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(54) **Title**: CONNECTION SET FOR FORMWORK BEAMS

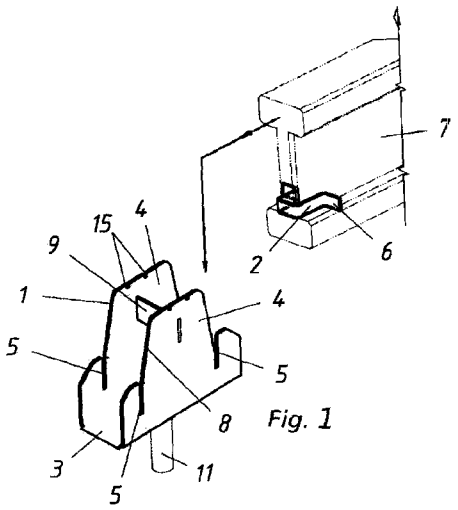


Fig. 1

(57) **Abstract**: The invention relates to a connection set for formwork beams, which will find application in the building industry in the production of formwork, mainly for slabs. It is possible to use the entire effective length of the formwork beams and accurate assembly is achieved. Furthermore, easy and quick fixing is provided. Connection set for formwork beams, comprise a formwork head and connecting tools (2) for formwork beams from the group of profiles with an open contour, straps, braces, brackets, the edges of which, in the assembled state, extend beyond the contour of the formwork beams (7). Formwork head (1) is a U-shaped profile, bent from sheet material, with a horizontal base (3) and vertical side walls (4). The vertical side walls (4) and/or the base (3) have fixings (5, 51, 52, 9) corresponding to the connecting tools (2) for formwork beams.

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CONNECTION SET FOR FORMWORK BEAMS

TECHNICAL FIELD

The present invention relates to a connection set for formwork beams, which will find application in the building industry for assembling formwork, mainly for slabs.

BACKGROUND ART

In present practice, a connection set for formwork beams includes a formwork head, commonly called "fork", on which formwork beams are placed; which beams are bearing formwork panels. The formwork head consists of a support plate, with a generally rectangular shape, to which corners vertical profiles are attached, protruded unilaterally to it, designed to keep the formwork beams in a vertical position. The support plate has, on the opposite side to the vertical profiles, a guide to a vertical – most often telescopic – prop, designed to bear the load of the formwork and the casted concrete. When assembled, the formwork beams are parallel to each other on the support plate of the "fork" and their ends are overlapped in the horizontal direction.

The known connection set has a major disadvantage that the formwork beams, when assembled, have their ends overlapped and the full effective length of the formwork beams is not in use. Another disadvantage is that it is not possible to fix the same distance between each two adjacent formwork heads transversely and longitudinally without prior measuring, hence time is wasted.

SUMMARY OF INVENTION

An objective of the invention is to provide a connection set for formwork beams, ensuring quick and easy fixing for axially and successively mounted beams as well as allowing the connection of any two formwork heads in the transverse direction without the use of additional measuring devices.

This problem is solved by a connection set for formwork beams, including a formwork head and connecting tools for formwork beams. The formwork head of

the connection set is a U-shaped profile, bent from sheet material with a horizontal base and vertical side walls, and on these vertical side walls and/or the base there are fixing elements, corresponding to the connecting tools for formwork beams. The connecting tools are from the group of profiles with an open contour (straps, splints, braces, brackets,etc.) which edges extend beyond the contour of the formwork beams when assembled.

According to one of the embodiments, the fixing elements are slots.

It is appropriate the slots to be "open" and located at a distance from the ends of the two vertical side walls.

It is possible also that the slots are located in the horizontal base of the U-shaped profile.

It is appropriate at least one transverse plate to be mounted between the vertical side walls of the formwork head, depending on the thickness of the sheet material of the formwork head U-shaped profile,.

According to another embodiment, the fixing elements are at least one transverse plate, fixed between the vertical side walls of the formwork head.

The connection set for formwork beams may also include a cross retainer, which is a beam with mounting slots at its ends, which fit to locking slots on the upper edge of the vertical side walls of the formwork head.

It is appropriate, that at least one guide to the vertical prop to be fixed to the beam of the cross retainer.

It is recommended the cross retainer beam to have a U-shaped cross-section, and the guide to be installed in its interior.

It is appropriate in each of the embodiments of the connection set for formwork beams, the horizontal base of the formwork head to have a guide to a vertical prop on its outside, in order to facilitate its assembly to the respective vertical prop.

