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(54) **Locking system for wired panels of a fence**

Verschlussystem für Zaungittermatten

Système de fermeture pour des treillis de clôture

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Description

[0001] The present invention relates to the technical field concerning boundary walls, placed to fence working areas of yards, industrial facilities and machineries, automated robots, storage areas and generally any place, where it is necessary to separate an area from the surrounding areas, so as to protect workers, users, unauthorised persons or passers-by. The above mentioned barriers are usually made of a plurality of posts, which have a base or are secured to the ground, and which are arranged suitably spaced apart, and a corresponding series of wall panels, aimed at closing the gaps between the adjacent posts. According to a widespread solution, the panels are made of a metallic net structure, which gives appropriate strength without being excessively heavy, and at the same time, it allows a visual control of what is going on inside the fenced area.

[0002] The net structure of the panels is preferred, where possible, also for aesthetic reasons, since it is visually less "overwhelming" with respect to a blind panel.

[0003] The same Applicant owns the Italian Patent no. 1,334,471, which discloses a "Boundary wall", in which the panels have a net structure without a frame and are crossed by horizontal ribs, made at different heights with a trapezoid profile.

[0004] The panels are fastened to the posts by means of shaped plates, which are associated to the two ends of each rib and are then secured to the corresponding posts by means of relative bolts, screwed into corresponding threaded holes made on the posts; as a consequence of tightening the plates to the posts, the respective portions of the vertical wires of the net situated along the panel sides becomes locked, so that the panel cannot slide in any way.

[0005] In order to facilitate the assembly step, each plate, according to the invention, has temporary coupling elements, which include holding teeth allowing the plate to remain hung to the panel, in determined conditions, during the transitory step between the panel positioning and the beginning of screwing the relative bolt.

[0006] In many applications of the above mentioned boundary walls, it is necessary that the latter satisfy precise safety regulations.

[0007] In the European Union, there have been introduced regulations (L. 157/43 EU's Official Gazette of 9/6/2006), which provide the following requirements for fixed protections:

- avoiding them or making them inefficient must not be easy;
- the fixed protections must be fastened with systems that require tools to be used to open or disassemble them;
- the fastening systems must remain attached to the protections or to the machine when the protections are removed;
- if possible, the protections must not remain in their

position in absence of their fastening means.

[0008] The boundary walls obtained according to the above mentioned patent meet only partially the above specified requirements.

[0009] In particular, it is found that the shape of said temporary coupling elements allows the plate to be kept fastened to the panel in a very precarious way, only if the panel is kept perfectly vertical, moved slowly, in absence of shakes and accidental hits.

[0010] Therefore, in practice, said temporary coupling elements are functional, with due care, only during the assembly step, as it has been specified, among other things, in said patent objects, while they are almost inefficient during the panel disassembling step and when the panel, separated from the posts, is replaced at the side in a casual position.

[0011] Still with reference to the assembly step, it has been also found that the plates of known type, due to the precarious holding by said temporary coupling elements, do not ensure sufficient support for the panel in the correct position when the bolts are screwed only partially, which from time to time causes some difficulties in the respective assembling operations.

[0012] The regulation, according to which the fastening systems must remain fastened to the protections, concerns obviously, also the bolt associated to each plate; in the solution reported in the above mentioned patent, it is inserted freely in a slotted hole of the plate and thus the bolt is not constrained thereto in any way.

[0013] A further aspect that does not meet the requirements derives from the fact that, if in a panel, fastened to the relative posts, for example with four plates for each side, three plates are removed on each side, leaving only the two highest ones, the panel can be supported, but it is not prevented from being rotated, in either direction, about the horizontal axis of the two remaining bolts, thus nullifying the barrier function.

[0014] The patent documents FR 2 175 171 and US 5 747 040 describe as many fastening devices for modular delimiting panels that present the characteristics described in the preamble of the claim 1. However, the above mentioned devices do not support efficiently and securely the corresponding panels, to which they are associated, before locking the devices to the relative posts is completed.

OBJECTS OF THE INVENTION

[0015] Therefore, it is an object of the present invention to propose a system for defining and fastening a boundary wall, conceived so as to fully meet the current Community regulations concerning fixed protections, and consequently, capable of obtaining all the necessary certificates

[0016] Another object of the invention is to provide a locking system that overcomes the reported disadvantages of the known solution, occurring during the assem-

bly step, as mentioned in the introduction.

[0017] Still a further object of the invention is to develop a locking system, formed so that it can be used also on the previous type boundary walls, so as to adapt them to the most recent regulations.

[0018] Yet a further object of the invention is to present a locking system so designed as not to require right and left elements in order to avoid errors during the assembling step, and at the same time, to contain the production costs.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The characteristic features of the invention will become evident from the following description of a preferred embodiment of the locking system under discussion, in accordance with the contents of the claims and with the help of the enclosed drawings, in which:

- Fig. 1 shows a perspective view of a panel with the locking system under discussion separated by a respective pair of posts;
- Fig. 2 shows a perspective view, enlarged with respect to Fig. 1, of a portion of a post and a plate of said locking system, from the side, from which the associated holding means are visible;
- Fig. 3 shows a perspective view, enlarged with respect to Fig. 1, of the left upper portion of the panel, fastened to the corresponding post.
- Fig. 4 shows a perspective view, symmetrical to Fig. 3, of the right upper portion of the panel, fastened to the corresponding post.

