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(54) **Title**: SUPPORT ANCHOR

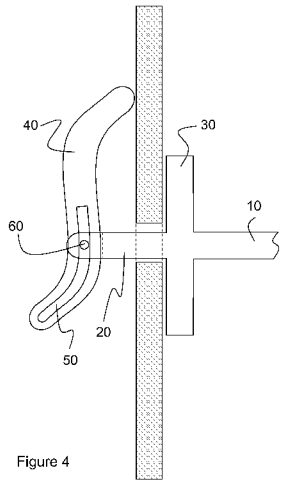


Figure 4

(57) **Abstract**: A support anchor for temporary attachment to a substantially vertical structure, the structure having a hole, the anchor comprising: a shaft (10), comprising a first end portion (20) suitable for insertion through the hole, and restricting means (30) disposed along the shaft (10) at a predetermined distance from the first end, the distance being greater than a thickness of the structure, and the restricting means adapted to restrict insertion beyond that distance; and an elongate retaining member (40), movably connected to the first end of the shaft, having a first released configuration in which it may be threaded through the hole and a second locked configuration in which it may not; wherein the elongate retaining member (40) comprises a slot (50) and the first end (20) of the shaft comprises a pivot (60), the pivot connected to the slot such that the elongate member is operable to slide over the pivot and, in at least the released configuration, to be freely rotatable about it.

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DESCRIPTION

# SUPPORT ANCHOR

This invention relates to a support fixture for attaching a load to a substantially vertical structure. Such fixtures are relevant, for example, as step bolts for electricity transmission towers.

Electricity transmission towers (pylons) are commonly constructed from a lattice of metal beams. In order to provide access for maintenance purposes, climbing step bolts are typically provided at regular intervals on the legs of the tower. These are generally affixed in drilled holes in the metal beam forming the leg.

In conjunction with the provision of access in this way, measures are usually taken to prevent or deter unauthorized persons from climbing the tower. One such measure is not to fit the step bolts along the full height of the tower. Thus, for an initial vertical interval above the ground, although holes are drilled in the structure, no bolts are fitted. A further anti-climb device may be fitted at the top of the initial interval.

In order to climb the tower, an authorized person must fit the missing step bolts into the holes at the base of the tower leg. It is common for up to ten step bolts to be needed, each of which must be secured with nuts on a threaded section of the bolt at the reverse side of the hole. Fitting this number of nuts and bolts is a time consuming and awkward task. Needless to say, when work is finished, the same number of bolts must once again be removed.

According to the current invention, there is provided a support anchor for temporary attachment to a substantially vertical structure, the structure having a hole, the anchor comprising:

a shaft, comprising a first end portion suitable for insertion through the hole, and restricting means disposed along the shaft at a predetermined distance

from the first end, the distance being greater than a thickness of the structure, and the restricting means adapted to restrict insertion beyond that distance; and

an elongate retaining member, movably connected to the first end of the shaft, having a first released configuration in which it may be threaded through the hole and a second locked configuration in which it may not;

wherein the elongate retaining member comprises a slot and the first end of the shaft comprises a pivot, the pivot connected to the slot such that the elongate member is operable to slide over the pivot and, in at least the released configuration, to be freely rotatable about it.

This support anchor is suitable for use as a transmission tower step bolt and removes the need for multiple parts (nuts and bolts) by providing an anchor with integral means of attachment. These means, the retaining member, can be inserted through the hole in the tower leg and clipped securely into place. The possibility of dropping the nut while trying to fit it is thus removed. Furthermore, the clamping in place of the bolt is easy and quick, and just as easily reversible when it is desired to remove the bolt. Indeed, a skilled user may be able to fit and detach the bolt single-handedly.

Preferably the retaining member is freely rotatable about the pivot in the first released configuration and not freely rotatable about the pivot in the second locked configuration.

In this design, the pivot end of the shaft and the slot or groove in the retaining member are arranged such that rotation is impossible when the device is clamped in place. When the device is undone, the retaining member is freely rotatable, assisting the easy threading of the member and end of the shaft through the hole. This provides simple but effective operation of the device.

In the released configuration the pivot may be positioned at a first end of the slot, corresponding to a first end of the retaining member.

An end-to-end arrangement of the retaining member and the shaft can facilitate threading through the hole.

Preferably, the slot is curved and in the locked configuration the pivot is positioned at an intermediate position along the slot.

