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(54) **Anchoring device for anti-fall systems, particularly suitable for metal covers**

Verankerungsvorrichtung für Absturzsicherungssysteme, die insbesondere für Metallabdeckungen geeignet ist

Dispositif d'ancrage pour systèmes anti-chute, convenant particulièrement pour des couvercles métalliques

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(56) References cited:
WO-A1-02/43809 **WO-A1-03/039680**
AT-A1- 500 522 **DE-C1- 3 923 691**

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Description

STATE OF THE ART

[0001] The present invention relates to improvements for anti-fall devices that can be directly anchored to a metallic covering coat of buildings and that in case of fall provide for spreading stresses on the covering coat preventing its damage at the point of the covering coat where the device is anchored.

[0002] Technological evolution and development of materials, together with arising needs prescribed by building regulations, are progressively asserting the use of metallic-type covering coats in the field of building construction and architecture, with an expansion of types and product range.

[0003] The use of metallic-type covering coats is also asserting in the field of restructuring and in renewal of existing buildings, in which there is a need for replacing the fiber cement-type covering coats, which usually contain asbestos, with new metallic-type covering coats.

[0004] Metallic-type covering coats are offered on the market in different materials, such as: sheet steel, aluminum, copper, specific alloys, with a wider expansion of iron and aluminum sheets.

[0005] The offered shapes too are different for ribbing, fixing method, junctions and exposures with single, double, coupled sheets with insulating or waterproofing materials.

[0006] The result is a wide range designed to meet a variety of needs arising from time to time.

[0007] This type of covers suitable for a variety of constructions has the advantage of lightness, so it is often used on lightweight, prefabricated structures and structures characterized by large bearing distances, typical of non-residential premises in particular for industrial use.

[0008] The installation of the anchoring devices on coats, to be used for subsequent accesses to the coat itself, presents considerable difficulties in presence of metallic-type coats; on the one hand because of the need for piercing metallic elements for the transition and anchoring of the vertical components of the anchoring devices and then for sealing the remaining spaces by means of dry usable products; on the other hand, because of the impossibility to directly bind the "ordinary" anchoring devices on metallic covering panels.

[0009] In fact, the stresses induced by the supporting devices and hence the covering panel against the possible fall of operators are important, with significant effort of the hook and the panel, thus irremediably damaged, resulting in a lack of or insufficient retention of the fall.

[0010] In the art the following patents are known:

WO 02/43809 A1, WO 03/039680 A1, AT 500 5522 A1, DE 39 23 691 C1.

Summary of the invention

[0011] These patents describe devices for protection against falls from height, none of which however can reduce the stresses transmitted during the fall to the anchoring systems and thereby to the cover of the building.

[0012] It is an object of the present patent to provide devices able to remedy the problems mentioned above.

[0013] Anchoring devices for anti-fall systems according to the present invention, particularly suitable for metal covers, comprise:

two end poles;
a large number of intermediate poles in relation to the extension of the cover surface;
a large number of corner poles in relation to the extension of the cover surface;
a fixing plate of each pole to the cover;
a steel cable of the line;
an energy dissipator;
a turnbuckle and accessory components of the cable fixing.

[0014] It is a first object of the present invention to realize a steel plate fixing the pole capable to offer a high resistance to tearing if operator falls.

[0015] It is a second object of the present invention to realize a pole, or rather an element capable to support the pole, to which the devices for workers' safety are fastened, capable to orient itself in accordance with the falling line of operator by rotating about its vertical axis, and moving from a vertical position to a position parallel with the falling line of operator.

[0016] These objects are achieved by an anchoring device as defined in claim 1.

[0017] The first object, in particular, is achieved by realizing a shaped fixing plate (base plate) and connection of the covering coat - a supporting component which has a specific metallic shape for any type of metal covering coat, and is provided with a double row of holes, preferably positioned near the terminal portions of at least two opposite sides of the plate in which the fixing rivets in the covering coat are placed. The plate also allows the anchorage on the side of the ribbing; in the middle of the shaped plate are planned at least four angular holes for the attachment of a second plate; said second plate comprises a steel plate provided with four angular holes placed in correspondence with the angular holes of the shaped fixing plate.

[0018] The second object of the present invention is in particular achieved by means of a rotating and swinging vertical supporting component for the steel cable, comprising:

- a U-shaped rotating base provided with a central hole in the bottom portion apt for securing it with a high-strength bolt to said second plate, mentioned earlier, said rotating base with its vertical sides ar-

ranged with holes for the insertion of retaining means and rotation of a vertical swinging component

- and a vertical component comprising a steel press-bent plate with holes arranged for the insertion of horizontal rotating bolts, a coupling loop of the steel cable, and sealing bolts.

