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(54) Foldable ladder

(57) The invention concerns a foldable ladder (8) comprising a first pair (11) of opposite stiles with a first stile (1a) and a second stile (1b), and a second pair (12) of opposite stiles with a third stile (1c) and a fourth stile (1d); a series of steps (2) with their first ends (2a) articulated to said first and said third stile (1a, 1c), and with their second ends (2b) articulated to said second and said fourth stile (1b, 1d). The steps (2) are pivotable into grooves of the opposite stiles whilst they are moved towards each other for inoperative position. The steps (2) are turnable out of the grooves of the opposite stiles whilst they are moved away from each other for operative position. Said foldable ladder further comprises hinges (5, 6) between the upper ends (7a, 7b) of said first pair (11) and the lower ends (7c, 7d) of said second pair (12). The opposite stiles of the first pair and the opposite stiles of the second pair are pivotable to lengthen each other for attaining a final operative position (P1), in which said opposite stiles are moved to a maximum distance (W2). The first pair of opposite stiles are pivotable around a common axis in respect to said second pair of opposite stiles when said opposite stiles has said minimum distance, so as to position said stiles side by side for attaining a final inoperative position.

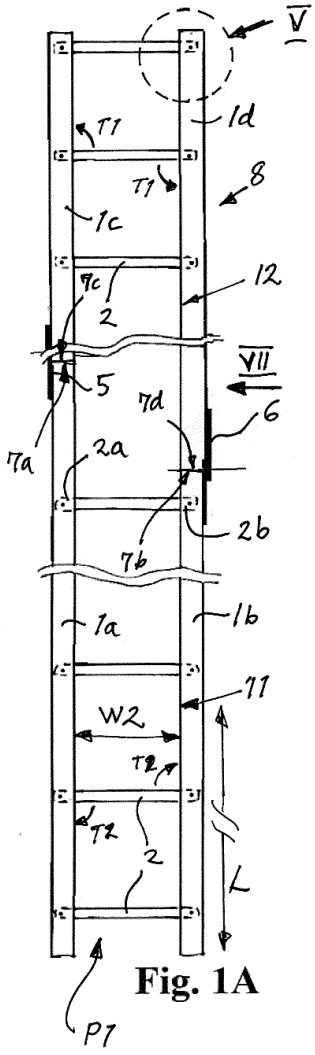

Fig. 1A

EP 2 878 760 A1

Description

FIELD OF THE INVENTION

[0001] The invention relates to a foldable ladder comprising: a first pair of opposite stiles with a first stile and a second stile, and a second pair of opposite stiles with a third stile and a fourth stile, said stiles being U-profiles with two longitudinal forks and a groove there between opening towards each other in both pairs; a series of steps with their first ends articulated to said first and said third stile inside their U-profile, and with their second ends articulated to said second and said fourth stile inside their U-profile, so that said steps are pivotable into said grooves of the opposite stiles whilst said opposite stiles of the pairs are moved towards each other for inoperative position, and said steps are turnable out of said grooves of the opposite stiles whilst said opposite stiles of the pairs are moved away from each other for operative position

BACKGROUND OF THE INVENTION

[0002] Document EP-0 188 178 describes a ladder comprising a pair of main stiles, a series of centrally-hinged rungs with ends articulated to the two main stiles, whereby the ladder can adopt a folded inoperative configuration in which the main stiles are alongside each other and an extended operative configuration in which the main stiles are spaced from each other, and means for stopping the ladder in the extended operative configuration. The main stiles are articulated together at their upper ends and the ladder further includes a single auxiliary stile articulated at its upper end to the two upper ends of the main stiles about an axis substantially perpendicular to the articulation axis of the two main stiles. The auxiliary stile is movable between a position alongside the two main stiles, corresponding to the folded inoperative condition of the ladder, and a position spaced from the main stiles, corresponding to the extended operative condition of the ladder.