This arrangement enables the temporary anchor to attach to existing structures of different thickness. As the retaining member slides along the curved slot it is simultaneously rotated into the locked position. Different thicknesses of the structure can therefore be accounted for by different degrees of rotation, corresponding to different points along the slot and a continuum of locked positions exists. At each such position, the retaining member essentially has at most one degree of freedom – the rotational position being determined by the curvature of the slot.

Preferably, in normal operation in the locked configuration, the first end of the retaining member extends below the pivot.

This arrangement of the retaining member allows gravity to contribute to the secure attachment of the device in the locked position. In order to release the anchor, the retaining member must be slid upwards (against gravity) until a release is achieved.

Preferably, in the locked configuration a portion of the retaining member is suitably positioned to brace the anchor firmly against the structure.

This means that the anchor is rigidly fixed in position. Frictional forces can then help maintain the locked configuration.

The invention will now be described by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows an example of a support anchor according to the invention being threaded through a hole in a suitable structure, in an unlocked configuration;

Figure 2 shows the anchor of Fig. 1 with the shaft in place but still in its unlocked configuration;

Figure 3 shows the same example anchor as the retaining member is being moved into its locked configuration; and

Figure 4 shows the same example in the locked configuration.

Note that the drawings are illustrative and not necessarily to scale. Like elements are given like reference numerals throughout.

As described above, a step bolt that can be attached and detached quickly and easily while providing similar security to a permanent fixing, is highly desirable. The support anchor of the current invention fulfils these needs. However, its application is not limited to the field of electricity transmission towers. It may be useful in a variety of circumstances where a temporary load-bearing fitting is required on a substantially vertical structure, provided that a suitable hole is available. The other prerequisite is that both sides of the structure providing the hole are accessible, so that the retaining member can be latched and unlatched manually.

Referring to the embodiment of Fig. 1, the step bolt is formed of two movably connected rigid parts. The first part is the main shaft 10, which on its load-bearing side may be no different from the shaft of a traditional step bolt. At a point along the shaft close to the insertion-end, there is a front plate 30. This is wider than the aperture of the hole for which the bolt is intended and prevents the bolt from being inserted through the hole further than the end portion 20 of the shaft. At the end of the shaft is a pivot 60, which sits in a slot or groove 50 in the retaining member 40, connecting the two. The slot may extend for part of the length of the retaining member, as shown in Fig. 1. In particular, it is advantageous for at least the slot and potentially also the retaining member to be curved. As shown in Figs. 3 and 4, when locked in place, the ends of the slot are curved away from the structure (for example the tower leg) to which the support anchor is being attached. A temporary step bolt of this type can be manufactured from steel and zinc plated to protect against corrosion.

To install the temporary step bolt, the retaining member 40 is first threaded through the hole, as shown in Fig. 1, ensuring that the device is in the correct (upright) orientation. For the embodiment pictured, the correct orientation is determined by the direction of curvature of the slot. The retaining member 40 is then followed through the hole by the end portion 20 of the shaft 10 until the plate 30 engages against the front surface of the tower leg.

As indicated in Fig. 2, the hanging retaining member is then rotated on the pivot 60, raising it into the upright position. In this position, it becomes possible to slide the pivot 60 in the slot 50, simultaneously lowering and rotating the retaining member, as shown in Fig. 3. Once the pivot has travelled away from the end of the slot, it is no longer possible to freely rotate the retaining member. Rather, rotation is guided by the construction of the slot 50, pivot 60 and/or shaft-end 20.

Finally, as shown in Fig. 4, the tail end of the retaining member comes into contact with the reverse surface of the tower leg. The retaining member cannot be slid or rotated further. It is held securely in this locked configuration by a combination of friction at the pivot and point of contact with the tower leg; and gravity, acting to pull the retaining member further downwards over the pivot. Of course, this action of gravity is dependent on the correct (upright) orientation of the device.

The fact that the retaining member is slid along its slot or groove to engage with the back of the tower leg means that tower legs of different thicknesses can be accommodated by a given temporary bolt. A step bolt of the type described in this embodiment may be suitable for electricity transmission towers having leg thicknesses ranging from 10mm to 28mm.

Once fitted, the temporary step bolt can be used as a climbing aid, like a rung of a ladder. It may also be suitable for attachment of safety devices, such as a safety climbing lanyard. In this case, the bolt should be capable of withstanding the load incurred should a person fall while attached to it.

