leisure-time residences people want to live just as comfortably as at home, with all their electrical appliances, and then the energy source in the backwoods can be either a small windmill arranged on a column or a movable solar panel. The invariably rising price of energy also entices farms as well as residents in one-family houses and terraced houses to partially produce their own energy, or even to supply energy to the national grid. The energy source must in this case be easy to transport and simple to install. On the other hand, it must be possible to service the apparatus and, according to need, expand it or exchange it for a unit of higher output.

The object of the invention is to provide a solution to the specific problems presented above. More particularly, the purpose of the invention is to disclose a new kind of column structure based on standardized modular parts that is easy to transport and use and that meets all structural rigidity requirements.

The characteristic features of the invention are referred to in the claims, particularly in claim 1.

The conical frame parts of the column can be manufactured preferably by cutting strips from plate, which are edge-formed. After edge-forming, in connection with one preferred embodiment of the invention a perforated

flange is welded to the bottom part of the frame part, to which flange a stud bolt is fixed with bolts. The frame parts are joined together by welding such that the cross-section is polygonal in its shape, e.g. a hexangular cross-section formed of two parts.

A preferred modular dimension of the column is 6 m, in which case the mast can be either 6 m, 12 m or 18 m, depending on the number of frame parts.

The necessary holes are drilled in the frame parts so that the parts can be connected to each other with bolts. Additional holes are drilled in the lowermost frame part for the base joint.

A horizontal connecting flange is welded to the top end of the topmost frame part, to which the appropriate future apparatus can be fixed with bolts. Short flanges provided with a conical stem are manufactured for the top ends of the other frame parts, which flanges can be fixed with a standard bolted joint, such as conventional extensions of the frame parts.

The pedestal part, i.e. the foundation part, of the column is manufactured from two vertical profiles that are rigid to bending and connected to the base plate, preferably e.g. edge-formed U-profiles. The vertical profiles comprise holes for the horizontal connecting pins of the column as well as for the buffer joint of the column. The column is turned into a vertical position or into a horizontal position by means of the upper pin. The base plate comprises the holes needed for the appropriate number of foundation bolts.

The modularly dimensioned frame parts are manufactured for storage. The number of frame parts according to the length (height) required for the apparatus is transported as separate light parts and connected together at the installation site with bolts.

The foundation bolts are cast into the base, holes drilled into rock or a concrete footing, by means of an installation template. An approx. 50 mm reserve is left under the plate for concrete grouting. The base structure is installed perpendicularly by measuring e.g. the straightness of the vertical profiles with a spirit level and by rotating the bolt nuts under the base plate.

When the base structure is in its dimensions, the installation space between the base plate and the base is cast with grouting concrete.

When the grouting concrete has hardened, the bottom end of the column is moved to between the vertical profiles of the base structure such that the hole of the pivot pin is roughly in the center of the vertical profiles. A frame provided with a lifting hook is placed on top of the vertical profiles such that the frame structure rests on top of the vertical profiles and between the side flanges. The bottom end of the column is lifted upwards with a hoist tackle such that the pivot pin can be installed between the vertical profiles and the mast. The necessary number of counterweights is fixed to the stud bolt of the bottom end of the column. The weights are adjusted as far downwards as possible, if the stud bolt of the counterweights is suspended from a welded plate the position of the weights can be corrected with a bushing.

The top end of the column is lifted onto a trestle, which provides a good working position. The appropriate future apparatus with any flanges is fixed to the flange of the top end of the mast. The column is turned upright either by hand, or by turning the crank handle if the column is provided with a gearwheel welded to it. In the upright position the bottom end of the column rests on the buffer of the column and the pin of the bottom end can be installed. The horizontal pins are tightened such that the column is resting on the vertical profiles.

For the purpose of servicing procedures, the bottom pin fixing of the column is detached and the column is turned from the upright position into the horizontal position by using a trestle that is adequately high under the top end of the column. If necessary, a separate working platform is used for the servicing procedures for the apparatus.

If it is later needed to increase the size of the apparatus, the column can be turned into the horizontal position. The old apparatus and also its fixing flange are detached and a column part of the required length is added to the old column with a standard bolted joint. The top end of the column is provided with a fixing flange that is compatible to the new apparatus, to which fixing flange the new apparatus is fixed, and the column is lifted upright.