This invention achieves considerable advantages compared to the prior art: it is possible to use the entire effective length of the formwork beams. With the

cross retainer the invention achieves also accurate assembly of any two adjacent formwork heads in the transverse direction without prior measuring. Furthermore, easy and quick fixing is provided. An additional advantage is (under certain conditions, such as: appropriate thickness of the slab, respectively selected props and lengths of standard wooden beams) the possibility that the slab formwork could be assembled only with a single grid of standard wooden beams, and also early stripping through re-supporting of the cross retainers with telescopic props is possible.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 – Axonometric view of a connection set for formwork beams, according to the preferred embodiment of the invention, shown ready for assembling;

Fig. 2 – Axonometric view of the assembled connection set according to the embodiment of Fig. 1;

Fig. 3 – Section view A-A of Fig. 2;

Fig. 4 – Formwork beam with mounted connecting tool for formwork beams of the kind of a pair of angle profiles;

Fig. 5 – Axonometric view of an embodiment of a formwork head according to the invention;

Fig. 6 – Axonometric view of the assembled connection set in accordance with the embodiments in Fig. 4 and Fig. 5;

Fig. 7 – Embodiment of the formwork beam assembled with connecting tools for formwork beams of the angle brackets type;

Fig. 8 – Embodiment of the formwork head with fixing elements formed as slots in its horizontal base and a transverse plate;

Fig. 9 – Axonometric view of of the assembled connection set in accordance with the embodiments in Fig. 7 and Fig. 8;

Fig. 10 – Another embodiment of a formwork beam assembled with connecting tool for formwork beams of the angle brackets type;

Fig. 11 – Embodiment of the formwork head with fixing elements, formed as two transverse plates;

Fig. 12 – Axonometric view of of the assembled connection set in accordance with the embodiments in Fig. 10 and Fig. 11;

Fig. 13 – Cross retainer;

Fig. 14 – Connection set for formwork beams, including cross retainer according to the invention, shown ready for assembling;

DESCRIPTION OF EMBODIMENTS

The invention relates to a connection set for formwork beams, including formwork head 1, also referred to as "formwork fork", which is modified according to the invention, as well as the connecting tools 2 for formwork beams thereto. Formwork head 1 is a U-shaped profile, bent from sheet material, preferably metal, with a horizontal base 3 and vertical side walls 4. On the vertical side walls 4 and/or the horizontal base 3 there are fixing elements 5 corresponding to the connecting tools 2 for formwork beams. The connecting tools 2 for formwork beams are from the group of profiles with an open contour (straps, splints, braces, brackets, etc.), which edges 6 extend beyond the contour of the formwork beams 7, when assembled.

The connecting tools 2 for formwork beams are fixed to each formwork beam 7. The dimensions of the connecting tools 2 for formwork beams and their type are selected to have edges 6, which in assembled position protrude beyond the contour of the formwork beams 7 and with these edges 6 the formwork beams are attached to the fixing elements 5 of the formwork head 1. The horizontal base 3 of the U-shaped profile, forming the formwork head 1, has a length, corresponding at least to the length, necessary for the two formwork beams 7 to step on it in a safe axial alignment, and the vertical side walls 4 of the formwork head 1 have a height which is sufficient to provide the vertical position of the beams. The exact dimensions are subject to calculation depending on the formwork beams 7 cross section and the load.

The fixing elements 5, as a preferred embodiment, are of the type of slots

51. As shown on drawings 1-2 and 6 of other possible embodiments, the slots are open and are placed at a distance from the ends of the two vertical side walls 4 of the formwork head 1. They are intended to clamp the connecting tools 2 for formwork beams.

On all drawings of the connection set for formwork beams, only one formwork beam 7 is shown, although the actual connection is between two formwork beams 7 arranged coaxially one after the other. This is made for the purpose of clarity of the illustrated embodiments of the invention.

Fig. 1 shows an embodiment of a formwork set, where the connecting tool 2 of the formwork beam is a profile with an open contour made of a bended steel flat bar, covering the forehead of the formwork beam 7 and which ends 6 protrude beyond the outline of the respective formwork beam 7. In this case, the connecting tool 2 is fixed near the base of the formwork beam 7. The shown connecting tool 2 comes as a set with the formwork head 1, on which fixing elements 5 exist, shaped as symmetrical open slots 51. They are located at a distance from the ends of the two vertical side walls 4 of the formwork head and very close to the base, and the adjacent sections 8 of the vertical side walls 4 are cut obliquely. This facilitates the assembly of the two formwork beams 7, while the inclined sections 8 serve as guides of the connecting tools 2 for formwork beams to slots 51. In this case also another type of connecting tool 2 for formwork beams of that group can be used, for example a pair of angle profiles, without departing from the scope of the invention.

An embodiment of the formwork set is also possible wherein the connecting tools 2 for formwork beams are of the kind of plates, fixed to the formwork beam forehead or a pair of angle profiles as shown in Fig. 4. The fixing elements 5 in this embodiment are open slots 51, which may be located along the upper edges of the vertical side walls, as shown in Fig. 5 and Fig. 6.

In order to reduce the weight of the material for manufacturing the formwork head by using thinner sheet material, it is appropriate in any of the embodiments of the invention to mount at least one transverse plate 9 between the vertical side walls 4 of the formwork head 1.