In normal use, the load placed on the shaft 10 will be under force of gravity (that is, downwards). To the extent that there is any play around the shaft-end 20 in the hole, the pivot end 20 of the shaft (opposite to the load-bearing end) will tend to be forced upwards. If anything, this will urge the pivot 60 further up in the slot 50, to tighten the clamping action, and ensure the security and stability of the device. A step bolt of the type described in this embodiment may be suitable for electricity transmission towers with legs having holes ranging from 17mm to 21 mm in diameter.

To remove the temporary step bolt, the attachment process described above is simply reversed. The retaining member 40 is slid upwards and allowed to fall into a hanging position. The end of the shaft and the retaining member can then be threaded or pulled through the hole to withdraw.

Various modifications will be apparent to those skilled in the art.

CLAIMS

1. A support anchor for temporary attachment to a substantially vertical structure, the structure having a hole, the anchor comprising:

a shaft, comprising a first end portion suitable for insertion through the hole, and restricting means disposed along the shaft at a predetermined distance from the first end, the distance being greater than a thickness of the structure, and the restricting means adapted to restrict insertion beyond that distance; and

an elongate retaining member, movably connected to the first end of the shaft, having a first released configuration in which it may be threaded through the hole and a second locked configuration in which it may not;

wherein the elongate retaining member comprises a slot and the first end of the shaft comprises a pivot, the pivot connected to the slot such that the elongate member is operable to slide over the pivot and, in at least the released configuration, to be freely rotatable about it.

2. The support anchor of claim 1, wherein the retaining member is freely rotatable about the pivot in the first released configuration and not freely rotatable about the pivot in the second locked configuration.

3. The support anchor of claim 2, wherein in the released configuration the pivot is positioned at a first end of the slot corresponding to a first end of the retaining member.

4. The support anchor of claim 2 or 3, wherein the slot is curved and in the locked configuration the pivot is positioned at an intermediate position along the slot.

5. The support anchor of claim 4, wherein in normal operation in the locked configuration, the first end of the retaining member extends below the pivot.

6. The support anchor of any preceding claim, wherein in the locked configuration a portion of the retaining member is suitably positioned to brace the anchor firmly against the structure.

7. The support anchor of any preceding claim, wherein the restricting means comprises a plate fixed to the shaft, extending at least in a direction perpendicular to the axis of the shaft in the plane of rotation of the retaining member.