[0019] According to the present invention, in case of stress of the steel cable due to the fall of an operator, the vertical rotating and swinging component rotates positioning itself in the direction of the falling line and, at the same time, bends down bringing itself from a vertical position to a position parallel to the falling line, thereby avoiding that, like it happens with traditional poles supporting steel cables, the lever effect of the pole on the sealing plate would add to the traction due to the weight of the falling body, which often causes the unhinging of the plate from the covering coat, with easily imaginable consequences for both safety and restoration costs.

Brief description of the drawings

[0020] For a complete understanding of the objects mentioned above reference should be made to the following detailed description of an explanatory example, but not limited, provided with accompanying drawings, wherein:

Figure 1 shows a schematic view of a safety system used on buildings' covers
Figure 2 shows a sectional and plan view of the shaped plate for fixing to the covering coat
Figure 3 shows an axonometric view of the base plate
Figure 4 shows a bottom axonometric view of the rotating base
Figure 5 shows a side axonometric view of the vertical swinging component.
Figure 6 shows a side view of the vertical swinging component.
Figure 7 shows an exploded front view of the whole system.
Figure 8 shows a side view of the mounted rotating base and vertical swinging component.
Figure 9 shows a top view of the rotating base and vertical swinging component.

Detailed description of the invention

[0021] With reference to said figures, the anchoring device for anti fall systems particularly suitable for metallic covers, consists of:

- A shaped base plate (1), in steel or other suitable material, provided with a variety of holes (2) and (3) positioned along its terminal portions, suitable for the installation of rivets, or other similar anchoring means, to fix it to the covering panel; furthermore, the shaped plate (1) has at least four holes (4) to secure a second steel plate (5), and a series of service holes (6) to secure it to the covering beams;
- A second steel plate (5) provided with four holes (7) positioned near the corners in correspondence with the holes (4) on the shaped base plate (1), for securing it to the steel shaped plate (1), and a central hole (8) to secure a retaining means for the anchorage of the rotating base (9).
- A rotating base (9) comprising a U-shaped plate, preferably made of steel, provided with a central hole (10) in the bottom side to secure it to the second steel plate (5) by means of a stopping device which anchors it to said second steel plate (5), but lets it free to rotate 360 degrees; the vertical sides of the rotating base (9) have holes (11) for the insertion of said horizontal rotation pins, holes (12) for the insertion of sealing bolts and holes (13) for the insertion of guarantee bands (13a), preferably made of plastic material, which pass through the holes (13) and are tensed and blocked in correspondence with the sealing bolts.
- A vertical swinging component (14) comprising a steel press-bent plate with holes (15) for the insertion of a horizontal rotation pin, also provided with holes (16) for the insertion of sealing bolts and with holes (17) for the insertion of a coupling loop of the steel safety cable.

[0022] The device of the present invention is installed by fixing the shaped base plate (1) to the covering panel by means of rivets or the like inserted through holes (2 and 3) and, if in correspondence with the cover supporting beam, securing means inserted into holes (6). To the shaped base plate (1) is then coupled the second plate (5) by means of high-strength bolts inserted into holes (7); to the second steel plate (5) is coupled the rotating base (9), let free to rotate 360 degrees by means of a self blocking bolt inserted into a metal sleeve of rotation. To the rotating base (9) is coupled the press-bent plate (14), by means of staybolts inserted into the holes (11) of the rotating base (9) and into the holes (15) of the press-bent plate (14); so that the press-bent plate (14) can rotate relative to the second plate (5) together with the rotating base (9) and take positions different from the vertical one.

[0023] As mentioned, the press-bent plate (14) acts as a "pole" to support the steel cable to which the operator is hanged up with provided safety means during work carried out on the cover.

[0024] During the assembly phase, which provides tensioning of the steel cable of the operator anchoring line, which passes through the holes (17) of the press-bent plate (14), the press-bent plate (14) keeps a vertical position thanks to the side sealing bolts inserted into holes (16); the bolts (16) are suitably sized to withstand the tensioning or the involuntary impact stresses with an operator during standard assembly and use steps.