An embodiment of the formwork set is also possible, wherein the connecting tools 2 for formwork heads are of the type of angle profiles and/or brackets, fixed to the formwork beam and protruded under its outline, as shown in Fig. 7. Fixing elements in this embodiment shown in Fig. 8 and Fig. 9 are formed as slots 52 arranged in the horizontal base 3 of the U-shaped profile of the formwork head 1. In this embodiment it is also possible to have at least one transverse plate 9 mounted between the vertical side walls 4, as shown in Fig. 8, which would allow the use of thinner sheet material.

As a connecting tool 2 for the formwork beams also any other type of profile with an open contour (like straps, braces, brackets, etc.) can be used in a symmetrical or non-symmetrical make. It is sufficient that these profiles ensure that the ends 6 of the connecting tool 2 for formwork beam protrude beyond the outline of the formwork beam 7 and fit into their respective fixing elements 5 of the formwork head 1.

Another embodiment is also possible, where the connecting tools 2 for formwork beams are angle profiles and/or brackets as shown in Fig. 10, as well as other open contour profiles, protruded beyond the forehead 10 of the formwork beams 7 and fixed to each of them. In this case the fixing elements of the formwork head 1 are of the type of at least one transverse plate 9, fixed between the vertical side walls 4. The use of the two transverse plates 9 is appropriate, in order to facilitate the assembly of the formwork beams 7, as shown in Fig. 11 and Fig. 12. In this embodiment, the height position of the transverse plates 9 on the vertical side walls 4 of the formwork head 1 may vary, depending on the positon of the connecting tools 2, as they are protruded beyond the forehead 10 of the formwork beam 7. The said choice of the position of the transverse plates 9 is within the scope of the present invention.

In some of the embodiments shown, on the outer side of the horizontal base 3 of the formwork head 1 there is a rigidly attached guide 11 to a vertical prop, which facilitates the mounting of the formwork head 1 to vertical props 12 (Fig. 14). The presence or absence of such a guide 11 to a vertical prop does not change the essence of the invention.

According to the invention, a connection set includes a cross retainer 13,

which is a beam with mounting slots 14 at its edges. On the upper edge of the vertical side walls 4 of the formwork head 1 there are locking slots 15 corresponding to the mounting slots 14 of the cross retainer. It is appropriate that a guide 11 to a vertical prop is rigidly attached to the beam of the cross retainer 13, thus allowing early stripping when using a single grid of formwork beams and the upper part of the cross retainer profile has a direct contact to the concrete slab on the same level with the shuttering panels (plywood, three-layered wood panels, etc.), mounted on the formwork beams. A preferred embodiment of the cross retainer 13 is a beam with a U-shaped cross-section, as shown in Fig. 13, where the guide 11 to a vertical prop is rigidly attached inside it.

The cross retainer 13 is designed to connect in a transverse direction any two adjacent formwork heads 1 of adjacent axes and to fix the distance between them.

For all the variants of the formwork head 1 it is appropriate to have locking slots 15 on the upper edge of their vertical side walls 4.

INDUSTIAL APPLICABILITY OF THE INVENTION

This invention is mainly used for the assembly of slab formwork in combination with formwork beams 7 and telescopic or other suitable type of vertical props 12.

The connecting tools for formwork beams 2 are pre-assembled to the formwork beams, as shown in Fig. 14.

At least two vertical props 12 are raised in working position together with tripods, associated to them, at a distance, corresponding to the length of the formwork beam 7.

According to the invention, a formwork head 1 is mounted by using the guide 11 on each vertical prop 12 or on another appliance for vertical support of the concrete slab. A formwork beam 7 with pre-assembled connecting tools 2 for formwork beams is mounted on the horizontal bases (3) of the two formwork heads 1. When placing the formwork beam 7, the connecting tools 2 fix it to the modified formwork head 1 into the open slots 51 in the vertical side walls 4 or into

the slots 52 in the base 3 of the U-shaped profile, or to the transverse plates 9, depending on the chosen embodiment of the modified formwork head 1 and on the connecting tools 2 for formwork beams.

The edges 6 of the connecting tools 2 for formwork beams, which protrude beyond the outline of the formwork beams 7, enter respectively in these slots 51, 52, or hang on the transverse plates 9, whereby they are fixed in place without requiring measurements during installation. In this way accuracy and speed of installation is achieved, and simultaneously the entire effective length of the formwork beams 7 is in use.

As a next step of installation, in the same direction of longitudinal axis of the formwork beam 7, another vertical prop 12 together with a tripod is raised, at a distance, corresponding to the length of one formwork beam 7. The modified formwork head 1 is mounted on top of the vertical prop 12 by means of the guide 11. The next formwork beam 7 is placed on top and connects to the formwork heads 1 in the way already described. The installation continues in the same order until getting close to the end of the longitudinal direction of the formwork grid as far as possible with standard lengths of the formwork beams 7.

