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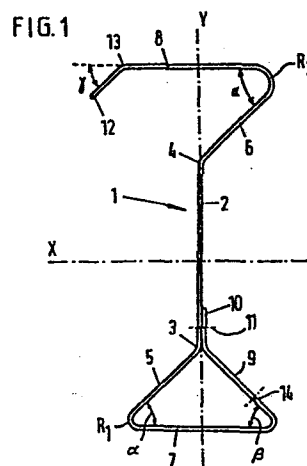
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⑤④ Cold-rolled girder section.

⑤⑦ A girder section of Z- or S-shaped cross-section, the web (2) being situated in a plane substantially coinciding with the plane through the minimal principal axis of inertia (Y). The edges (3,4) of the web (2) are each connected by means of a connecting part (5,6) to one end of a leg (7,8) of the section. The two connecting parts (5,6) are situated on either side of the plane through the first principal axis of inertia (Y), while the end (9) of the lower leg (7) averted from the connecting part (5) is return-bent in the direction of the web (2) and is connected to the web (2), thereby forming a closed triangle (5,7,9) having acute base angles (α, β), the section, after rotation about its longitudinal axis, being nestable in a similar section not rotated about its longitudinal axis.



Title: Cold-rolled girder section.

The invention relates to a cold-rolled girder section of Z- or S-shaped cross-section.

Cold-rolled girder sections are known in practice in various forms. The advantages thereof are mainly that, at equal resistance and inertia moment, they may be considerably lighter than hot-rolled sections. The drawbacks of cold-rolled girder sections, and in particular when these are employed as boom sections, are:

- the slight lateral stiffness of the girder section, mostly requiring coupling sections,
- the slight torsional stiffness, and
- the slight capacity of discharging high loads adjacent the support.

By application of coupling sections it is possible to prevent lateral buckling of the flange under pressure as well as rotation of the section if the line of action of the load is not oriented according to a principal axis of inertia of the section or if the load eccentrically acts relative to the centre of gravity of the section or if the centre of transverse forces does not coincide with the centre of gravity.

It is an object of the invention to provide a cold-rolled girder section, while substantially eliminating the above drawbacks. The girder section according to the inven-

tion is characterized to that end in that the web is situated in a plane substantially coinciding with the plane through the minimal principal axis of inertia, the edges of the web each being connected through a connecting portion to an end of a leg of the section, while the two connecting portions are situated on either side of the plane going through said principal axis of inertia, the end of the lower leg averted from the connecting portion being bent back in the direction of the web and being connected to the web, thereby forming a closed triangle with acute base angles, the section, after rotation about its longitudinal axis, being nestable in a similar section not rotated about its longitudinal axis.

The closed triangular section portion present at the bottom of the girder section offers the advantage that the free unsupported web height of the girder section is slightly reduced, so that relatively high sections nevertheless allow an economical construction. The section form furthermore offers a simple supporting possibility for wooden beams as well as for so-called "loaves" of a pre-fabricated floor, while relatively substantial loads can be transmitted onto the girder section or can be passed from the girder section in the rest of the carrier construction. The foot of the girder section according to the invention is furthermore stiff in torsion, while the girder section, due to the larger lateral stiffness and resistance, is less sensitive to "tilting" and is better

capable of discharging lateral loads.

A major advantage furthermore is obtained by the nestability of the section, so that from a constructive viewpoint, a continuous girder system can be built up of
5 girders of limited lengths, while variations in dimension in the construction can be prevented by nesting the sections.

Another advantage of the nestability is the smaller volume in case of transport and storage.

10 Some embodiments of the girder section according to the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 shows the girder section according to the invention;

15 Figs. 2-4 show variants of the girder section shown in Fig. 1;

Figs. 5-6 show application possibilities of the girder section according to the invention.

20 The Z-shaped girder section shown in Fig. 1 comprises a web 2 substantially coinciding with the plane going through the principal axis of inertia Y, while two legs are provided, i.e. the lower leg 7 and the upper leg 8, extending substantially parallel to a second principal axis of inertia X. The legs 7,8 are connected to the web
25 2 through connecting parts 5,6, with the part 5 extending from the edge 3 of the web 2 to one end of the lower leg 7, while the part 6 extends from the edge 4 of the web 2

to one end of the upper leg 8. The connecting parts 5,6 are disposed on either side of the plane going through the principal axis of inertia Y and are mutually parallel. The connecting parts 5,6 intersect the legs 7,8 at an
5 accute angle α , while the fillet radius R_2 between the connecting part 6 and the upper leg 8 is minimally equal to the fillet radius R_1 between the connecting part 5 and the lower leg 7, increased by the plate thickness of the section. In this manner, the nestability of the section 1
10 is obtained in another similar section rotated through 180° about its longitudinal axis.