[0025] In case of fall of an operator, there is a stress on the cable to which the operator is anchored that varies with the geometry and length of the line formed by the cable, and that is transferred to the press-bent plates (14). Press-bent plates (14), thanks to the possibility of rotating about two axes, undergo two movements caused by the action of the cable, through the following steps:

- breakup for the shearing of the side sealing bolts inserted into holes (12-16) for efforts of the cable higher than 200 daN;
- breakup of the guarantee bands (13a) in plastic material inserted into holes (13) as fall indicator which were tensed and blocked in correspondence with the sealing bolts when the device is in a vertical position;
- rotation about the horizontal axis with lowering of the press-bent plate (14) up to the horizontal position parallel to that of the base plate;
- rotation about the vertical axis of the rotating base (9) and of the press-bent plate (14) up to position themselves aligned with the pulling direction of the steel cable of the line;
- beginning of the deformation of the steel cable of line (geometric, elastic and finally plastic) with actuation of the energy dissipator inserted in the line up to the falling stop.

[0026] The double movement system of the final and intermediate components modifies the stresses induced by the steel cable to the anchoring plate and then to the building cover.

[0027] Compared to other anti-fall systems with rigid end poles, flexural stress is greatly reduced by the knocking down of the press-bent plate (14) (rotation about the horizontal axis), which results in turning it into a edgewise effort, lifted a few centimeters from the covering coat, with obvious ease of absorption by the cover.

[0028] Furthermore, the possibility of the components to rotate about a vertical axis, bringing themselves in the pulling direction of steel cable, prevents stress out of main levels of resistance and then the deformation of the components, with torsional stresses on the anchoring plate which indefinably change the stress on anchorages. Possible moves for the devices are defined, being allowed to rotate around clearly identified axes

[0029] This is an important difference from other systems that require the abatement of vertical components for deformation of one or more of their parts, which do not allow to unequivocally define the amount of stress on the anchorage in different configurations as it is not possible to define the deformation level and mode.

[0030] As mentioned above, the possible movements of the system are required and provide the only break of the sealing bolts and guarantee bands.

[0031] After a fall it is required, in accordance with safety rules, to check all the components of the system, and their behaviors which, by the present patent, resulted not deformed after dynamic tests carried out on test field, with the possibility to simply restore the system by testing the anchoring components, and by replacing the sealing bolts and bands, but without the need to replace major components.

[0032] The guarantee band prevents the possible tampering of components that could compromise the safety system operation; in fact, the band covers the safety bolts and prevents them from being replaced by other unsuitable ones without removing the band.

[0033] The presence of the guarantee bands ensures that the system consists of elements correctly assembled and tested. Authorized maintenance envisaged by the laws in force provide for the replacement of the band with another one supplied by the manufacturer to ensure the successful enforcement of the checking for each element.

Claims

1. Anchoring device for anti-fall systems particularly suitable for metal covers comprising covering panels and covering beams, said device being composed of:

   - a shaped base plate (1) in steel or other suitable material, provided with a variety of holes (2, 3) positioned along its terminal portions, suitable for the installation of rivets or other similar anchoring means to secure it to the covering panel; the shaped base plate (1) has also at least four holes (4) to secure a second steel plate (5) and a series of service holes (6) for its securing to the covering beams;
   - a second steel plate (5) provided with four holes (7) arranged near its corners in correspondence with the holes (4) on the shaped base plate (1) and a central hole (8) to secure a retaining means for a rotating base (9) anchorage;
   - a rotating base (9) comprising a U-shaped steel plate, provided with a central hole (10) in the bottom side for its securing to said second steel plate (5), by means of a stopping device which anchors it to said second steel plate (5), but lets it free to rotate 360 degrees about a vertical axis; the vertical sides of the rotating base (9) have holes (11) for the insertion of horizontal rotation pins; holes (12) for the insertion of sealing bolts and holes (13) for the insertion of guarantee bands (13a);
   - a vertical swinging component comprising a steel press-bent plate (14) with holes (15) for the insertion of said horizontal rotation pins such that said steel press-bent plate (14) is free to rotate about a horizontal axis formed by said horizontal rotation pins; holes (16) for the insertion of sealing bolts and holes (17) for the insertion of a coupling loop of the safety steel cable.

2. A method to achieve a fall protection using an assembled anchoring device according to claim 1 **characterized in that** in case of a fall there is a stress on the steel cable of the line, which varies with the geometry and length of the line;
said stress is transferred to the press-bent plate (14);
said press-bent plate (14) thanks to its ability to rotate about two axes undergoes two movements caused by the action of the cable, through the following steps:

    - breakup for the shearing of the side sealing bolts inserted into holes (16) for efforts on cable higher than 200 daN;
    - breakup of the guarantee bands (13a) inserted into holes (13) which act as fall indicator as tensed over sealing bolts;
    - rotation about the horizontal axis with lowering of the press-bent plate (14) up to the horizontal position parallel to that of the shaped base plate (1);
    - rotation about a vertical axis of the rotating base (9) and press-bent plate (14) up to bring themselves aligned with the pulling direction of the steel cable line;
    - beginning of the deformation of the steel cable line, geometric, elastic and finally plastic, with actuation of the energy dissipator inserted in the line up to the stop of the fall.