When an adjacent row of formwork beams 7 should be mounted parallel to the one already installed, a cross retainer 13 is used. Each cross retainer 13 is placed with its mounting slots 14 into the locking slots 15 of the vertical side walls 4 on the already installed formwork heads 1 of two adjacent rows. The cross retainer 13 keeps always the same distance between two adjacent formwork heads 1 and formwork beams 7 in transversal direction and ensures these rows are parallel to each other.

The assembly of the formwork beams 7 in longitudinal direction and fixing the distance between their rows in the transverse direction continues as described here above until the supporting structure of the slab formwork is assembled. Shuttering panels (plywood, three-ply wooden panels. etc.) are placed onto the formwork beams 7 and then the reinforcement of the slab is placed and after that the concrete is poured.

The cross retainer 13 can be used for early stripping of the slab formwork

in accordance with a scheme provided by an engineer responsible for the formwork design. This is realized by adding vertical props 12, for example telescopic ones, which support through guides 11 the cross retainers 13 according to the designer's scheme. Then the vertical props 12 under the rows of formwork beams 7 are removed and the slab remains re-supported on the cross retainers 13 and the respective vertical props 12 underneath, until it reaches its designed strength. After being released from the re-supported slab, the vertical props 12 and the relevant formwork heads 1, the formwork beams 7 and the shuttering panels (plywood, three-ply wooden panels, etc.) can be used in another slab formwork, which contributes to faster progress of construction works at the respective building site.

CLAIMS

1. A connection set for formwork beams, including a formwork head **characterized in that** it includes also connecting tools (2) for formwork beams, where the formwork head (1) is a U-shaped profile, bent from sheet material, with a horizontal base (3) and vertical side walls (4) and on these vertical side walls (4) and/or the base (3) there are fixing elements (5, 51, 52, 9), corresponding to the connecting tools (2) for formwork beams, and the connecting tools (2) are from the group of profiles with an open contour like straps, splints, braces, brackets, etc., which edges (6) extend beyond the contour of the formwork beams (7) when assembled.

2. A connection set according to claim 1, **characterized in that** the fixing elements are slots (5).

3. A connection set according to claim 2, **characterized in that** the slots are open (51), and are at a distance from the ends of the two vertical side walls (4).

4. A connection set according to claim 2, **characterized in that** the slots (52) are arranged in the horizontal base of the U-shaped profile.

5. A connection set according to any one of the claims from 1 to 4, **characterized in that** between the vertical side walls (4) of the formwork head (1) at least one transverse plate (9) is mounted.

6. A connection set according to claim 1, **characterized in that** the fixing elements being at least one transverse plate (9) fixed between the vertical side walls (4) of the formwork head (1).

7. A connection set according to any of the claims from 1 to 6, **characterized in that** the horizontal base (3) of the formwork head (1) has, on its outside, a guide (11) to the vertical prop (12).

8. A connection set according to any of the claims from 1 to 7, **characterized in that** a cross retainer (13) is also included, being a beam with mounting slots (14) at the ends, and on the upper edge of the vertical side walls (4) of the formwork head (1) there are locking slots (15) corresponding to the mounting slots (14) of the beam.

9. A connection set according to claim 8, **characterized in that** at least one guide (11) to the vertical prop is fixed to the beam of the cross retainer (13).

10. A connection set according to claim 9, **characterized in that** the beam of the cross retainer (13) has a U-shaped cross-section and the guide is mounted in its interior.