In the following the invention and its advantages will be described in more detail with reference to the attached drawings, wherein

Fig. 1 presents a side view of a column structure according to the invention, which is formed from two frame parts and from a base structure, which comprises a crank for turning the column

Fig. 2 presents a side view of a flange joint that can be disassembled, when the shorter column is delivered without the topmost frame part

Fig. 3 presents a top view of the connection of the column to the base structure

Fig. 4 presents the joint of Fig. 3 as viewed towards the base from the side

Fig. 5 presents a side view of the counterweight fixing of the bottom part of the column to the frame part when on the horizontal plane

Fig. 6 presents the counterweight system of Fig. 5 as seen from below

Fig. 7 presents a side view of a second counterweight fixing of the bottom part of the column

Fig. 8 presents the counterweight system of Fig. 7 as seen from below

Fig. 9 presents a side view of the connection of the installation framework to the base structure

Fig. 10 presents a top view of the joint of Fig. 9 (frame structure not drawn)

Fig. 1 presents a column according to the invention, which is formed from two conical frame parts 1, 2, which can be fitted and locked to each other as an extension with a bolted joint 5.

The column is connected to its pedestal with horizontal pins 7, 8 between two vertical steel profiles 6 such that the straight surfaces 17 of the cross-section of the column are supported on the inner surfaces 18 of the steel

profiles 6, which inner surfaces are opposite each other at the distance of the diameter of the bottom end.

The upper frame part 1 and the lower frame part 2 of the column of Fig. 1 are tubular cones of a regular polygonal cross-sectional shape. The conical bottom end 3 of the upper frame part presses against the top end 4 of the lower frame part and the bending rigidity of the joint is ensured with the bolts 5. The lower frame part is connected to the vertical profiles 6 of the base structure with a horizontal pin 7 and a pivot pin 8. At the point of the pivot pin 8, a gearwheel 9 is welded to the frame part 2 (to the straight surface 17 of it) and the turning crank 10 comprises a pinion 11 at a corresponding point, in which case the gearwheel 9 connects to the vertical profiles 6 of the base structure of the frame part 2 via the pinion 11 and the turning crank 10. Also the base plate 12 and the foundation bolts 13 fixed to the pedestal are seen in the bottom part of the figure. The top end of the mast comprises a horizontal connecting flange 14 for the bolt fixing of the apparatus.

Fig. 2 presents the flange joint 14, which is welded to the conical flange 15 according to the cross-section of the column and can be connected by means of it to the top end 4 of the lower frame part with the bolts 5. If necessary, the flange can be disassembled by detaching the bolts 5 and e.g. the column can be lengthened by connecting the upper frame part 1 to the top end 4 of the lower frame part.

Fig. 3 shows the connection of the lower frame part 2 to the vertical profiles 6 of the base structure. The straight section 17 of the cross-section of the column rests on the inner surface 18 of the vertical profile 6. The ends of the lower horizontal pin 7 comprise threads and nuts 21, with which the joint surfaces are tightened together. Wind loads can now be transmitted from the column to the base structure. The holes 16 for the foundation bolts 13 as well as the buffer plate 20 of the column are also seen in the figure, which buffer plate is fixed with screws 19 to the vertical profile 6 such that the column maintains its position after being lifted upright.

In Fig. 4 the vertical profile 6 of the base structure is fixed directly to the base plate 12. By rotating the bottom nuts 22 of the foundation bolt 13 the vertical flanges 6 can be installed perpendicularly. The correct position is

locked with the top nuts 23 of the foundation bolts 13 and the seam 24 between the base 25 and the base plate 12 is base grouted. The success of the casting can be checked via the hole in the base plate.

Figs. 5 and 6 present one way of connecting the counterweights 26 to the lower frame part 2. A perforated flange 27 is welded to the frame part 2, to which a stud bolt 29 is fixed with nuts 28. The stud bolt 29 is fixed to the lower end of the lowermost frame part 2 and the perforated weights 26 are installed onto it such that the mass of the mast and the apparatus connected to it is distributed roughly equally in relation to the pivot pin 8. The counterweights 26 comprise holes for the stud bolt 29 and they are locked to the stud bolt with a nut 30. The placement of the weights 26 depends on the length of the bushing 31. Installation of the counterweights 26 is easier when e.g. one weight 32 centers the weights 26 so that they can be handled with the fingers. By adjusting the placement and the amount of counterweights 26, the column /apparatus structure is balanced in relation to the pivot pin 8.