[0003] E.g. Yongkang Yuxinghong Co., Ltd. delivers (http://bolair.en.alibaba.com/product/529469242-213216757/Portable_Aluminium_folding_ladder.html) scaffolds or ladders, which have two branches forming a self standing support with a common form of the letter A, whereupon both branches include a longitudinal center bar/stile having swiveljoints with the rungs/steps at the center parts of each rungs/steps. The ladder or scaffold is foldable such as to have a small size, but the ladder/scaffold is quite large in its opened position, whereupon the ladder/scaffold is to be used as self-standing scaffold on a horizontal surface, whereupon no building structure or the like is needed for support. As a comparison, traditional ladders need a wall or a similar structure against which the ladder is tilted.

[0004] Document US 1,232,221 concerns a collapsible ladder comprising side members composed of channel iron bars, steps pivoted at their opposite ends to said bars and adapted to fold within the channels thereof, spindles having angular central portions engaging said steps, provided with rounded portions engaging the holes of said flanges and having angular projecting ends respectively, pins on the opposite side members, and hasps provided with angular recesses, each of said hasps being adapted to engage one of said angular extensions for locking the ladder in open position and one of said pins for locking it in collapsed position.

SUMMARY OF THE INVENTION

[0005] The foldable non-telescopic ladder according to the invention further comprises: hinges between the upper ends of said first pair of opposite stiles and the lower ends of said second pair of opposite stiles, whereupon said hinges have a common axis when said opposite stiles in the pairs are moved to a minimum distance, whereupon said opposite stiles of the first pair and said opposite stiles of the second pair are pivotable to lengthen each other with the upper ends abutting the lower ends for attaining a final operative position, in which said opposite stiles are moved to a maximum distance, and said first pair of opposite stiles are pivotable around said common axis in respect to said second pair of opposite stiles when said opposite stiles has said minimum distance, so as to position said stiles side by side for attaining a final inoperative position. In this way the foldable ladder is useful for actuation inside manholes of various containers, vessels or pipelines or the like, which manholes generally have limited dimensions. Generally, the ladder construction according to the invention allows folding or collapsing the ladder to a compact size for transport thereof, and for quick opening for use, whereupon the ladder has a such a narrow width that enable its use through tightly dimensioned manholes or the like.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

Fig. 1A discloses the ladder of the invention in its final operative position P1 seen in direction perpendicular to the virtual plane formed by stiles and the steps, in direction I of Fig. 5.

Fig. 1B discloses the ladder according to Fig. 1A in a position, when the opposite stiles are somewhat moved towards each other, in the same view as in Fig. 1A.

Fig. 1C discloses the ladder according to Fig. 1A and 1B in a position, when the opposite stiles are moved to their minimum distance, whereupon the first pair of opposite ladders are ready for pivoting around the common axis of the hinges in respect to the second

pair of opposite stiles, in the same view as in Figs. 1A and 1B.

Fig. 2A discloses the ladder according to Figs. 1A to 1C but in a position, when the first pair of opposite stiles has been pivoted around the common axis of the hinges in respect to the second pair of opposite stiles, in the same view as in Figs. 1A-1C in direction II of Fig. 2B. Here the ladder is in its final inoperative position.

Fig. 2B discloses the ladder of Fig. 2A in direction III of Fig. 2A.

Fig. 3 is more detailed view of an articulation between one of the steps and one of the stiles, enlarged from the area V of Fig. 1A.

Fig. 4 is more detailed view of a hinge between the first pair of opposite stiles and the second pair of opposite stiles, enlarged from the area VI of Fig. 5.

Fig. 5 discloses the ladder of the invention in its final operative position as shown in Fig. 1A, but in the direction VII of Fig. 1A.