DETAILED DESCRIPTION OF THE INVENTION

[0020] With reference to the above mentioned Figures, reference numeral 1 indicates a boundary wall as a whole, mentioned in the introduction, aimed at fencing working areas of yards, industrial facilities and machineries, automated robots, storage areas and generally any place where it is necessary to separate an area from the surrounding areas, so as to protect workers, users, unauthorised persons or passers-by.

[0021] The boundary wall 1 includes, in a way known in itself, a modular structure, stackable as required, made of a plurality of posts 2, for example of the type that can be fastened to the ground by means of rawlplugs, spaced out at prefixed distances along the periphery of the area to circumscribe, and a corresponding series of wall panels 3, fastened to the posts 2 and aimed at closing the gaps between the adjacent posts. The posts 2 are preferably made of a square cross-section metallic tube.

[0022] The panels 3 are made, at least along the respective sides 3A, 3B, of a net structure without a frame, generally metallic, defined by horizontal wires 30 and vertical wires 31, mutually arc-welded.

[0023] The panels 3 are crossed by horizontal ribs 13, made at different heights, having a trapezoid profile, and

extending from one side to the other; the depth of the ribs 13 is suitably smaller than the dimension of the post 2 side.

[0024] For sake of simplicity, Fig. 1 illustrates a boundary wall 1 defined by a single pair of posts 2 and only one panel 3.

[0025] The locking system S according to the invention is aimed at coupling the panels 3 with the respective posts 2 and includes at least two shaped plates 4 for each panel 3, in the minimum configuration; in the example of Fig. 1, referred to a system for boundary walls 1 complying with the European regulations, there are four pairs of shaped plates 4.

[0026] The shaped plates 4 are made of press-moulded metallic sheet and have a vertically elongated form with dimension longer than the height of the above mentioned ribs 13.

[0027] In the plate 4, which defines a face M, aimed at being turned towards the corresponding side of the post 2, there is made a slot 40, with introduced therein a screw element, formed by a bolt 5, aimed at engaging with a corresponding threaded hole 20 made in the post 2 (Fig. 2). Holding means 15, associated to said bolt 5, are aimed at keeping the latter fixed to the respective plate 4, when the plate is separated from the post 2.

[0028] Said holding means 15 are formed, for example, by a washer of elastomeric material, fitted adherently onto the threaded shank of the bolt 5, at the side corresponding to the face M of the plate 4 (see again Fig. 2).

[0029] There are hook-shaped coupling means 6 in the plate 4, aimed at fixing the latter to the corresponding net structure of said panel 3, when the panel is separated from the above mentioned posts 2, with the hook-shaped coupling means 6 being also aimed at supporting the respective side 3A, 3B of said panel 3, as a consequence of at least partial screwing of said bolt 5 in the foregoing threaded hole 20; the above mentioned functions of the hook-shaped coupling means 6 will be better described later on.

[0030] The above mentioned hook-shaped coupling means 6 are formed, for example, by two hooks 60, made integral with the plate 4, at the opposite ends thereof, oriented symmetrical to each other, so as to face each other and substantially coplanar with the plate 4.

[0031] In the plate 4, there are also stabilising means 7, made working by tightening of said bolt 5 in said threaded hole 20 and aimed at preventing the plate 4 and the associated panel 3 from rotating with respect to the axis of the bolt 5, also in co-operation with said hook-shaped coupling means 6, as better described later on.

[0032] Said stabilising means 7 are formed, for example, by at least one square wing 70, made integral with the plate 4 in the respective vertical side 4A interposed between said hooks 60, in an asymmetrical position, so as to be offset with respect to the slot 40.

[0033] The square wing 70 extends horizontally and is formed by a first segment 70A, coplanar with the plate 4, and a terminal portion 70B, perpendicular to the plate

and turned outwards of said face M.

[0034] The mounting of the boundary wall 1 includes initially, as usual, placing the posts 2 at the determined distance and in a suitable alignment.

[0035] Respective plates 4 are positioned at the two ends of each rib 13, the plates having their bolt 5 and washer 15 and being oriented so that the respective faces M are turned outwards. Each plate 4 is introduced in the last mesh of the net close to the corresponding side 3A, 3B of the panel 3, taking care to couple the hook 60, situated at top, to the corresponding horizontal wire 30; in this way, the face M contacts the portions of the outermost vertical wire 31, that define the oblique sides of the trapezoid profile of said rib 13.

[0036] The panel 3 with the plates 4 and the respective bolts 5 (Fig. 1) are fastened one to another and consequently, it is possible to handle the whole without excessive care, to place it between the posts 2: by screwing partially, by hand, the bolts 5 of the topmost couple of plates 4, a temporary support of the panel 3 is obtained immediately, thus allowing to release it, so as to continue, with all ease, to screw the remaining bolts 5 and consequently to tighten them.