3. Anchoring device for anti-fall systems particularly suitable for metal covers according to claim 1 **characterized in that** guarantee bands passing through holes (13) are personalized and contain a code which guarantees the product.

4. Anchoring device for anti-fall systems particularly suitable for metal covers according to claim 1 **characterized in that** a guarantee band (13a) covers sealing bolts preventing them from being replaced with unsuitable bolts without removing the band.

Patentansprüche

1. Abspannvorrichtung für Fallsicherungssysteme mit besonderer Eignung für Metallabdeckungen, einschließlich Abdeckplatten und Abdeckbalken, wobei besagte Vorrichtung sich wie folgt zusammensetzt:

    - eine geformte Grundplatte (1) aus Stahl oder aus anderem geeigneten Material mit einer Vielzahl von Löchern (2,3), die längs deren Endbereichen angebracht sind, die sich für die Verlegung von Bolzen oder ähnlichen Abspannmitteln zur Befestigung an der Abdeckplatte eignen; die geformte Grundplatte (1) weist außerdem mindestens vier Löcher (4) zur Befestigung von einer zweiten Stahlplatte (5) sowie eine Reihe von Wartungslöchern (6) zur Befestigung an den Abdeckbalken auf;
    - eine zweite Stahlplatte (5) mit vier Löchern (7) nahe der Ecken derselben auf der Höhe der Löcher (4) in der geformten Grundplatte (1) sowie mit einem mittleren Loch (8) zur Befestigung eines Halterungsmittels zum Abspannen einer rotierenden Basis (9);
    - eine rotierende Basis (9) bestehend aus einer "U" ähnlich geformten Stahlplatte, mit einem Loch (10) in der Mitte der Unterseite zur Befestigung an der besagten zweiten Stahlpatte (5) mit Hilfe einer Haltevorrichtung, welche diese an der besagten zweiten Stahlplatte (5) verankert, diese jedoch zur Drehung um 360° um eine senkrechte Achse frei lässt; die senkrechten Seiten der rotierenden Basis (9) besitzen Löcher (11) zum Einsetzen von Stiften zur waagrechten Drehung; Löcher (12) zum Einsetzen von Dichtungsschrauben sowie Löcher (13) zum Einschub von Garantiebändern (13a);
    - eine senkrechte Schwingkomponente bestehend aus einer druckgebogenen Stahlplatte (14) mit Löchern (15) zum Einsetzen besagter Stifte zur waagrechten Drehung, damit besagte druckgebogene Stahlplatte (14) sich frei um eine waagrechte Achse drehen kann, die von den besagten Stiften zur waagrechten Drehung gebildet wird; Löcher (16) für den Einsatz der Dichtungsbolzen und Löcher (17) zum Einsetzen der Schlaufe zum Ankuppeln des Sicherheitsstahlkabels .

2. Eine Methode zur Herstellung eines Fallschutzes unter Verwendung einer montierten Abspannvorrichtung nach dem Anspruch 1, **dadurch gekennzeichnet, dass** bei einem Fall das Stahlkabel der Linie belastet wird, die sich je nach Geometrie und Länge der Linie verändert; besagte Belastung wird auf die druckgebogenen Platte (14) übertragen; dank der Fähigkeit, sich um zwei Achsen zur drehen, wird besagte druckgebogene Platte (14) unter der Wirkung des Stahlkabels durch folgende Schritte zwei Bewegungen ausgesetzt:

    - Auseinanderbrechen infolge von Abscherung der seitlich in die Löcher (16) eingesetzten Dichtungsbolzen durch Beanspruchungen an dem Kabel von mehr als 200 daN;
    - Reißen der in die Löcher (13) eingesetzten Garantiebänder (13a), die aufgrund ihrer Spannung über den Dichtungsbolzen als Fallanzeiger arbeiten;
    - Drehung um die waagrechte Achse mit Absenken der druckgebogenen Platte (14) bis zur waagrechten Stellung parallel zur geformten Grundplatte (1);

- Drehung der rotierenden Basis (9) um eine senkrechte Achse sowie um die druckgebogene Platte (14) bis sie eine zur Zugrichtung des Stahlkabellinie ausgerichtete Stellung einnimmt;
- Beginn der Deformation der (geometrischen, elastischen und zuletzt plastischen) Stahlkabellinie mit Betätigung des in die Linie eingesetzten Kraftableiters bis zum Stoppen des Falls.