Fig. 6 visualizes the form of the stiles in cross-section IV-IV of Fig. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0007] The invention concerns a foldable non-telescopic ladder 8, which comprises a first pair 11 of opposite stiles, and a second pair 12 of opposite stiles. In the first pair 11 there is a first stile 1a and a second stile 1b, and in the second pair 12 there is a third stile 1c and a fourth stile 1d. These stiles are U-profiles 16 - typically aluminum profiles - with two longitudinal forks 3a, 3b connected by a basis 16 and a groove 4 between these forks, whereupon the grooves in the first pair of stiles as well as the grooves in the second pair of stiles open towards each other, i.e. in both pairs 11 and 12 the opposite grooves are open towards each other. The foldable ladder 8 also comprises a series of steps 2 with their first ends 2a articulated, using pivot axes 15, to the first and the third stile 1a, 1c inside their U-profile, and with their second ends 2b articulated to the second and the fourth stile 1b, 1d inside their U-profile. These steps 2 are pivotable - in direction T1 - into the grooves 4 of the opposite stiles whilst the opposite stiles of the pairs 11, 12 are moved towards each other for the inoperative position P1 of the ladder 8. This is the first phase for folding the ladder into the compact transport and storage position, as shown in Fig. 1C. The reverse phase means that the steps 2 are turned out - in direction T2 - of the grooves 4 of the opposite stiles whilst the opposite stiles of the pairs 11, 12 are moved away from each other.

[0008] By the described reverse turning T2 the ladder 8 is finished to the operative position P1 as shown in Fig. 1A. In the operative position P1 the steps 2 are substantially parallel and typically perpendicular to the stiles 1a, 1b, 1c, 1d, whereupon the opposite stiles 1a and 1b and the opposite stiles 1c and 1d respectively have the maximum distance W2 there between. In this situation the maximum distance W2 can be selected to be practical for the purpose. For instance for use through manholes or the like, the maximum distance W2 may be selected to be quite small, e.g. from 20 cm to 50 cm. Greater widths = maximum distances are not necessary, because the ladder according to the invention is intended to be supported against a wall, an edge of the manhole or the like, whereupon no extra width is needed for balance - contrary to the self standing constructions of the prior art. The described system for ladder also means that no telescopic components or movement are needed. Then possible dirt from surrounding does not harm the use and folding of the ladder 8 according to the invention.

[0009] The foldable ladder 8 according to the invention further comprises hinges 5, 6 between the upper ends 7a, 7b of the first pair 11 of opposite stiles and the lower ends 7c, 7d of the second pair 12 of opposite stiles. Here definitions "lower" and "upper" mean that the ends are abutting each other, though in fact either component may be upper or lower, i.e. the ladder can be used just as defined or upside down. The construction is typically - but not necessarily - symmetrical in the longitudinal direction L thereof. The hinges 5, 6 have a common axis 10 when the opposite stiles 1a and 1b, and 1c and 1d respectively in the pairs are moved to a minimum distance W1. It shall be noted that the common axis 10 is valid only when the opposite stiles of the pairs 11, 12 are moved towards each other in the closed state shown in Fig. 1C. In the final operative position P1 the hinges 5 and 6 have separate axes with a dimension there between in the longitudinal direction L, as can be understood from Fig. 1A.

[0010] For attaining the final operative position P1 the opposite stiles 1a, 1b of the first pair 11 and the opposite stiles 1c, 1d of the second pair 12 are at first pivoted around the above mentioned common axis 10 to a position, in which the stiles of the first pair 11 lengthen the stiles of the second pair 12 with the upper ends 7a, 7b of the first pair stiles abutting the lower ends 7c, 7d the second pair stiles. This means change from the state of Figs. 2A/2B to the state of Fig. 1C. Further, for attaining the final operative position P1 the opposite stiles 1a and 1b, and 1c and 1d respectively are moved away from each other - in directions T2 - so that the maximum distance W2 between the opposite stiles is created. This means change from the state of Fig. 1C to the state of Fig. 1A. In the final operative position P1 the first stile 1a and the third stile 1c are parallel extensions of each other and the second stile 1b and the fourth stile 1d are parallel extensions of each other. At the same time the steps 2 are substantially perpendicular to the stiles 1a, 1b, 1c,

1d, or as near as possible (=approaching) the perpendicular state.