[0037] Similarly to the known solution mentioned in the introduction, due to tightening the bolts 5, the plates 4 clamp said respective portions of the vertical wires 31 against the corresponding post 2, so that the panel 3 is prevented from sliding in any direction (Figs. 3 and 4).

[0038] Due to tightening the respective bolt 5, the terminal portion 70B of the wing 70 of each plate 4 goes in abutment against the side of the corresponding post 2, orthogonal to the one, against which the plate 4 rests.

[0039] Fig. 3 illustrates a portion of the upper rib 13, at the left side 3A, with the respective plate 4 clamping the rib to the corresponding post 2; the square wing 70, situated lower with respect to the slot 40, and consequently, to the axis of the bolt 5, gives a one direction anti-rotation constraint.

[0040] Fig. 4 illustrates another portion of the upper rib 13, at the right side 3B, with the respective plate 4 clamping the rib to the corresponding post 2; since this plate 4 is identical with the other one and is only arranged overturned, the respective square wing 70 is situated, in this case, higher than the slot 40 and therefore gives an anti-rotation constraint in the direction opposite to the one of the other wing 70.

[0041] With only one wing 70 for each plate 4 and making use of the alternate orientation that derives from its asymmetrical position on the plate, the regulations mentioned in the introductory note are met; actually, even after removing the three plates 4 below the upper one from each side 3A, 3B, the panel 3 is prevented from rotating with respect to the common axis of the two remaining bolts 5, in either direction, due to the combined action of the two wings 70.

[0042] The panel 3 rotation is advantageously prevented also by the fact that a hook 60 of each plate 4 is always engaged with a corresponding horizontal wire 30 and

consequently makes the constraint between the panel 3 and plate 4 more stable; depending on the height, at which the plate is locked, the engaged hook can be the lower hook 60 (Fig. 3) or the upper one (Fig. 4).

[0043] The constructive solution that includes only one asymmetric wing 70, aimed at having the foregoing alternate orientation, appears to be still further convenient, when an post 2 is positioned at a corner of the boundary wall 1, since it allows to fasten two plates 4 on two adjacent sides of said post 2 without interference of the wing 70 of one plate with the other one.

[0044] When a panel 3 must be removed from the respective posts 2, the operation can be performed keeping the respective plates 4, as well as the corresponding bolts 5, locked to the panel 3, according to the regulation that sets out this requirement (see again Fig. 1). The peculiar characteristics of the locking system under discussion appear extremely evident from what above, said system allowing to prepare boundary walls which are totally complying with the Community regulations that concern fixed protections and, at the same time, avoiding the reported drawbacks of the known solution during the assembly step.

[0045] The proposed locking system is thus suitable for obtaining boundary walls provided with the required safety certifications; this important property allows also to adapt the pre-existing barriers.

[0046] A further advantageous aspect of the locking system under discussion derives from the fact that the same plate is used without distinction in the two sides of the panel and the only asymmetric element, i.e. the square wing, performs a function that completes the function of the other, due to this asymmetry.

[0047] The positive characteristics of the described locking system allow the barrier to be assembled and disassembled, easily and without errors, by only one operator.

[0048] Finally, the system simplicity allows the production costs to be contained within a range of values very similar to those of the previous solution.

[0049] It is understood that what above has been said as a not limiting example, therefore possible detail changes, that could become necessary due to the technical-functional reasons, are hitherto considered within the protective scope defined by the following claims.

Claims

1. A locking system for defining a boundary wall, the latter of the type comprising at least two posts (2), arranged at a predetermined distance from one each other, and a wall panel (3), in which panel at least the respective sides (3A, 3B) are formed by a net structure, said panel being designed to be fastened to said posts (2) to close the gap between them, said locking system (S) comprising at least two shaped plates (4), aimed at engaging with corresponding

vertical wires (31), situated at the ends of said net structure, for fastening said corresponding side (3A, 3B), each of said shaped plates (4) including: a screw member (5), designed to engage with a corresponding threaded hole (20) made in said corresponding post (2); hook-shaped coupling means (6), defined in said shaped plate (4) and aimed at fastening the latter to the corresponding net structure of said panel (3), said locking system (S) being **characterised in that** said hook-shaped coupling means (6) are substantially coplanar with the respective shaped plate (4) to support the respective side (3A, 3B) of said panel (3), due to at least partial screwing of said screw member (5) in the foregoing threaded hole (20).

2. A locking system, as claimed in claim 1 **characterised in that** said hook-shaped coupling means (6) are formed by two hooks (60), made integral with said shaped plate (4), at the opposite ends thereof, oriented symmetrical, so as to be turned one towards the other.
3. A locking system, as claimed in claim 1 **characterised by** including holding means (15), associated to said screw member (5) and aimed at keeping the latter fastened to the respective shaped plate (4), when the plate is separated from said post (2).
4. A locking system, as claimed in claim 3 **characterised in that** said holding means (15) are formed by a washer of elastomeric material, fitted adherently onto the threaded shank of said screw member (5), on the side corresponding to a face (M) of said shaped plate (4) turned towards said post (2).
5. A locking system, as claimed in claim 1 **characterised by** including, in 5) each of said shaped plates (4), stabilising means (7), operated by tightening said screw member (5) in said threaded hole (20) and aimed at preventing the plate (4) and the associated panel (3) from rotating with respect to the axis of the screw member (5).
6. A locking system, as claimed in claim 5 **characterised in that** said stabilising means (7) are aimed at preventing said rotations of said respective shaped plate (4) and the associated panel (3), in a prefixed direction and are aimed at co-operating with complementary stabilising means (7) of the opposite plate (4), in turn aimed at preventing rotations of the plate (4) and the panel (3) in the opposite direction.
7. locking system, as claimed in claim 5 or in claim 6 **characterised in that** said 7) A locking system, as claimed in claim 5 or in claim 6 **characterised in that** said stabilising means (7) are formed by at least one square wing (70), made integral with said plate