Figs. 7 and 8 present a second way of connecting the counterweights 26 to the lower edge of the frame part 2. The stud bolt is fixed into a slot-like plate structure 33, which is preferably manufactured from two plate strips by edge-forming the one end. The L-profiles are joined by welding them to face each other so that a rectangularly shaped profile is obtained. The edge-formed end comprises a hole with which the slot structure 33 is joined to the frame part 2 with screws 34.

Figs. 9 and 10 present the lifting framework 35 intended for installing the mast. It can be placed such that the support plates 36 of the framework press onto the top of vertical profiles 6 of the base structure and the centering plate 37 of the framework between the flanges of the vertical profiles. Figs. 9 and 10 show the connection of the lifting frame 35 to the upper edge of the vertical profile 6. The lifting force is transmitted to the vertical profiles via the horizontal flange 36, the flange 37 installed inside the vertical profile 6 prevents inclination of the lifting frame and the flange 38 keeps the frame safely in position. The frame remaining in its position can be further ensured with a locking screw (not drawn).

The invention is described above using examples with the aid of the attached drawings with different embodiments of the invention being possible within the scope of the inventive concept defined by the claims.

PARTS LIST AND NUMBERING OF PARTS

1. upper frame part
2. lower frame part
3. bottom end of upper frame part
4. top end of lower frame part
5. fixing bolts of frame parts/apparatus flange
6. vertical profiles of base structure
7. horizontal pin
8. pivot pin
9. gear wheel
10. turning crank
11. pinion
12. base plate
13. foundation bolt
14. fixing flange of apparatus
15. conical flange of connecting flange (*cf* 3)
16. hole for foundation bolt
17. straight section of mast cross-section
18. inner surface of vertical profile of base structure
19. fixing screw of turning buffer
20. turning buffer
21. tightening nuts of horizontal pin
22. lower nut of foundation bolt
23. upper nut of foundation bolt (washer plates unnumbered)
24. base grouting
25. base (rock or footing cast)
26. counterweight
27. perforated flange
28. fixing nut for connecting part 29 to part 27
29. stud bolt
30. locking nut of counterweights
31. bushing, with which position of weights is adjusted
32. counterweight, which centers the weights inside the conical profile
33. locking profile of counterweights
34. fixing screw of locking profile
35. foot of lifting frame

36.support plate of frame
37.centering plate of frame
38.locking plate of frame

CLAIMS

1. Column structure, which is formed from a column (1, 2) that is of regular polygonal cross-sectional shape and from a pedestal that is fixed to a base (25), into which the column can be fitted
**characterized** in that
the pedestal comprises two vertical metal profile parts (6) at the distance of the outer diameter of the column from each other as well as two horizontal pin parts (7, 8) fitted into the metal profile parts at a different height such that the column can be fitted between the metal profile parts and can be fixed with the pin parts (7, 8) fitted into the holes in them such that the straight outer surfaces (17) of the cross-section of the column are supported on the inner surfaces (18) of the vertical profiles (6).

2. Column structure according to claim 1, **characterized** in that
the column can be connected to the vertical profiles (6) of the pedestal structure with a horizontal pin (7) and a pivot pin (8), at the point of which pivot pin a gearwheel (9) is fixed to the column and the turning crank (10) comprises a pinion (11) at a corresponding point, in which case the gearwheel (9) can be connected to the vertical profiles of the base structure of the column via the pinion (11) and the turning crank (10).

3. Column structure according to claim 1, **characterized** in that a stud bolt (29) is fixed to the lower end of the column (2), onto which stud bolt perforated weights (26) are installed such that the mass of the mast and the apparatus connected to it is distributed roughly equally in relation to the pivot pin (8).

4. Column structure according to claim 1, **characterized** in that the column is conical.

5. Column structure according to claim 1, **characterized** in that the fixing flange (14) of the actuator fitted to the column, welded to the conical flange structure (15) according to the cross-section of the column, is connected to the frame part (2) with a bolted joint (5).

6. Column structure according to claim 1, **characterized** in that it comprises a lifting framework (35) for installing the column, which lifting framework can be placed so that the support plates (36) of the framework press onto the top of the vertical profiles (6) of the base structure and the centering plate (37) of the framework between the flanges of the vertical profiles.