3. Abspannvorrichtung für Fallsicherungssysteme mit besonderer Eignung für Metallabdeckungen gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die durch die Löcher (13) laufenden Garantiebänder kundenspezifisch sind und einen Code zur Garantie des Produkts enthalten.

4. Abspannvorrichtung für Fallsicherungssysteme mit besonderer Eignung für Metallabdeckungen nach Anspruch 1 **dadurch gekennzeichnet, dass** ein Garantieband (13a) die Dichtungsbolzen abdeckt und verhindert, dass diese ohne das Band zu entfernen durch ungeeignete Bolzen ersetzt werden.

Revendications

1. Dispositif d'ancrage pour systèmes antichute particulièrement indiqué pour couvertures métalliques comprenant des panneaux de couverture et des poutres de couverture, ledit dispositif étant composé de:

- une plaque de base galbée (1) en acier ou autre matériel idoine, pourvue de multiples trous (2, 3) disposés le long de ses unités terminales, indiqués pour la pose des rivets ou autres moyens d'ancrage similaires pour la fixer au panneau de couverture; la plaque de base galbée (1) présente en outre au moins quatre trous (4) pour la fixation d'une deuxième plaque en acier (5) et une série de trous d'inspection (6) pour sa fixation aux poutres de couverture;
- une deuxième plaque en acier (5) pourvue de quatre trous (7) disposés à proximité de ses angles en face des trous (4) présents sur la plaque de base galbée (1) et d'un trou central (8) pour la fixation d'un moyen de retenue pour l'ancrage d'une base rotative (9);
- une base rotative (9) composée d'une plaque galbée en "U" fabriquée en acier, pourvue d'un trou central (10) dans sa partie inférieure pour sa fixation à ladite deuxième plaque en acier (5), au moyen d'un système de blocage qui la fixe à ladite deuxième plaque en acier (5), tout en la laissant libre de tourner à 360 degrés autour d'un axe vertical; les côtés verticaux de la base rotative (9) présentent des trous (11) pour l'insertion de pivots de rotation horizontale; des trous (12) pour l'insertion de boulons d'étanchéité et des trous (13) pour l'insertion de bandes de sécurité (13a);
- une composante verticale flottante composée d'une plaque presse-pliée (14) en acier avec des trous (15) pour l'insertion des dits pivots de rotation horizontale de sorte que ladite plaque presse-pliée (14) est libre de tourner autour d'un axe horizontal formé par lesdits pivots de rotation horizontale; de trous (16) pour l'insertion des boulons d'étanchéité ainsi que de trous (17) pour l'insertion du passant pour l'attelage du câble de sécurité en acier.

2. Une méthode pour réaliser une protection de la chute en se servant d'un dispositif d'ancrage assemblé tel qu'il a été décrit dans la revendication 1, **caractérisé par le fait qu'**en cas de chute il y aura une contrainte sur le câble en acier de la ligne, qui varie suivant la géométrie et la longueur de la ligne;
ladite contrainte est transférée à la plaque presse-pliée (14); ladite plaque presse-pliée (14), grâce à sa capacité de tourner autour de deux axes, subit deux mouvements sous l'action du câble en acier à travers les phases suivantes:

- rupture par cisaillement des boulons d'étanchéité latéraux insérés dans les trous (16) à la suite d'efforts sur le câble supérieurs à 200 daN;
- rupture des bandes de sécurité (13a) insérées dans les trous (13) qui servent d'indicateurs de chute puisqu'elles sont tendues sur les boulons d'étanchéité;
- rotation autour de l'axe horizontal avec abaissement de la plaque presse-pliée (14) jusqu'à la position horizontale parallèle à la plaque de base galbée (1);
- rotation autour de l'axe vertical de la base rotative (9) et de la plaque presse-pliée (14) jusqu'à se mettre en alignement avec la direction de la traction du câble en acier de la ligne;
- début de la déformation du câble en acier de la ligne, géométrique, élastique et puis plastique, avec actionnement du dissipateur d'énergie inséré dans la ligne jusqu'à l'arrêt de la chute.

3. Dispositif d'ancrage pour systèmes antichute particulièrement indiqué pour couvertures métalliques selon la revendication 1 **caractérisé par le fait que** les bandes de sécurité traversant les trous (13) sont personnalisées et portent un code garantissant le produit.