(4) at a respective vertical side (4A), so as to be offset with respect to the axis of said screw member (5), alternately above and below the latter, according to the side of the post (2), to which the plate (4) is fastened, with said square wing (70) extending horizontally to define a first segment (70A), coplanar with the plate (4) and a terminal portion (70B), perpendicular to the latter and aimed at going in abutment a side of said post (2), orthogonal to the one, to which the shaped plate (4) is fastened.

Patentansprüche

1. Ein Befestigungssystem zur Definition einer neuartigen Einfriedungsmauer bestehend aus wenigstens zwei Pfosten (2), die in einem vorbestimmten Abstand zueinander angeordnet sind und aus einer Wandplatte (3), wo mindestens die jeweiligen Seiten (3A, 3B) durch eine Netzstruktur gebildet sind, wobei die Platte dazu bestimmt ist, an den genannten Pfosten (2) befestigt zu werden, um die Lücke zueinander zu schließen und das gesagte Befestigungssystem (S) besteht mindestens aus zwei geformten Platten (4) zum Eingriff in die entsprechenden senkrechten Drähten (31), die sich an den Enden der genannten Netzstruktur befinden und zur Befestigung der entsprechenden Seiten (3A, 3B), wobei jede geformte Platte (4) wie folgt aufweist: Ein Schraubelement (5) zum Eingriff in die entsprechende Gewindebohrung (20) in dem genannten einschlägigen Pfosten (2) ausgelegt; hakenförmige Kopplungsmittel (6), in der gesagten geformten Platte (4) definiert und zur Befestigung der letzteren an der entsprechenden Netzstruktur der genannten Wandplatte (3), das oben erwähnte Befestigungssystem (S) ist **dadurch gekennzeichnet, daß** die vorgenannten hakenförmigen Kopplungsmittel (6) im wesentlichen koplanar mit der einschlägigen geformten Platte (4) sind, um die entsprechende Seiten (3A, 3B) der gesagten Wandplatte (3) zu stützen und dies ist wenigstens einem teilweisen Einschrauben des vorgesagten Schraubelements (5) in der vorigen Gewindebohrung (20) zuzuschreiben.
2. Ein Befestigungssystem nach Anspruch 1, **dadurch gekennzeichnet, daß** die vorgesagten hakenförmigen Kopplungsmittel (6) aus zwei mit der vorgesagten geformten Platte (4) integrierenden Haken (60) bestehen, die sich an den gegenüberliegenden Enden laut einer symmetrischen Ausrichtung befinden, um eine gegenseitige Drehung zu ermöglichen.
3. Ein Befestigungssystem nach Anspruch 1, **dadurch gekennzeichnet, daß** die illustrierten mit dem vorgenannten Schraubelement (5) verbundenen Halteinrichtungen (15) die Befestigung dieses letzteren an der einschlägigen geformten Platte (4) bei Tren-

nung solcher Platte aus dem vorgenannten Pfosten (2) gestatten.

4. Ein Befestigungssystem nach Anspruch 3, **dadurch gekennzeichnet, daß** die vorgenannten Halteeinrichtungen (15) aus einer Scheibe von gummiartigem dem Innenanzugsgewinde anhaftendem Material des vorgedachten Schraubelements (5) auf der Seite, die der Fläche (M) der vorgenannten geformten Platte (4) entspricht und dem gesagten Pfosten (2) zugewandt ist, bestehen. 5 10
5. Ein Befestigungssystem nach Anspruch 1, **dadurch gekennzeichnet, daß** es in jeder geformten Platte (4) - Stabilisierungsmittel (7) einschließt, die durch das Anziehen der vorgenannten Schraubelemente (5) in der gesagten Gewindebohrung (20) betrieben werden und dies mit dem Ziel, die Drehung der Platte (4) und der verbundenen Wandplatte (3) gegenüber der Achse des Schraubelements (5) zu verhindern. 15 20
6. Ein Befestigungssystem nach Anspruch 5, **dadurch gekennzeichnet, daß** die vorgedachten Stabilisierungsmittel (7) die vorgenannten Drehungen der einschlägigen geformten Platte (4) und der verbundenen Wandplatte (3) in einer vorbestimmten Richtung verhindern sollen, und zu das Zusammenwirken mit den ergänzenden Stabilisierungsmitteln (7) der gegenüberliegenden Platte (4) ebenso wie zur Verhinderung der Drehungen der Platte (4) und der Wandplatte (3) in der entgegengesetzten Richtung vorgesehen werden. 25 30
7. Ein Befestigungssystem nach Anspruch 5 oder 6, **dadurch gekennzeichnet, daß** die vorerwähnten Stabilisierungsmittel (7) aus wenigstens einem quadratischen Seitenflügel (70), das mit der genannten Platte (4) an einer einschlägigen Senkrechtheite (4A) fest verbunden ist, bestehen und gegenüber der Achse des vorgedachten Schraubelements (5), abwechselnd oberhalb und unterhalb der letzteren, versetzt werden und dies erfolgt laut der Seite des Pfostens (2), woran die Platte (4) befestigt ist und mit dem vorgenannten quadratischen Seitenflügel (70), das sich waagrecht ausdehnt, um ein erstes mit der Platte (4) koplanares Segment (70A) und einen zum letzteren senkrechten Endabschnitt (70B) zu definieren, der zur Abstützung auf einer Seite dieses Pfostens (2), der rechtwinklig zum anderen steht, woran die geformte Platte (4) befestigt ist, vorgesehen wird. 35 40 45 50