7. Column structure according to claim 1, **characterized** in that the column comprises at least two frame parts (1, 2) fitted one above the other, which are tubular cones of regular polygonal cross-sectional shape, in which case the conical bottom end (3) of the upper frame part always presses against the top end (4) of the lower frame part and the bending rigidity of the joint is ensured with the bolts (5).

8. Column structure according to claim 1, **characterized** in that the vertical profile (6) of the base structure is fixed to the base plate (12).

9. Column structure according to claim 1, **characterized** in that the pedestal comprises bolts (13), by rotating the bottom nuts (22) of which the vertical flanges (6) can be installed perpendicularly, and wherein the correct position can be locked with the top nuts (23) of the bolt (13).

10. Column structure according to claim 1, **characterized** in that the seam (24) between the base (25) and the base plate (12) is base grouted.

11. Column structure according to claim 1, **characterized** in that a buffer plate (20) is arranged in the column, which buffer plate is fixed to the vertical profiles (6) such that the column maintains its position after being lifted upright.

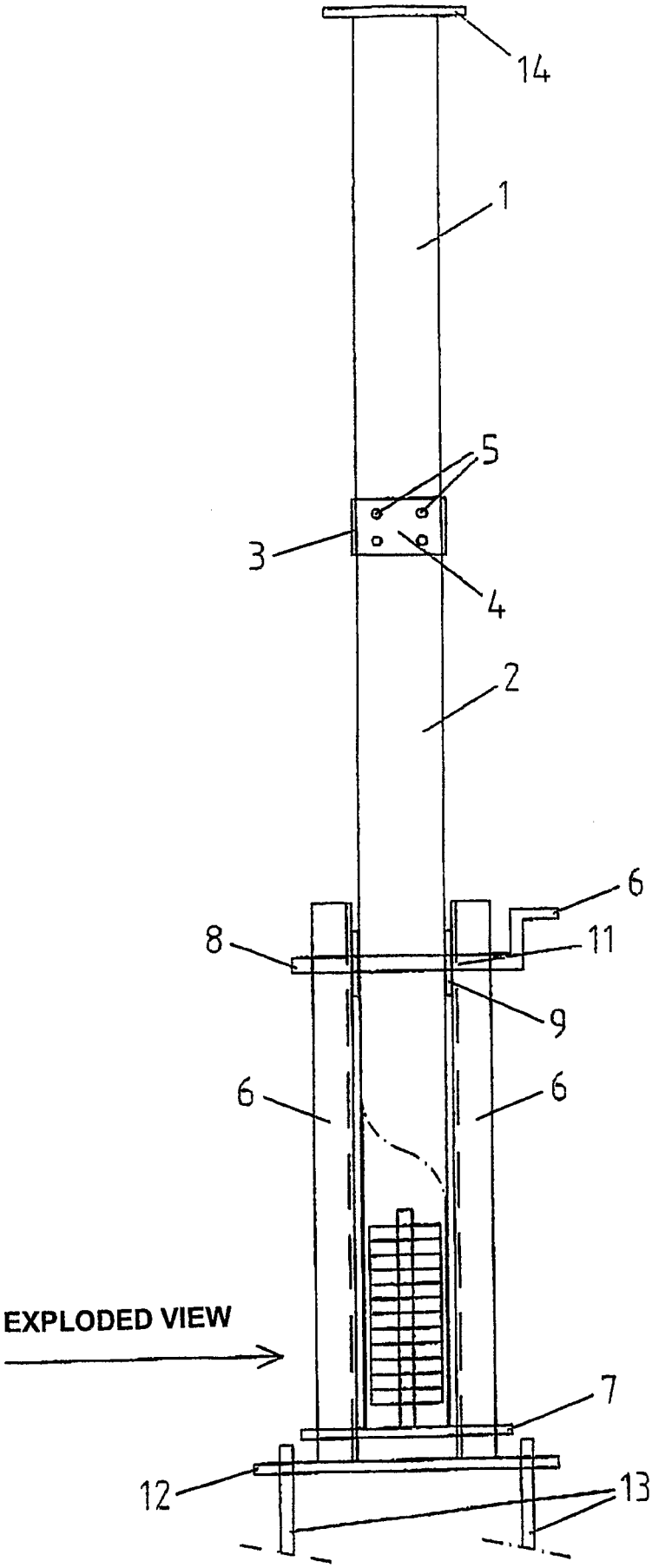


Fig. 1

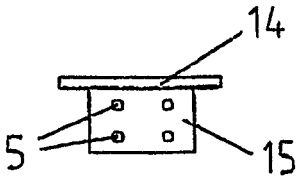


Fig. 2

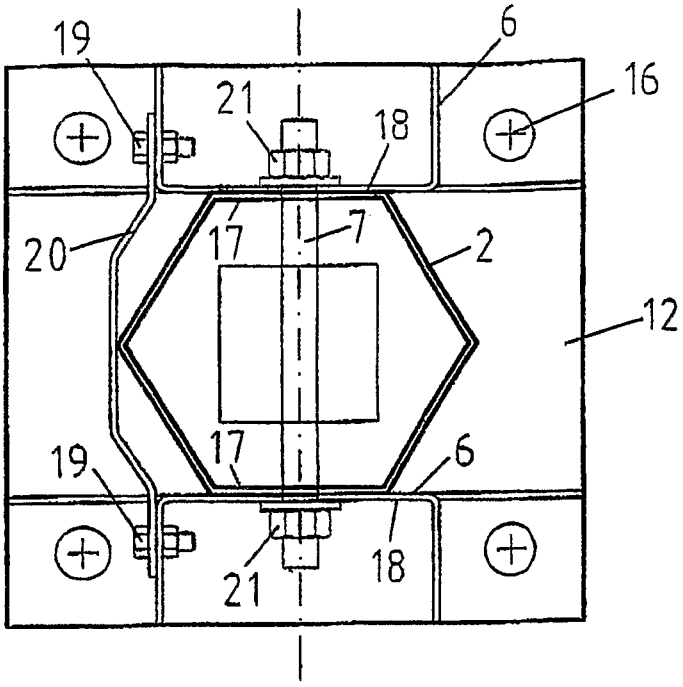
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Fig. 3

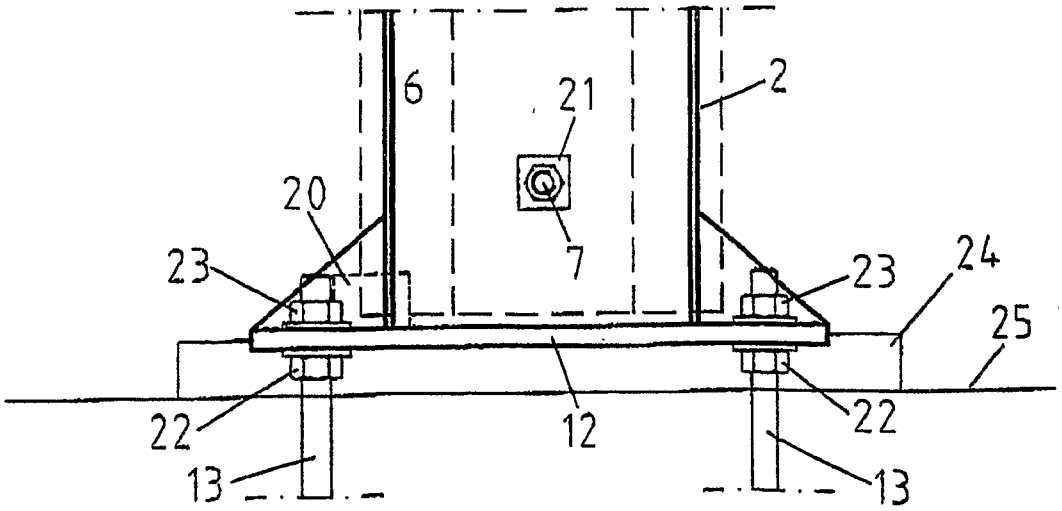
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Fig. 4