4. Dispositif d'ancrage pour systèmes antichute particulièrement indiqué pour couvertures métalliques selon la revendication 1 **caractérisé par le fait qu'**une bande de sécurité (13a) recouvre les boulons d'étanchéité pour empêcher qu'ils soient remplacés

par des boulons inadéquats sans enlever la bande.

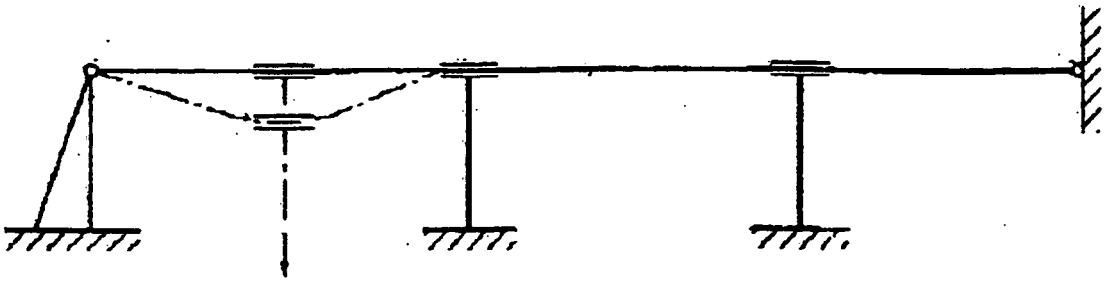

FIG 1

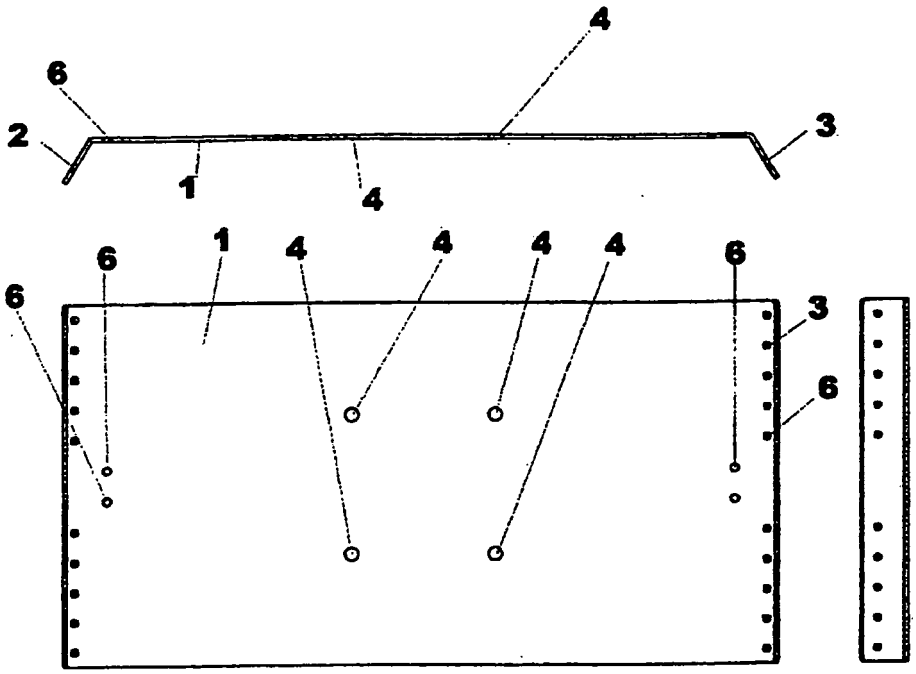

FIG. 2

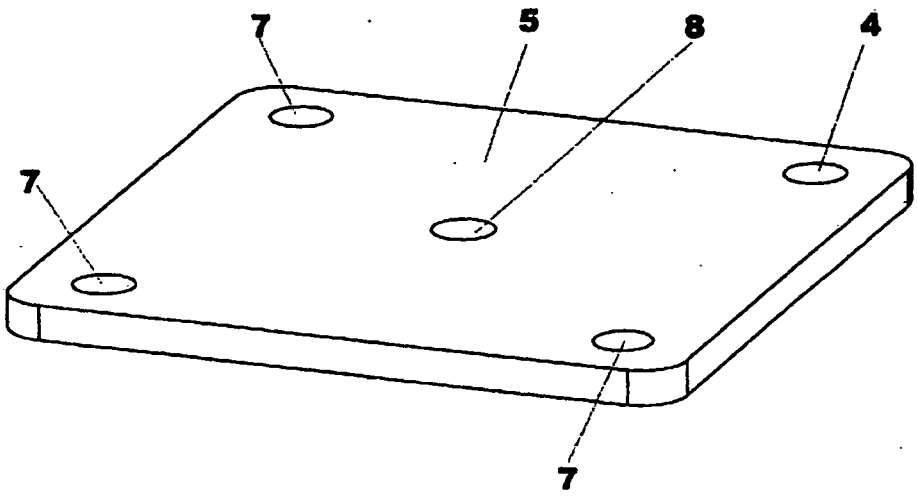

FIG 3

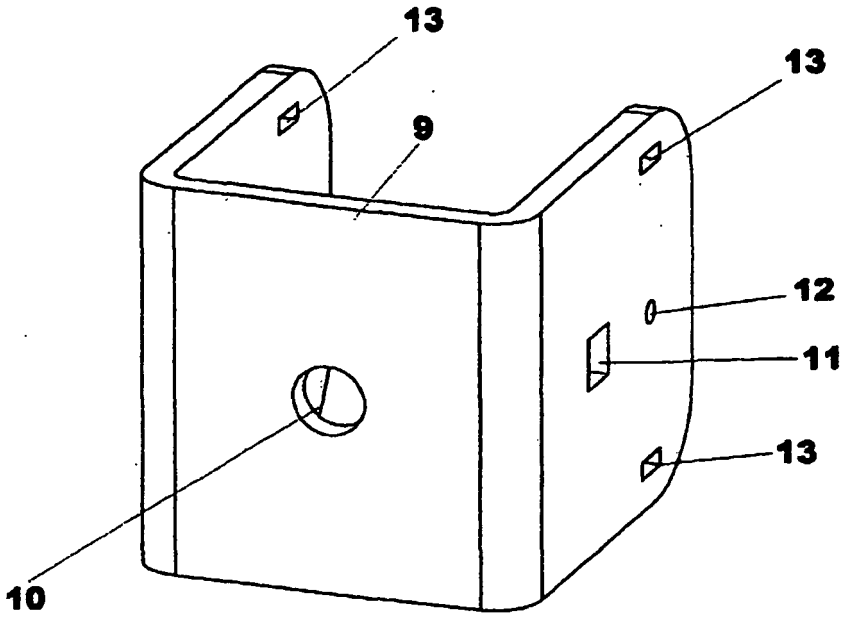

FIG. 4

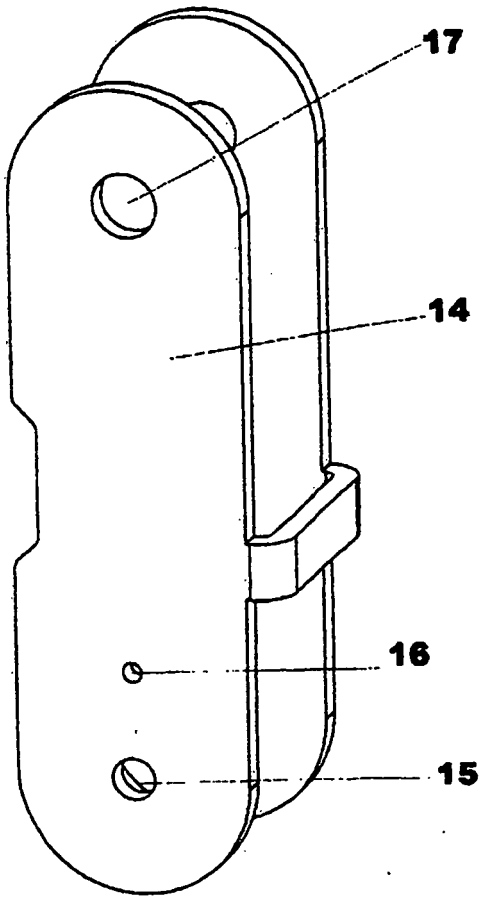

FIG.5