8. A transmission tower temporary step bolt comprising a support anchor as claimed in any preceding claim.

9. A support anchor substantially as described herein with reference to the accompanying drawings.

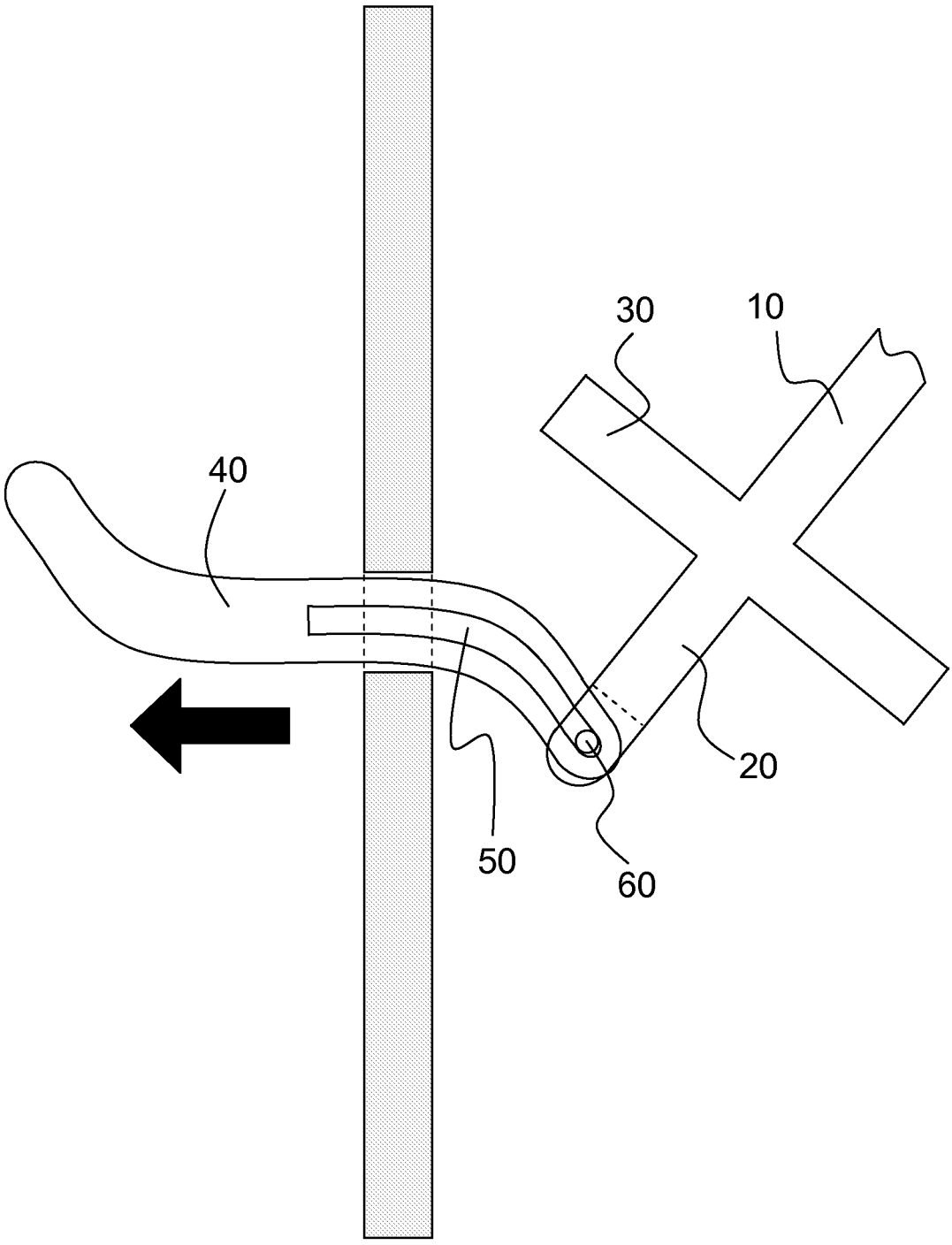



Figure 1

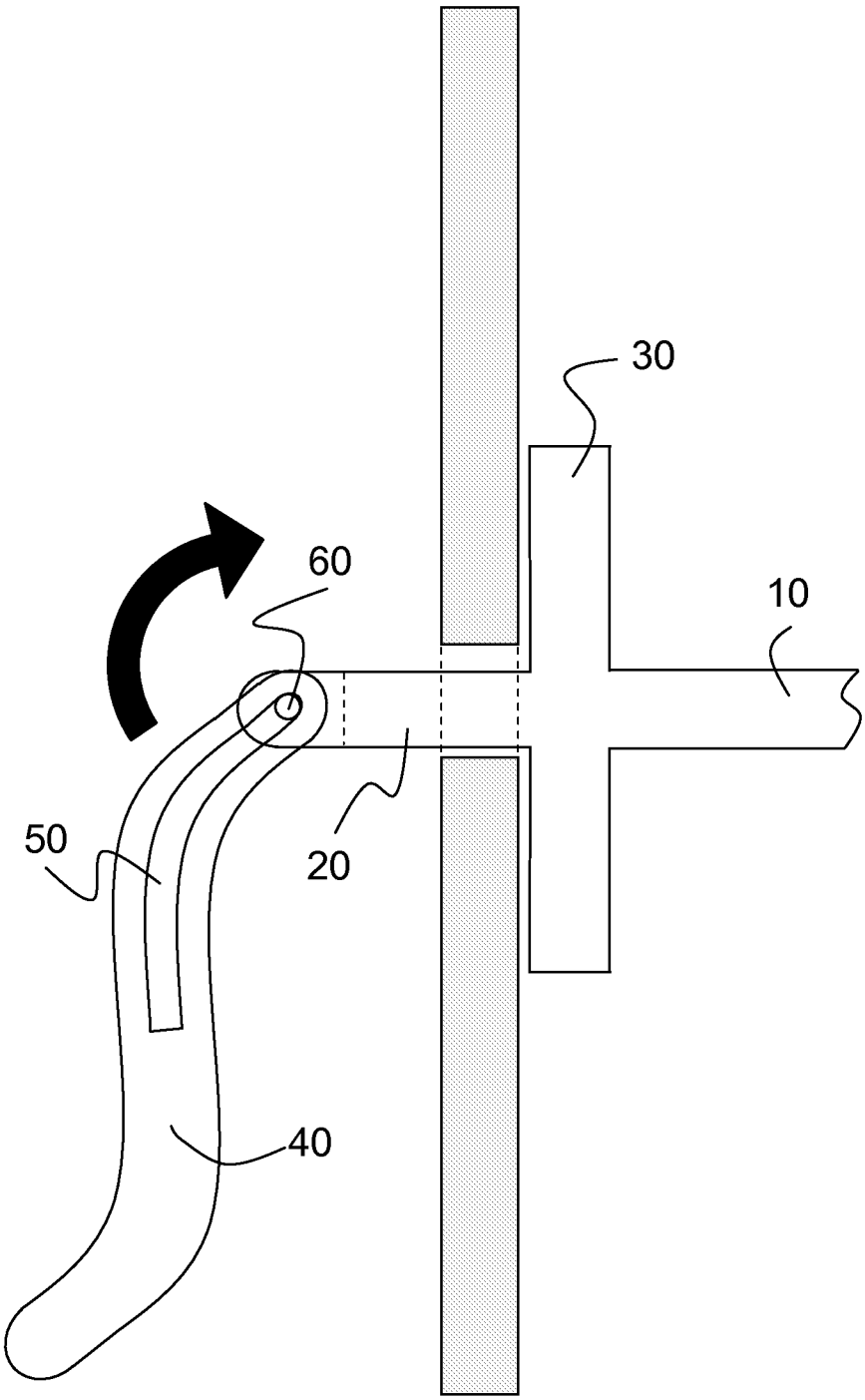



Figure 2

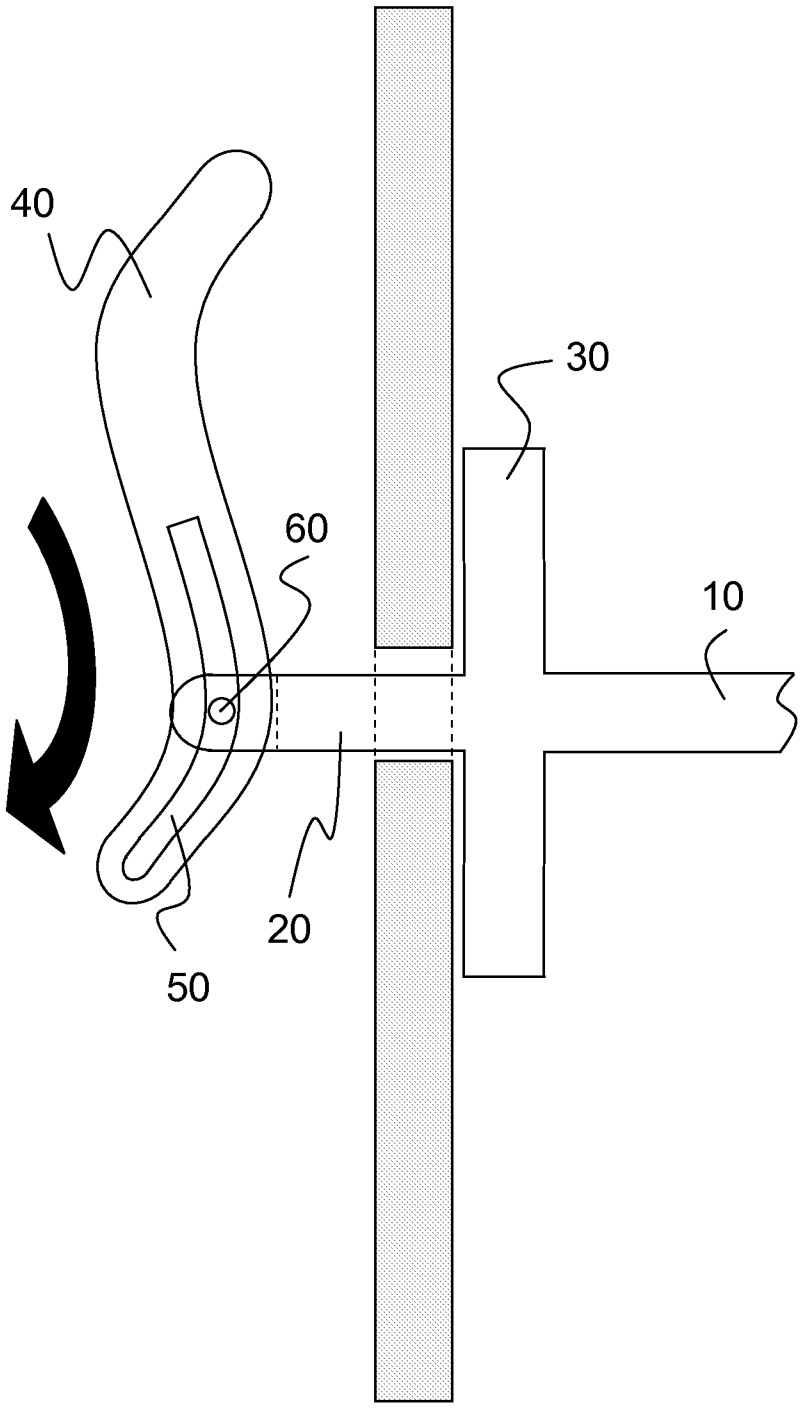



Figure 3