Revendications

1. Système de fermeture pour réaliser des treillis de clôture, ce dernier du type comprenant au moins deux montants (2), disposées à une distance prédé-

terminée l'un de l'autre, et un panneau de cloison (3), où au moins les côtés (3A, 3B) dudit panneau (3) sont formés par une structure réticulaire, ledit panneau est destiné à être fixé aux montants (2) pour fermer l'espace entre eux, ledit système de fermeture (S) comprenant au moins deux plaques profilées (4), destinées à engager des correspondants fils verticales (31), placés aux extrémités de ladite structure réticulaire, pour fixer ledit correspondant côté (3A, 3B), chacune desdites plaques profilées (4) comprenant: un élément à vis (5), prévu pour engager un correspondant trou taraudé (20) réalisé dans ce correspondant montant (2); des moyens de couplage (6) conformés à crochet, réalisés dans cette plaque profilée (4) et aptes à fixer cette dernière à la correspondante structure réticulaire dudit panneau (3), ou ledit système de fermeture (S) est **caractérisé en ce que** ledit moyens de couplage (6) à crochet sont fondamentalement coplanaires avec la respective plaque profilée (4) pour supporter le respectif côté (3A, 3B) dudit panneau (3), au moyen d'une au moins partiel vissage dudit élément à vis (5) dans son correspondant trou taraudé (20).

2. Système de fermeture, selon la revendication 1, **caractérisé en ce que** ledit moyens de couplage (6) à crochet sont formés par deux crochets (60), réalisés en corps unique avec ladite plaque profilée (4), aux extrémités opposées de cette dernière, et orientées symétriquement, de moyen d'être tournés l'un vers de l'autre. 25 30
3. Système de fermeture, selon la revendication 1, **caractérisé en ce que** il comprends des moyens de rétention (15), associés audit élément à vis (5) et destiné à tenir ce dernier fixé à sa respective plaque profilée (4), lorsque la plaque est séparée dudit montant (2). 35 40
4. Système de fermeture, selon la revendication 3, **caractérisé en ce que** lesdits moyen de rétention (15) sont formés d'une rondelle de matériel élastomérique, montée en relation d'adhérence sur le tige passémenté dudit élément à vis (5), du côté correspondant à la face (M) de ladite plaque profilée (4) orientée vers ledit montant (2). 45 50
5. Système de fermeture, selon la revendication 1, **caractérisé en ce que** il comprends, en chacune des plaques profilées (4), des moyens de stabilisation (7), actionnés en serrant ledit élément à vis (5) en dit trou taraudé (20) et destiné à s'opposer à des rotations de la plaque (4) e du panneau (3) associé par rapport à l'axe de l'élément à vis (5). 55
6. Système de fermeture, selon la revendication 5, **caractérisé en ce que** lesdits moyens de stabilisation (7) sont destinés à s'opposer à des rotations de la

respective plaque profilée (4) e du panneau (3) associé dans une direction préétablie, et ils sont destinés aussi à coopérer avec des moyens de stabilisation (7) complémentaires de la plaque (4) opposée, à son tour destinée à s'opposer à des rotations de la plaque (4) e du panneau (3) dans la direction contraire.

7. Système de fermeture, selon la revendication 5 ou la revendication 6, **caractérisé en ce que** lesdits moyens de stabilisation (7) sont formés par au moins une ailette carrée (70), réalisée en corps unique avec ladite plaque (4) dans un respectif côté verticale (4A), en moyen d'être décalée par rapport à l'axe dudit élément à vis (5), alternativement au dessus et au dessous de ce dernier, selon le côté du montant (2), auquel la plaque (4) est fixée, avec ladite ailette carrée (70) s'étendant horizontalement pour définir un premier segment (70A), coplanaire avec la plaque (4) et une portion terminale (70B), perpendiculaire à cette dernière et destinée à se disposer contre d'un côté dudit montant (2), orthogonal à celui auquel la plaque profilée (4) est fixée.