The free end 9 of the lower leg 7 is return-bent at an angle β in the direction of the edge 3 of the web 2, while the edge 10 of the free end 9 parallels the web 2.
15 The angles α and β will preferably be equal, but however may be different, the angle β being possibly both larger and smaller than the angle α .

The edge 10 is connected on the line 11 to the web 2, while this connection can be realized in any suitable
20 manner, e.g. by installing bolts or blind rivets, by welding or by molding the edge 10 and the web 2 into each other by rolling.

The upper leg 8, at the free end thereof from the edge 13 at an angle γ that is maximally equal to α , is
25 bent over in the direction of the lower leg 7 for stiffening the upper leg. The internal dimension in X direction between the edge 13 and the connecting part 6 is minimally

equal to the external dimension in X direction of the triangle 5-7-9.

Fig. 1 shows a Z-shaped section. It will be clear that this girder section in mirror-symmetrical form, has exactly the same properties relative to the principal axis of inertia Y. Such a girder section is indicated for brevity's sake as S-shaped section.

The web 2 of the girder section 1 is preferably fitted with a hole pattern 15 (see Fig. 2) in order to mutually secure nested sections.

The legs 7,8 of the girder section 1 may be provided with reinforcing ridges 16,17 (Fig. 3a). Also the web 2 may be staggered approximately in the centre for stiffening web, as indicated at 18 in Fig. 3b.

Fig. 4 shows a variant of the girder section according to the invention. In this section the free end 9 of the lower leg 7 return-bent in the direction of the web 2 terminates adjacent the end edge 14, so that the lower section portion does not form a closed triangle, as is the case with the girder section shown in Fig. 1.

This section variant 1' may be successfully used as an additional accessory in an S-shaped girder section 1 according to the invention, e.g. as local section thickening or as connecting piece between two girder sections 1, e.g. adjacent moments-zero points in a continuous girder system or for transmitting a partial moment of fixed end adjacent a support.

The section 1' can also be successfully employed in combination with section 1, e.g. as centre panel girder of a continuous girder system, for obtaining an optimum strength/weight ratio or whether or not combined with section 1, in those cases wherein the specific properties of said section 1', in particular the rotated principal axes of inertia, provide an optimum strength-weight ratio, as e.g. upon application in an inclined roof area. Also the girder section 1' may be provided with stiffening ridges 16, 17 in the upper or lower leg (Fig. 4b).

Fig. 5a shows the girder section 1 in combination with two wooden beams 19, 20 supported on the girder section 1. Fig. 5b shows at 21, 22 so-called "loaves" of a prefabricated floor, likewise supported on the closed section portion of the girder section 1.

Fig. 6a shows how the girder section 1 according to the invention is to be placed when a supporting reaction has to be taken up by the girder section. Fig. 6b shows two partly nested girder sections according to the invention for introducing a point load. For this, two identical sections nested into one another may be used (Fig. 6c), while likewise a girder section according to the invention in combination with an auxiliary section 1' shown in Fig. 4 can be employed, as shown in Fig. 6d. In view of the vertically downwardly directed point load acting on the nested girder, the girder section 1 should be mounted in such a manner that the closed triangle 5-7-9 thereof faces

the load P.

Starting from the basic possibilities shown in Fig. 6, girder systems in all kinds of variants may be composed, wherein the nestable sections 1 and 1', respectively, according to the invention can be combined in such a manner that the girder in different places has sufficient rigidity or bearing capacity to take up substantial loads, or to transmit the same to other portions of the construction.

* C L A I M S *

1. A cold-rolled girder section of Z- or S-shaped cross-section, characterized in that the web 2 is situated in a plane substantially coinciding with the plane through the minimal principal axis of inertia (Y), that the edges
5 (3,4) of the web (2) are each connected by means of a connecting part (5,6) to one end of a leg (7,8) of the section (1,1'), while the two connecting parts (5,6) are situated on either side of the plane through the first principal axis of inertia (Y), while the end 9 of the lower leg (7)
10 averted from the connecting part (5) is return-bent in the direction of the web (2) and is connected to the web, thereby forming a closed triangle (5,7,9) having acute base angles (α, β), the section (1,1') being nestable after rotation about its longitudinal axis in a similar section
15 not rotated about its longitudinal axis.

2. A cold-rolled girder section according to claim 1, characterized in that the free edge (12) of the upper leg (8) is bent over at an acute angle (γ) in the direction of the lower leg (7).

20 3. A cold-rolled section according to claims 1-2, characterized in that a hole pattern (15) is provided in the section web (2).

4. A cold-rolled girder section according to any one of claims 1-3, characterized in that stiffening ridges
25 (16,17) are provided in the two legs (7,8) of the girder section (1,1').

5. A cold-rolled girder section according to any one of claims 1-4, characterized in that parts of the section web (2) are disposed in staggered (18) relationship relatively to each other for stiffening the section web.