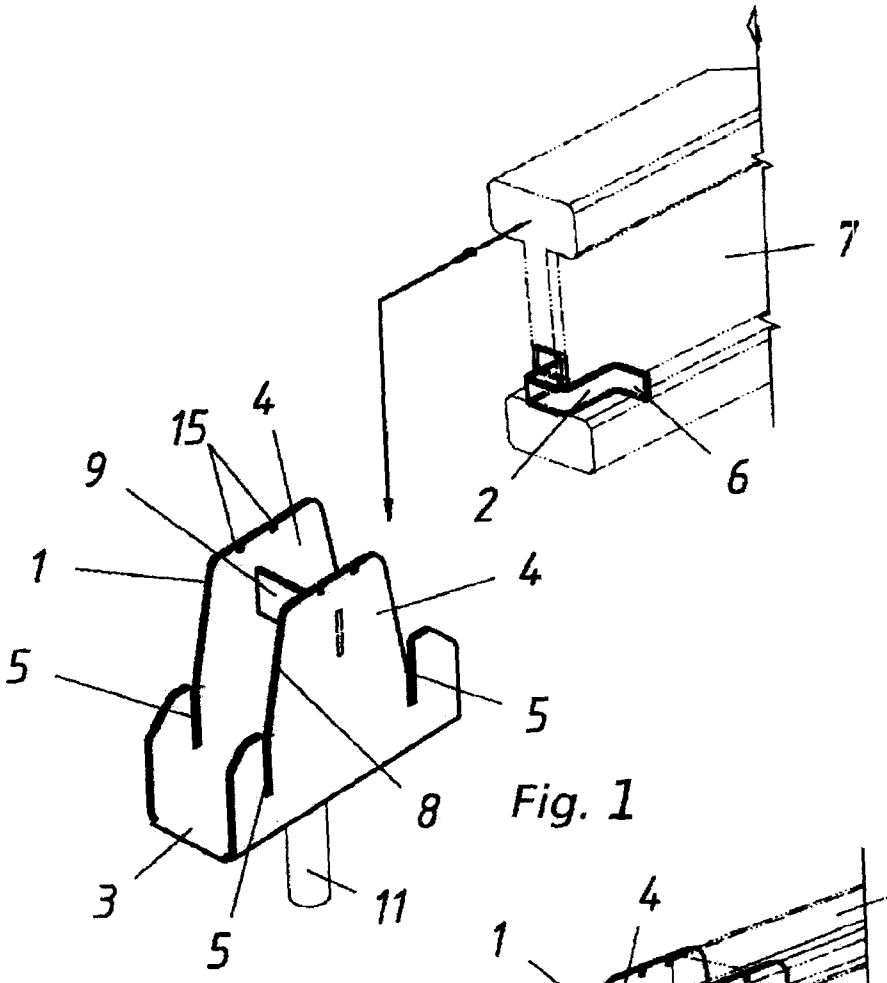


Fig. 1

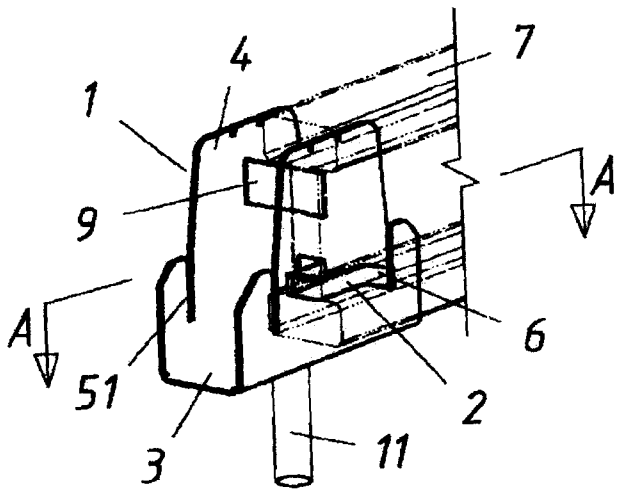


Fig. 2

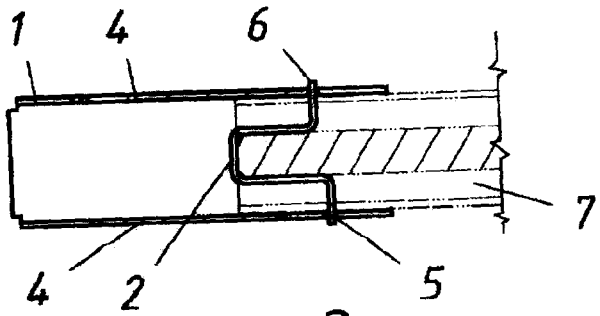


Fig. 3

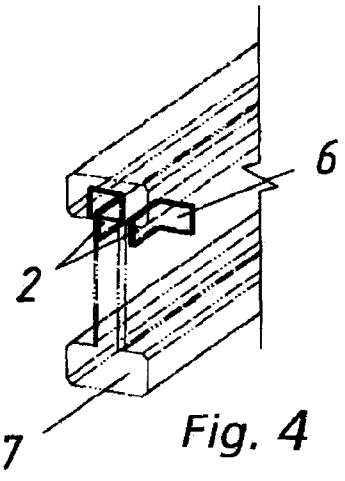


Fig. 4

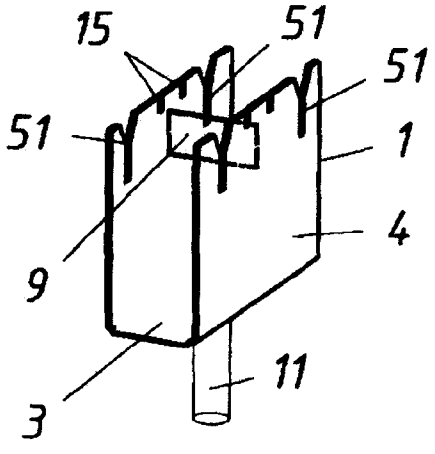


Fig. 5

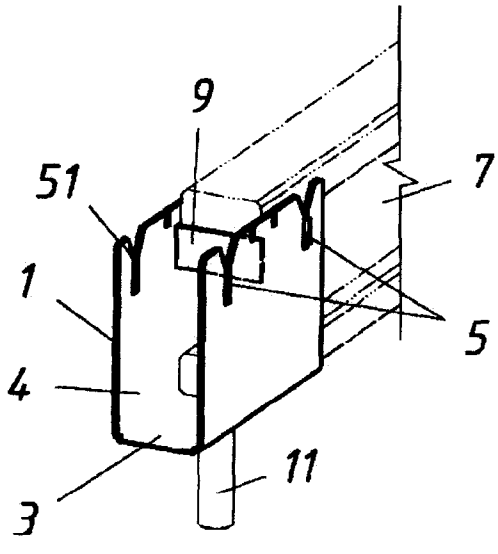


Fig. 6

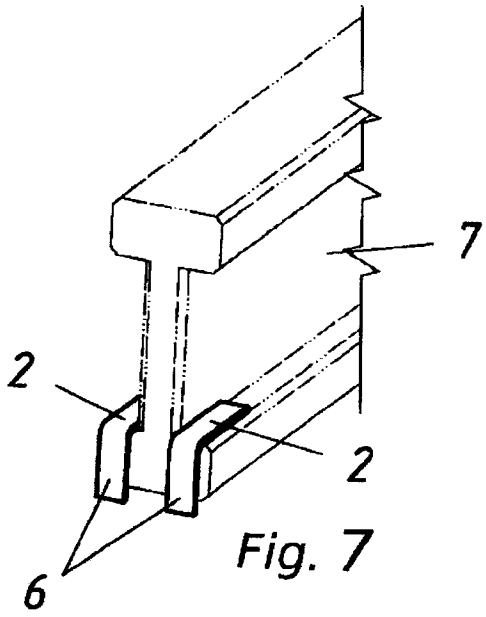


Fig. 7

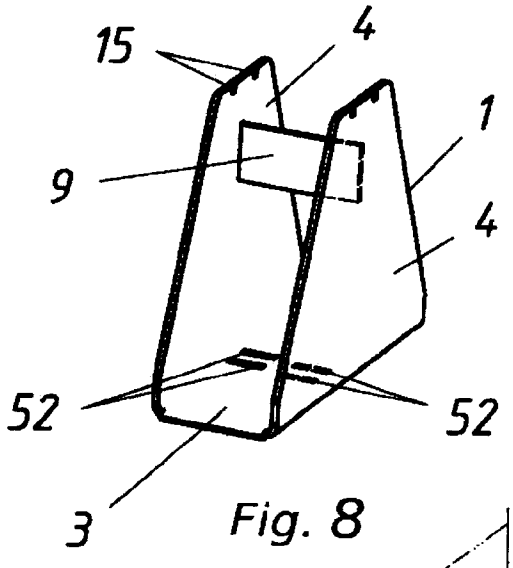


Fig. 8

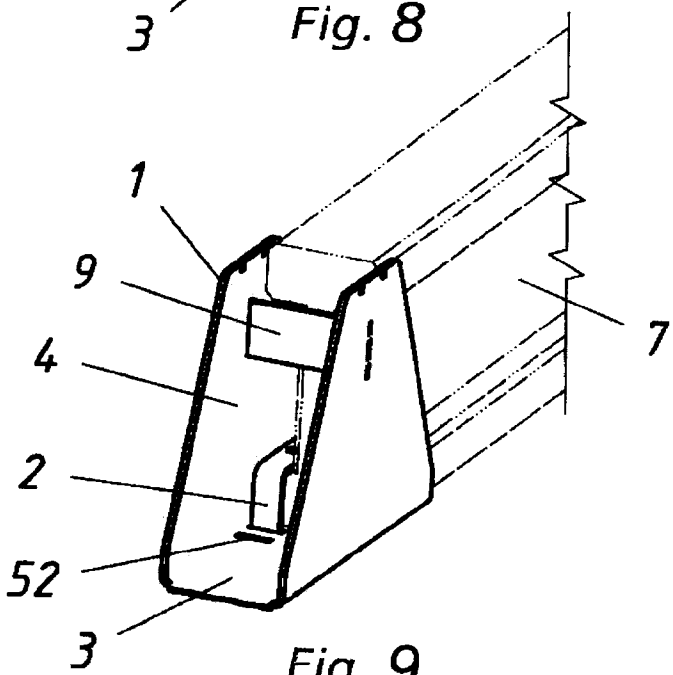


Fig. 9

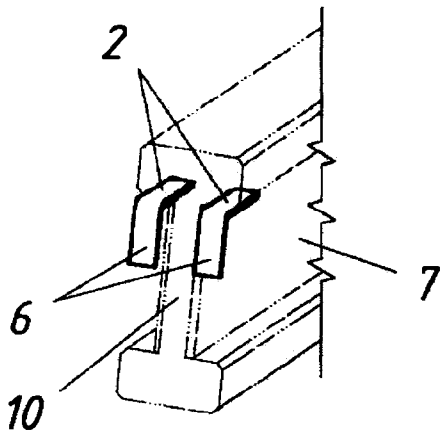


Fig. 10

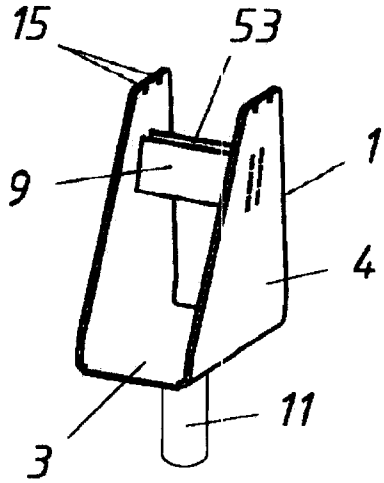


Fig. 11