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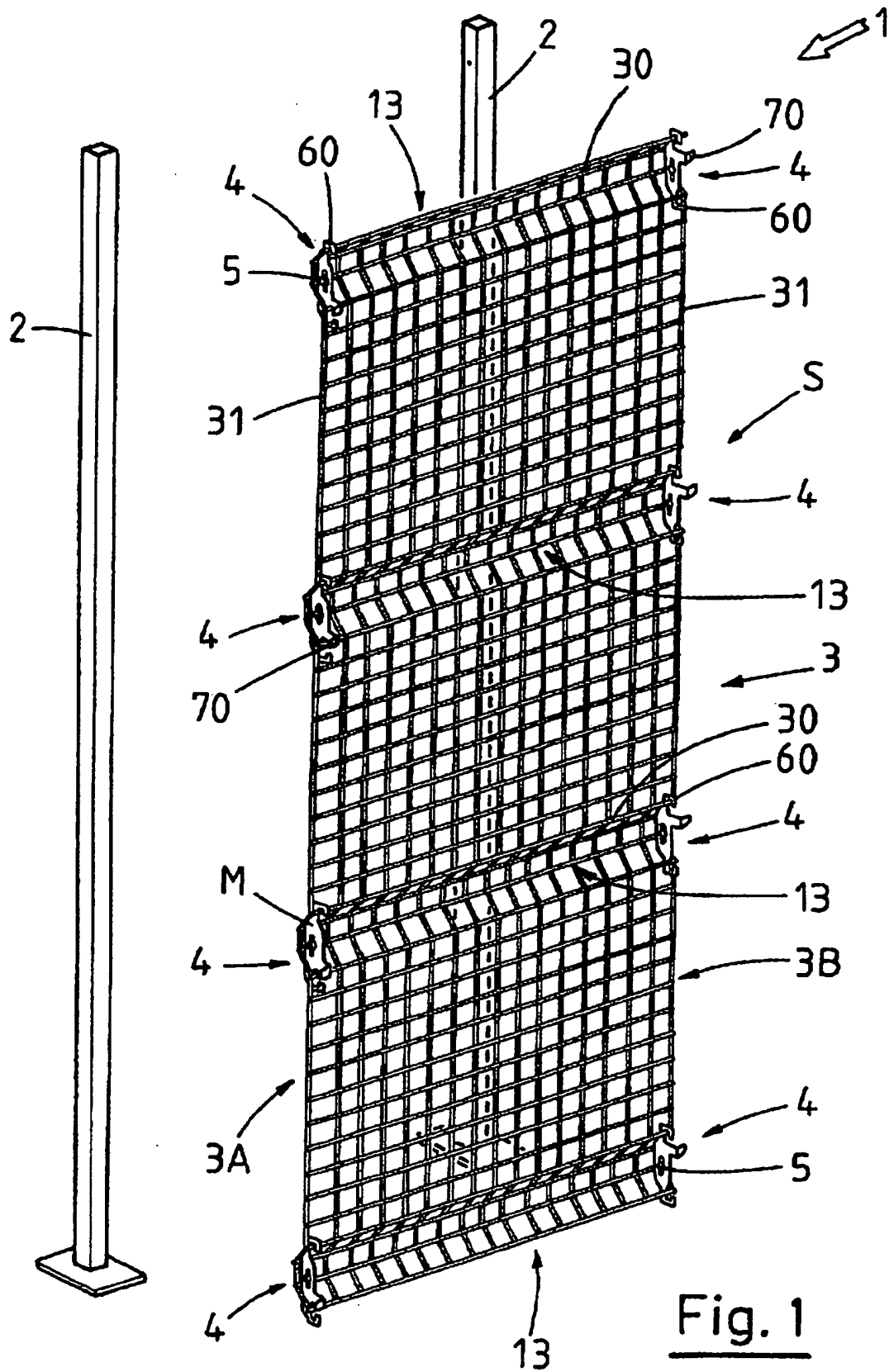