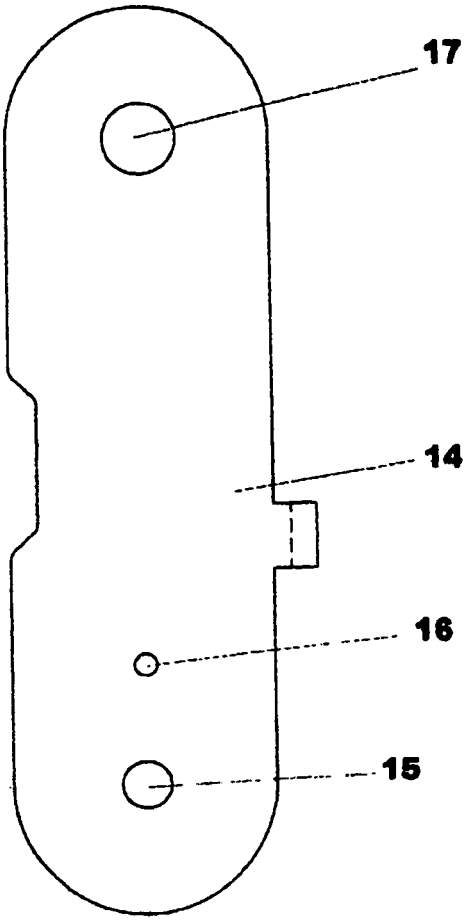

FIG.6

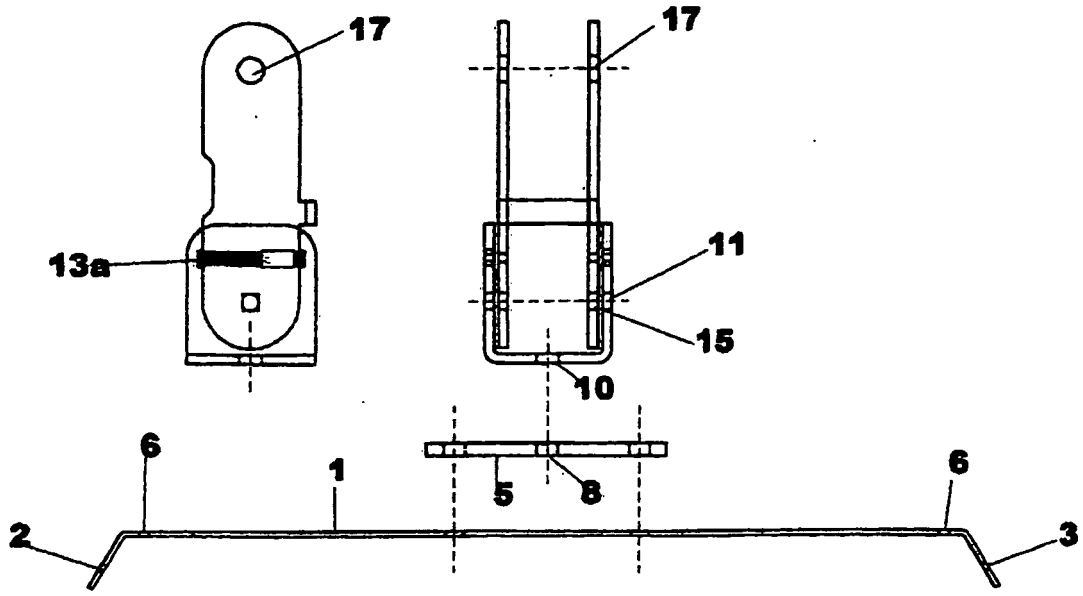

FIG.7

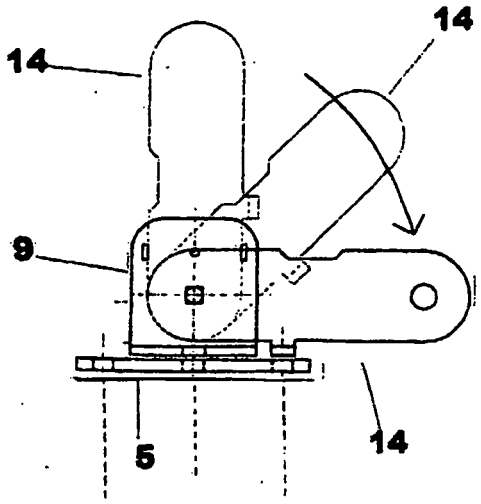

FIG.8

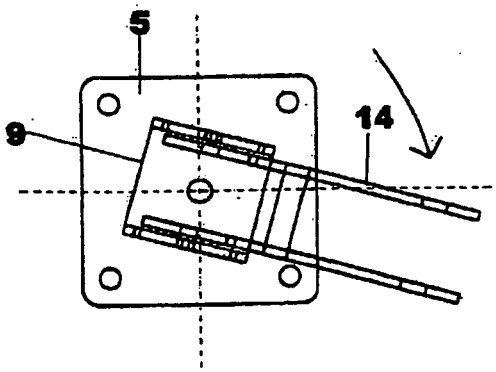

FIG.9

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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