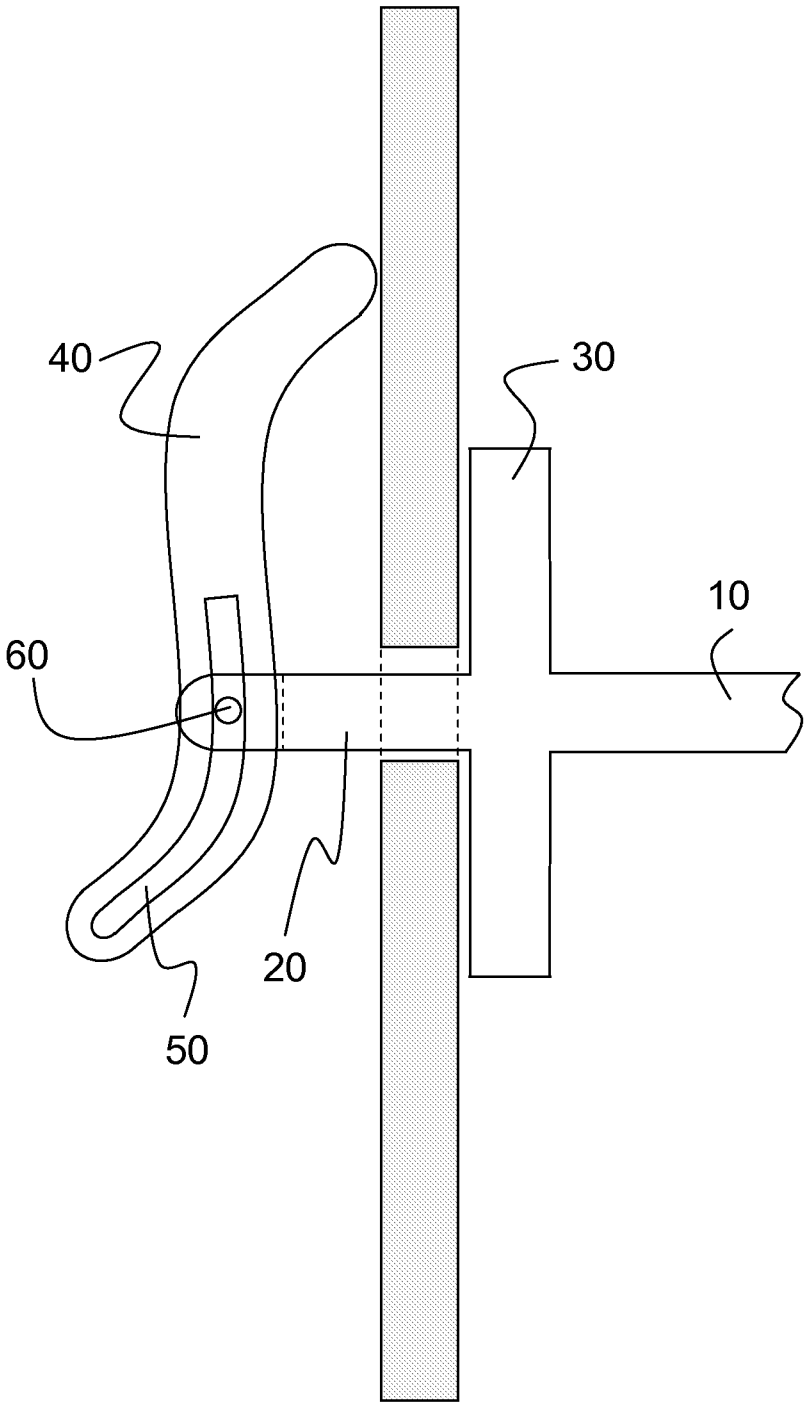



Figure 4

# INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. E04G21/32 E04H12/00 E06C9/04 A62B1/04

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)
E04G E04H E06C A62B

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | WO 00/68541 A (MACKINNON BRUCE RAYMOND [NZ]) 16 November 2000 (2000-11-16) page 5, line 8 - page 6, line 4; figures 2,3 | 1,8 |
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☒ See patent family annex.

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| 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 | Scharl, Willibald |

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Information on patent family members

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