Fig. 1

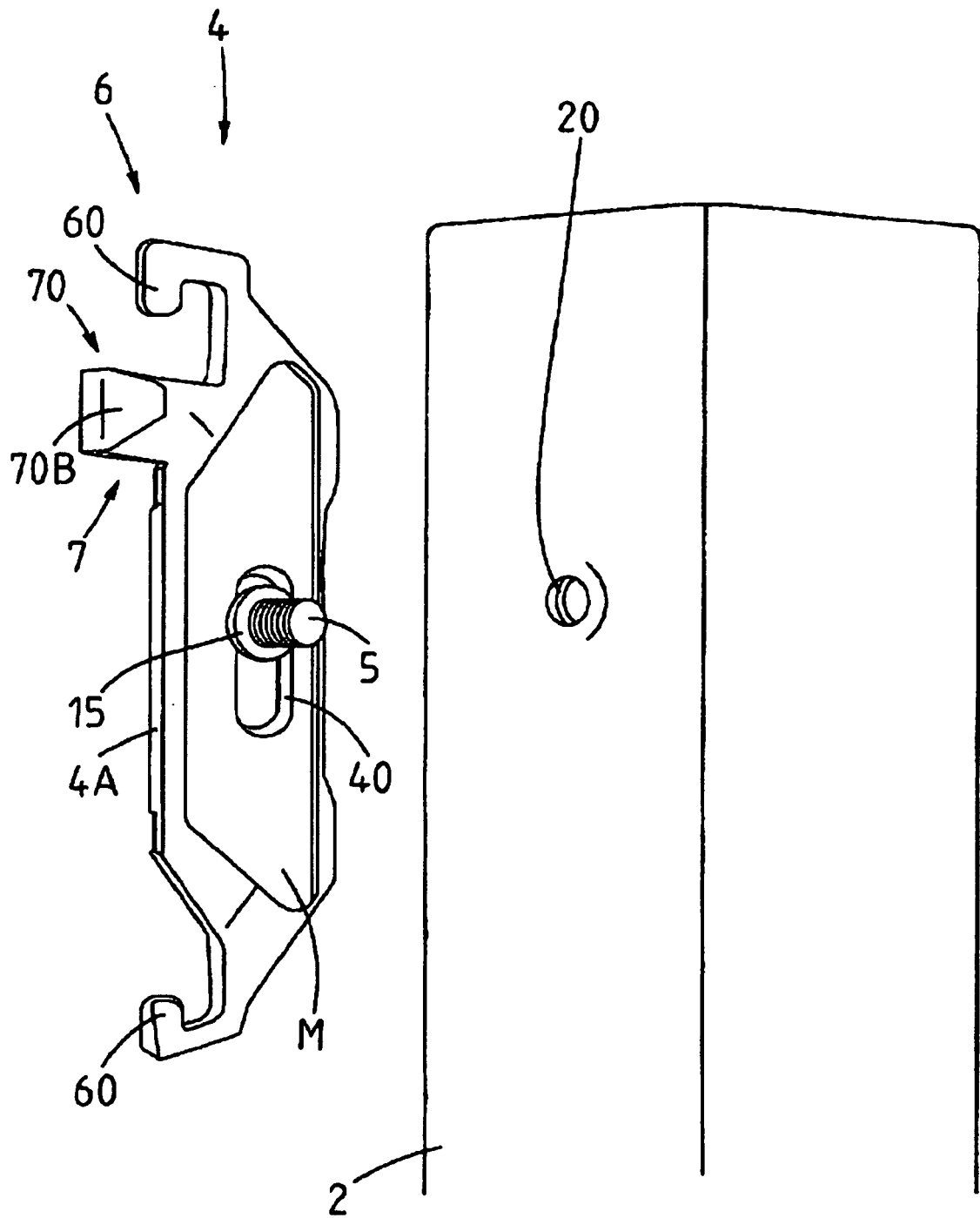


Fig. 2

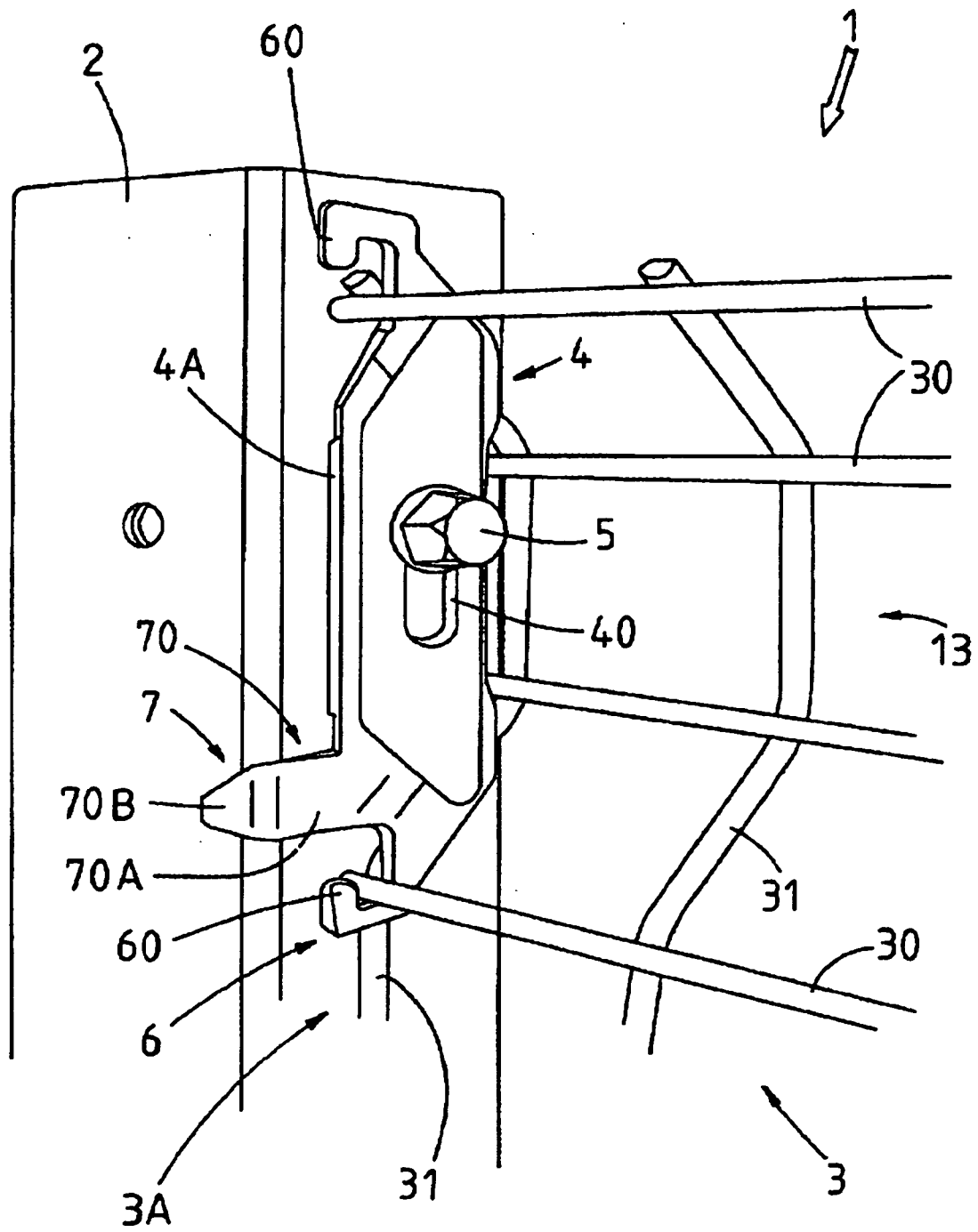


Fig. 3