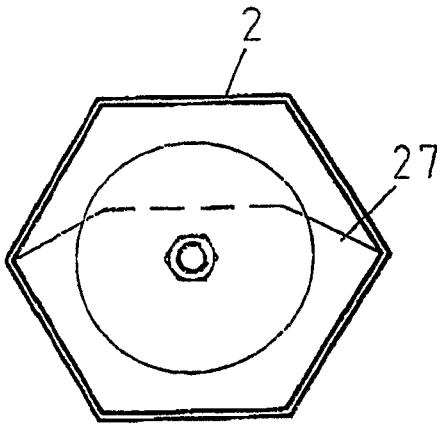


Fig. 6

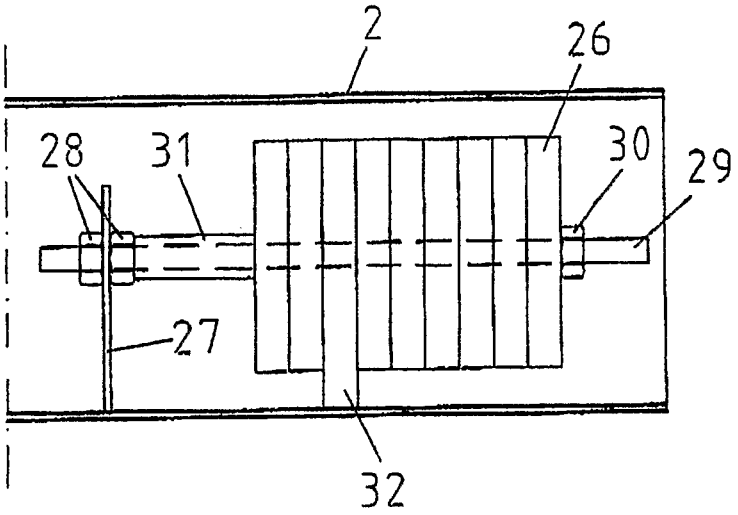


Fig. 5

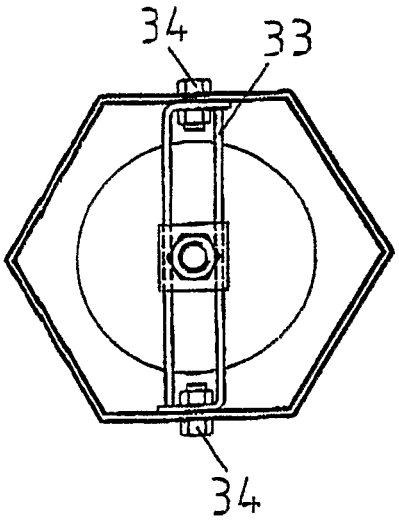


Fig. 8

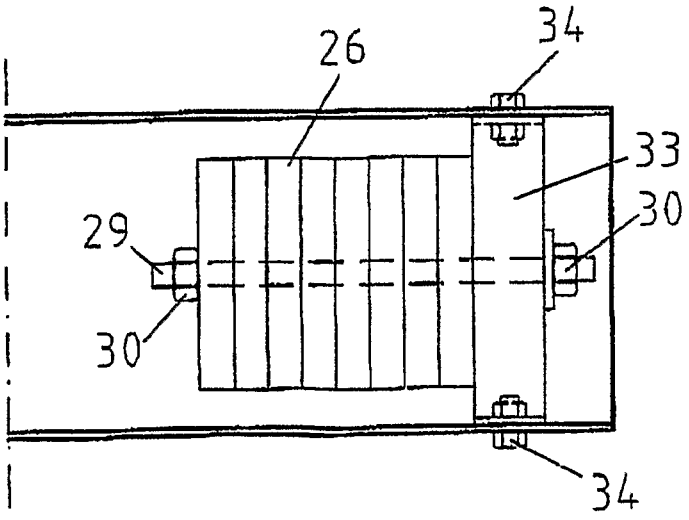


Fig. 7

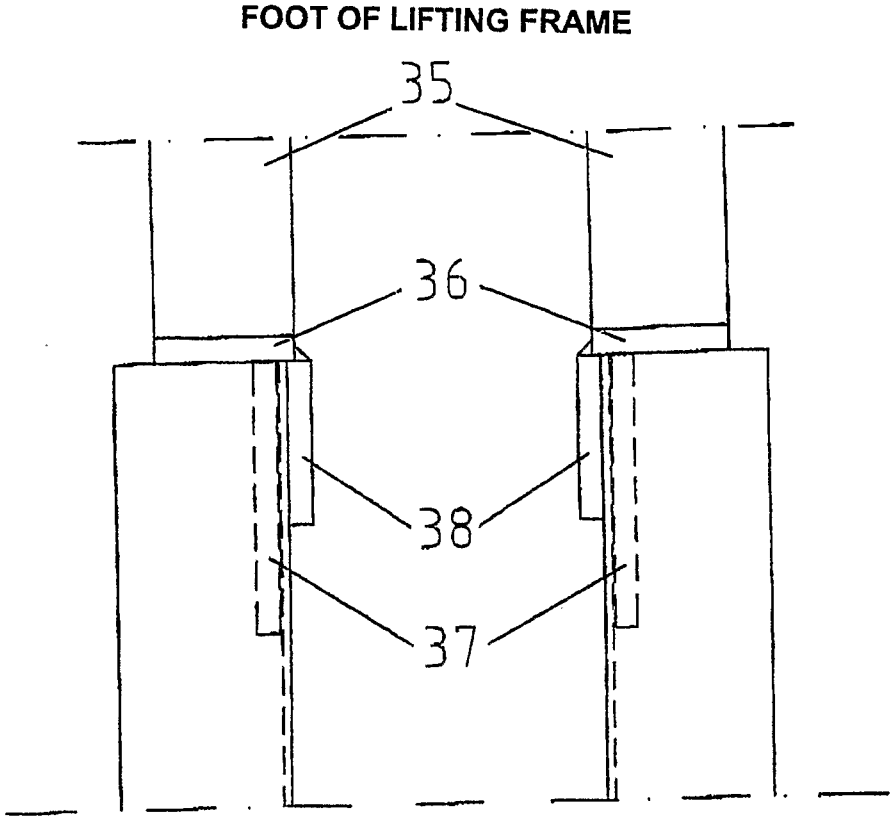


Fig. 9

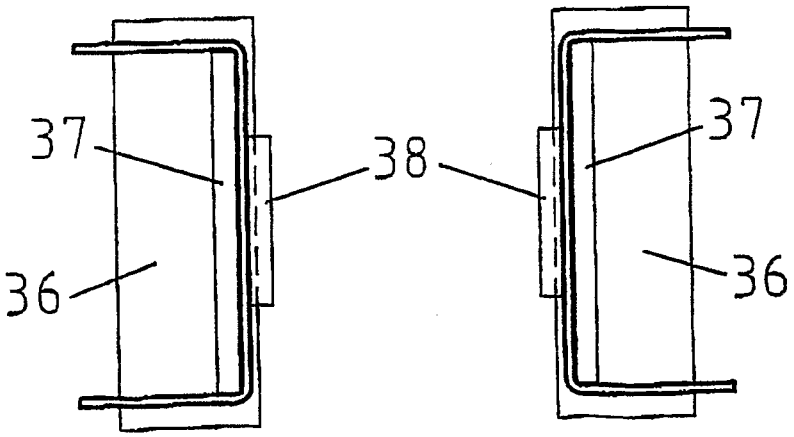


Fig. 10

# INTERNATIONAL SEARCH REPORT

International application No
PCT/FI2009/050576

A. CLASSIFICATION OF SUBJECT MATTER
INV. E04H12/18 E04H12/34

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)
E04H

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | JP 07 293040 A (SUMITOMO DENSETSU KK; SUMIKIN KOZAI KOGYO KK)<br>7 November 1995 (1995-11-07)<br>the whole document | 1-5,7-11 |
| X | JP 03 075267 U (UNKNOWN)<br>29 July 1991 (1991-07-29)<br>the whole document | 1,2 |
| X | JP 49 085831 U (UNKNOWN)<br>25 July 1974 (1974-07-25)<br>the whole document | 1,6 |
| X | US 1 438 166 A (BOLANDER LOUIS P)<br>12 December 1922 (1922-12-12)<br>the whole document | 1,3,4,11 |

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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| Date of the actual completion of the international search | Date of mailing of the international search report |
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| 3 November 2009 | 11/11/2009 |
| Name and mailing address of the ISA/<br>European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Authorized officer<br>Hellberg, Jan |

# INTERNATIONAL SEARCH REPORT

International application No
PCT/FI2009/050576

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| JP 7293040 A | 07-11-1995 | NONE | |
| JP 3075267 U | 29-07-1991 | NONE | |
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| US 1438166 A | 12-12-1922 | NONE | |