[0011] For the final inoperative position P2 the opposite stiles 1a and 1b of the first pair 11 and the opposite stiles 1c and 1d of the second pair 12 are at first moved towards each other. As a result the first stile 1a and the second stile 1b have lengthwise contact, and the third stile 1c and the fourth stile 1d have lengthwise contact. At the same time the steps 2 have a minimum angle K in respect to the stiles 1a, 1b, 1c, 1d. The minimum angle K approaches zero, but does not reach it, because the stiles have physical dimensions as can be understood with the aid the figures. This means change from the state of Fig. 1A to the state of Fig. 1C, whereupon a common axis of the hinges 5, 6 is formed. Further, for attaining the final inoperative position P2 the first pair 11 of opposite stiles are pivoted around the common axis 10 in respect to the second pair 12 of opposite stiles, when the opposite stiles has the minimum distance W1, to a state, in which the upper ends 7a, 7b do not abut the lower ends 7c, 7d, and the stiles do not lengthen each other any more. Finally, the first stile 1a and the third stile 1c are one on the other and the second stile 1b and the fourth stile 1d are one on the other. This means change from the state of Fig. 1C to the state of Figs. 2A/2B.

[0012] At least one of the stiles has a first hole 9a through the forks 3a and 3b in the area of one of the steps 2, and a second hole 9b through this mentioned step such that the first and the second hole 9a and 9b are aligned with each other when the ladder 8 is in the final operative position P1. For pivotal movement of the steps 2, and hereby for moving the stiles towards and away from each other, the steps have pivot axes 15 extending from one fork 3a to another fork 3b. Further, at least one of the stiles has a third hole 9c through the forks 3a and 3b in the area of one of the steps 2, and a fourth hole 9d through this mentioned step such that the third and the fourth hole 9c and 9d are aligned with each other when the ladder 8 is in the final inoperative position P2. I.e. there is two different pair of holes, one pair for final operative position P1, and one pair for final inoperative position P2. Additionally, in the ladder 8 there is a first security pin 13, which is formed in such a way that it can be inserted through the aligned first and second hole 9a and 9b during the final operative position P1 and through the aligned third and fourth hole 9c and 9d during the final inoperative position P2. This way the steps are locked in respect to the stiles in the operative position P1, hence ensuring that the ladder 8 maintain safety.

[0013] The ladder 8 further has at least in the area of the hinges 5 and/or 6 a fifth hole 9e through a fork 3a or 3b of the first and/or second stile 1b, and also a sixth hole 9f through a fork 3a or 3b in that stile, which is abutting the stile with the mentioned fifth hole. The fifth hole and the sixth hole are aligned with each other when the ladder 8 is in the final operative position P1. In the ladder 8 there is also a second security pin 14, which is formed in such a way that it can be inserted through the aligned fifth and sixth hole 9e and 9f. This way the first pair 11 of stiles and the second pair of stiles 12 are locked in respect to each other in the operative position P1, hence further ensuring that the ladder 8 maintains safety in every situation.

Claims

1. A foldable ladder (8) comprising:

- a first pair (11) of opposite stiles with a first stile (1a) and a second stile (1b), and a second pair (12) of opposite stiles with a third stile (1c) and a fourth stile (1d), said stiles being U-profiles (15) with two longitudinal forks (3a, 3b) and a groove (4) therebetween opening towards each other in both pairs (11 and 12);
- a series of steps (2) with their first ends (2a) articulated to said first and said third stile (1a, 1c) inside their U-profile, and with their second ends (2b) articulated to said second and said fourth stile (1b, 1d) inside their U-profile, so that

  - said steps (2) are pivotable into said grooves (4) of the opposite stiles whilst said opposite stiles of the pairs (11, 12) are moved towards each other for inoperative position, and
  - said steps (2) are turnable out of said grooves (4) of the opposite stiles whilst said opposite stiles of the pairs (11, 12) are moved away from each other for operative position,

characterized in that said foldable ladder further comprises:

- hinges (5, 6) between the upper ends (7a, 7b) of said first pair (11) of opposite stiles and the lower ends (7c, 7d) of said second pair (12) of opposite stiles, whereupon said hinges have a common axis (10) when said opposite stiles (1a and 1b; 1c and 1d) in the pairs are moved to a minimum distance (W1), whereupon