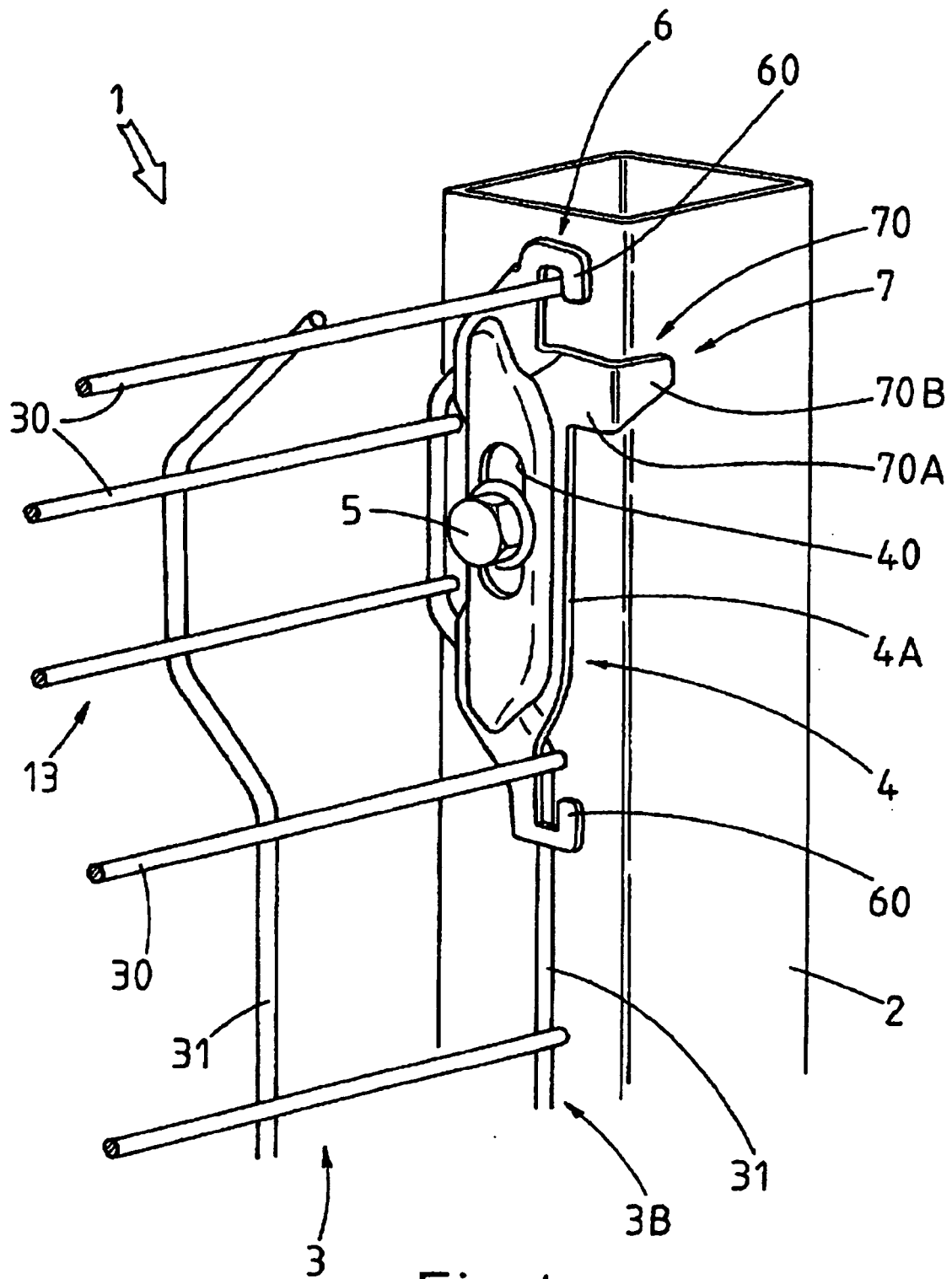


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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