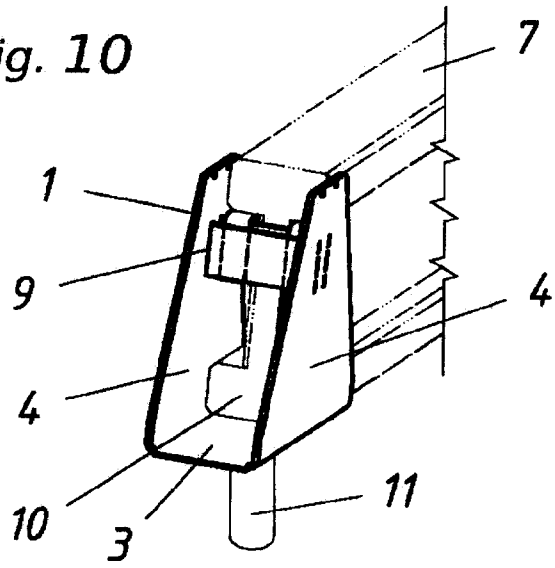


Fig. 12

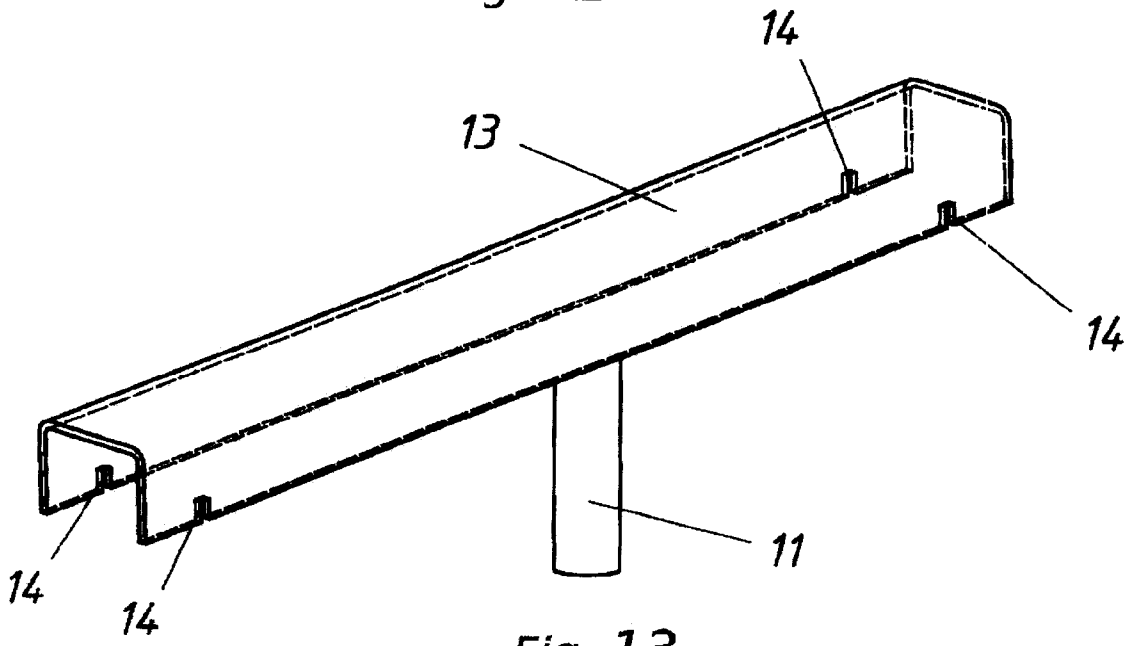


Fig. 13

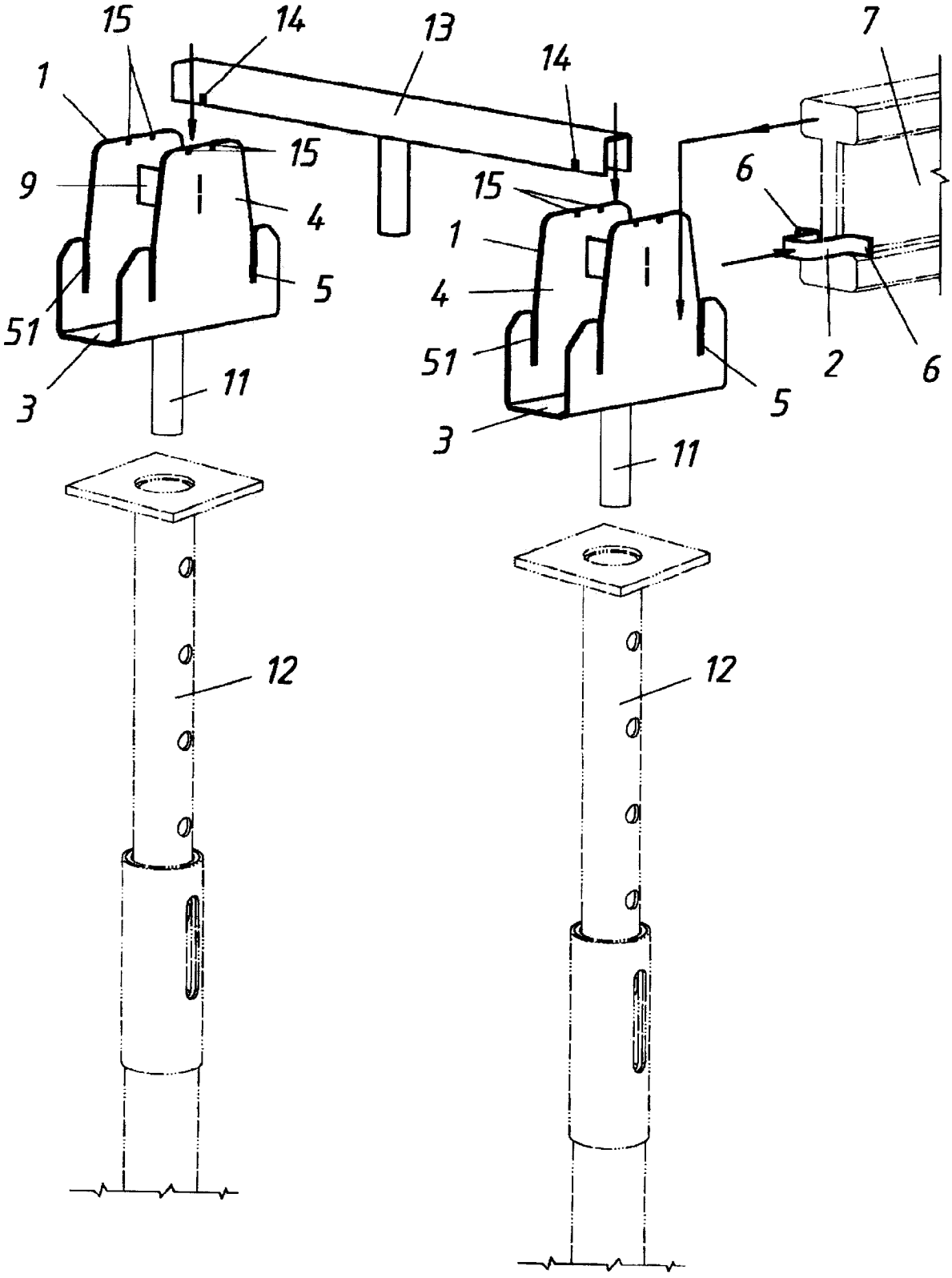


Fig. 14

INTERNATIONAL SEARCH REPORT

International application No
PCT/BG2014/000032

A. CLASSIFICATION OF SUBJECT MATTER
INV. E04G11/48 E04G11/50 E04G25/00
ADD.

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

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 practicable, 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.
X	WO 2009/035226 A2 (KIM S) 19 March 2009 (2009-03-19)	1,2,4-7
A	page 3, paragraph 21 - page 4, paragraph 24; figures 3,6-8 page 6, paragraph 54 page 6, paragraph 59	3

X	FR 2 136 813 A5 (KWIKFORM LTD) 22 December 1972 (1972-12-22)	1,7
A	page 4, line 33 - page 5, line 33; figures 1-3	2-6

X	GB 1 291 829 A (RAPID METAL DEVELOPMENTS LTD) 4 October 1972 (1972-10-04)	1,2,7
A	page 2, line 26 - line 32; figures 1-2	3-6

X	JP H07 207934 A (ITOCHU CORP) 8 August 1995 (1995-08-08)	1,7
A	abstract; figures 7-8	2,4-6

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

☒ See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 February 2015	17/04/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Manera, Marco

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/BG2014/000032

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-7

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-7

   a connection set for formwork beams

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2. claims: 8-10

   a cross retainer for formwork heads

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/BG2014/000032

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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