  - said opposite stiles of the first pair (11) and said opposite stiles of the second pair (12) are pivotable to lengthen each other with the upper ends (7a, 7b) abutting the lower ends (7c, 7d) for attaining a final operative position (P1), in which said opposite stiles (1a and 1b; 1c and 1d respectively) are moved to a maximum distance (W2), and
  - said first pair (11) of opposite stiles are pivotable around said common axis (10) in respect to said second pair (12) of opposite stiles when said opposite stiles has said

minimum distance (W1), so as to position said stiles side by side for attaining a final inoperative position (P2).

2. A foldable ladder according to claim 1, **characterized in that** in the final operative position (P1) said first stile (1a) and said third stile (1c) are parallel extensions of each other and said second stile (1b) and said fourth stile (1d) are parallel extensions of each other, and said steps (2) are perpendicular to the stiles (1a, 1b, 1c, 1d).

3. A foldable ladder according to claim 1, **characterized in that** in the final inoperative position (P2):

- said first stile (1a) and said second stile (1b) have lengthwise contact, and third stile (1c) and said fourth stile (1d) have lengthwise contact;
- said first stile (1a) and said third stile (1c) are one on the other and said second stile (1b) and said fourth stile (1d) are one on the other;
- and said steps (2) have a minimum angle (K) in respect to the stiles (1a, 1b, 1c, 1d).

4. A foldable ladder according to claim 1, **characterized in that** at least one of said stiles has a first hole (9a) through said forks (3a and 3b) in the area of one of the steps (2), a second hole (9b) through this mentioned step such that the first and the second hole (9a and 9b) are aligned with each other when the ladder (8) is in the final operative position (P1).

5. A foldable ladder according to claim 1, **characterized in that** at least one of said stiles has a third hole (9c) through said forks (3a and 3b) in the area of one of the steps (2), a fourth hole (9d) through this mentioned step such that the third and the fourth hole (9c and 9d) are aligned with each other when the ladder (8) is in the final inoperative position (P2).

6. A foldable ladder according to claim 4 and 5, **characterized in that** the ladder further comprises a first security pin (13), which is formed to be inserted through the aligned first and second hole (9a and 9b) during the final operative position (P1) and through the aligned third and fourth hole (9c and 9d) during the final inoperative position (P2).

7. A foldable ladder according to claim 1, **characterized in that** the ladder further comprises at least in the area of one of said hinges (5 and/or 6):

- a fifth hole (9e) through a fork (3a or 3b) of the first and/or second stile (1b) and a sixth hole (9f) through a fork (3a or 3b) in the abutting stile with said fifth hole;
- the fifth hole and the sixth hole are aligned with each other when the ladder (8) is in the final operative position (P1); and
- a second security pin (14), which is formed to be inserted through the aligned fifth and sixth hole (9e and 9f).

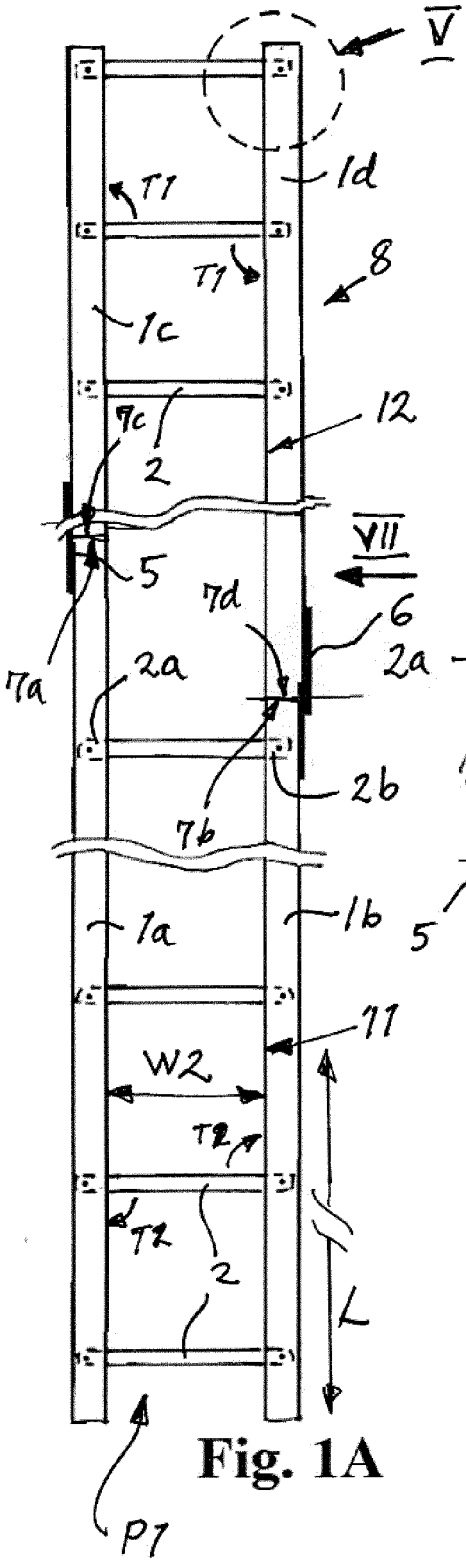

Fig. 1A

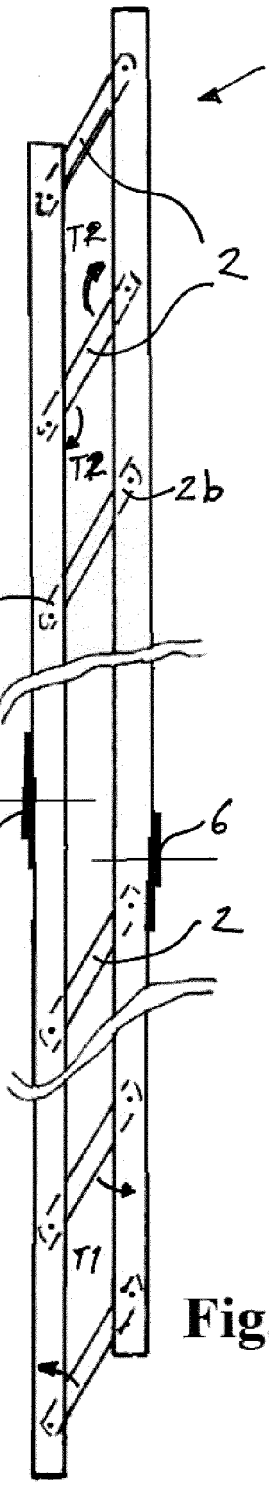

Fig. 1B

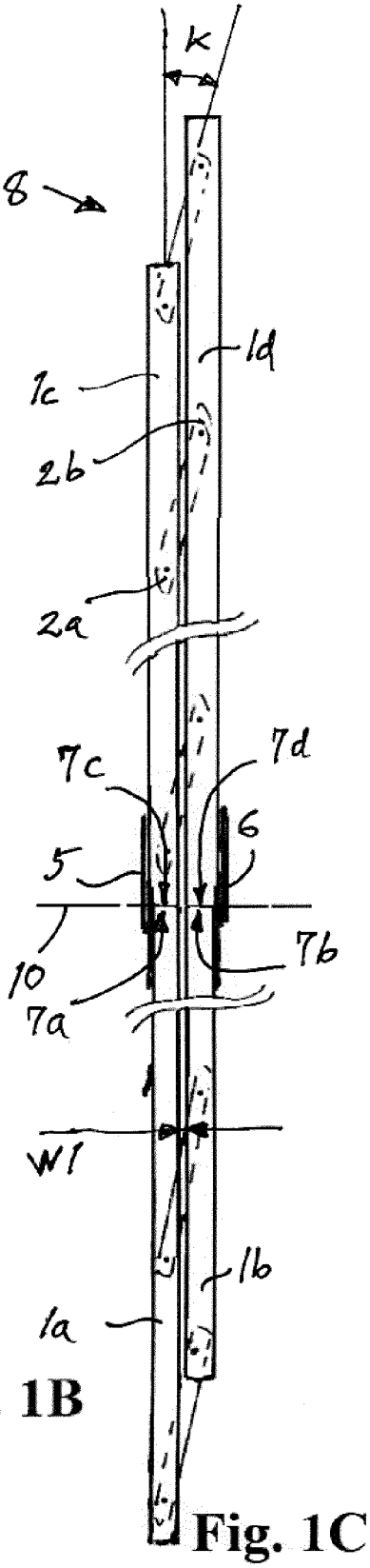

Fig. 1C

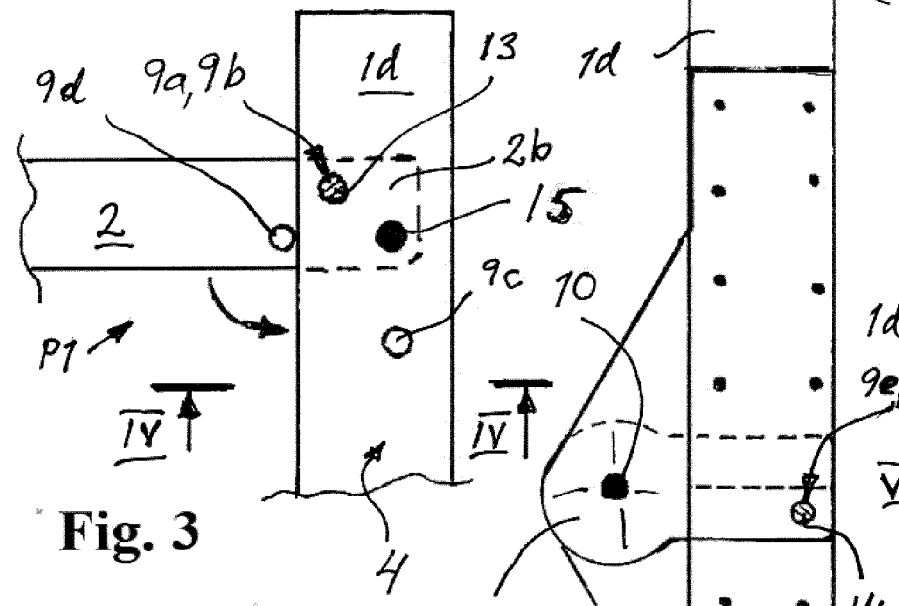

Fig. 3

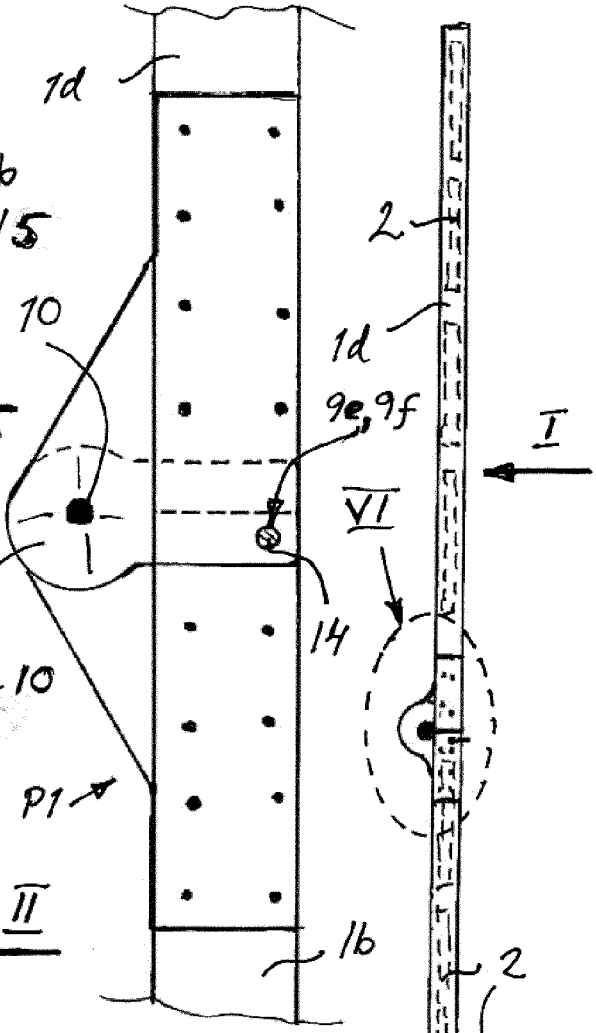

Fig. 4

Fig. 5

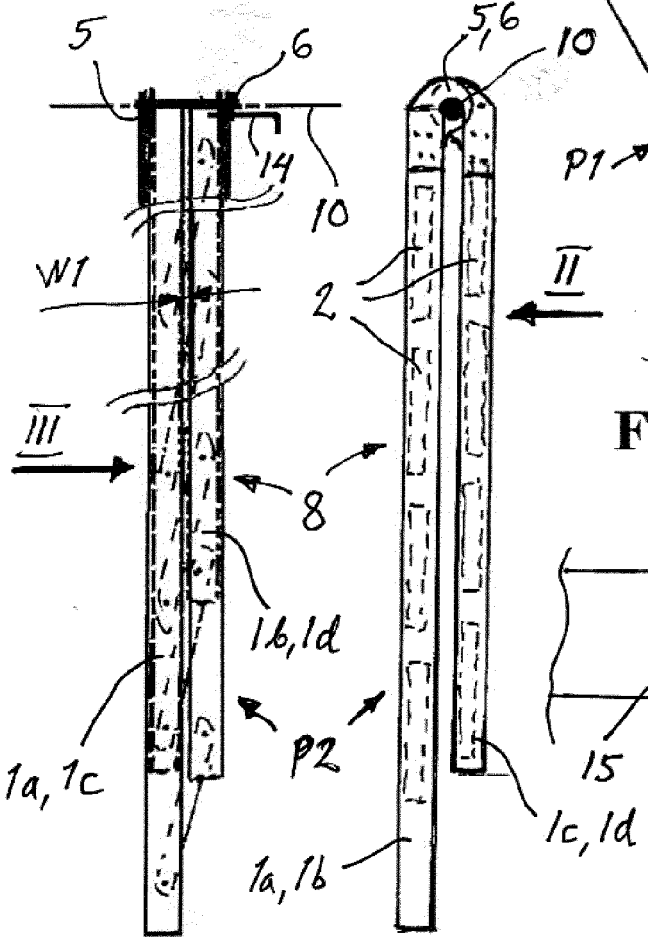

Fig. 2 A

Fig. 2B

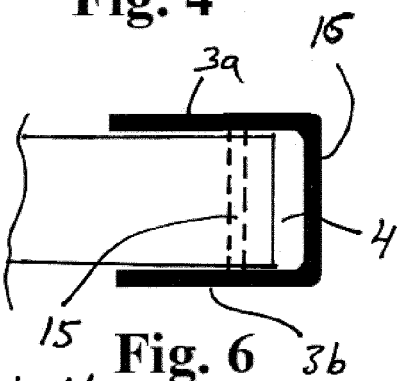

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 13 19 5039

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X	NL 1 011 148 C1 (DIJK CORNELIS VAN [NL]) 31 July 2000 (2000-07-31) * figures 1-5 *	1-3	
X	FR 374 147 A (WILLIAM STRONG HOGAN [FR]) 5 June 1907 (1907-06-05) * figures 1-4 *	1-3	
Y A	US 4 037 686 A (SHULL HAROLD H) 26 July 1977 (1977-07-26) * figures 2, 5, 6 *	5 4,6	
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A	FR 1 593 286 A (BOUTILLIER, VICTOR [FR]) 25 May 1970 (1970-05-25) * figure 4 *	7	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	2 May 2014	Bauer, Josef

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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02-05-2014

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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