FIG. 1

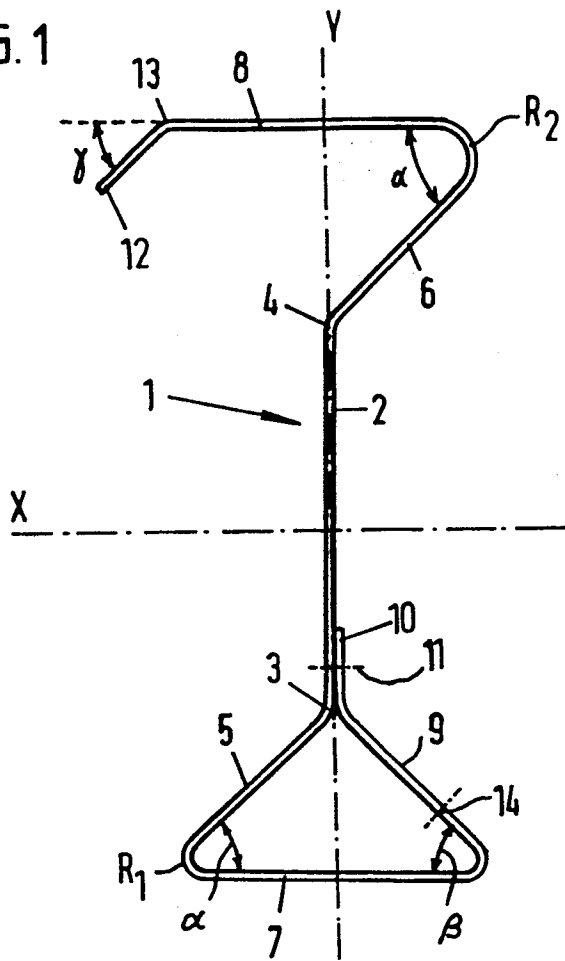


FIG. 2

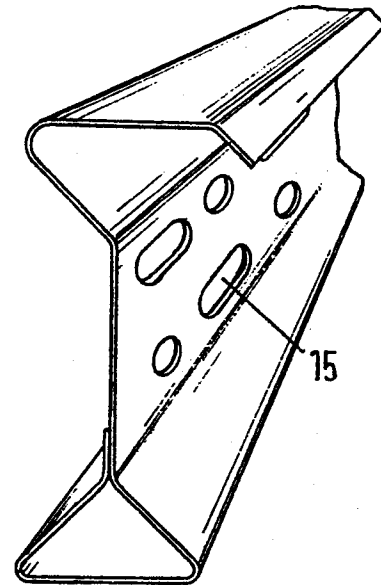


FIG. 3

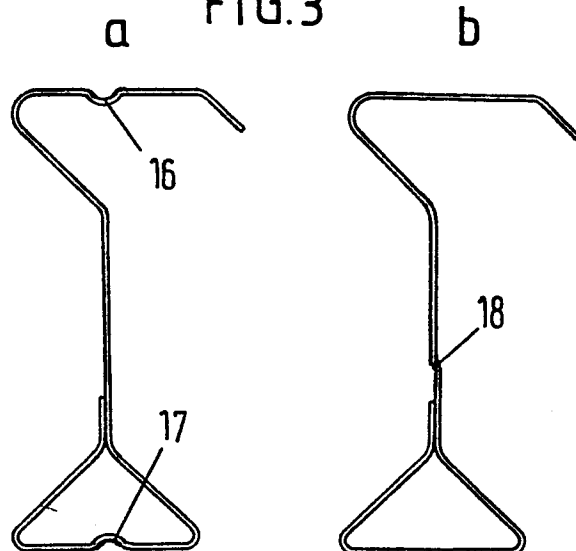


FIG. 4

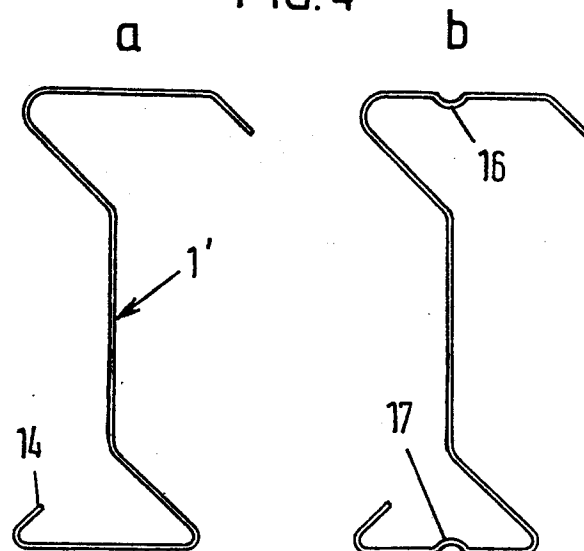


FIG. 5

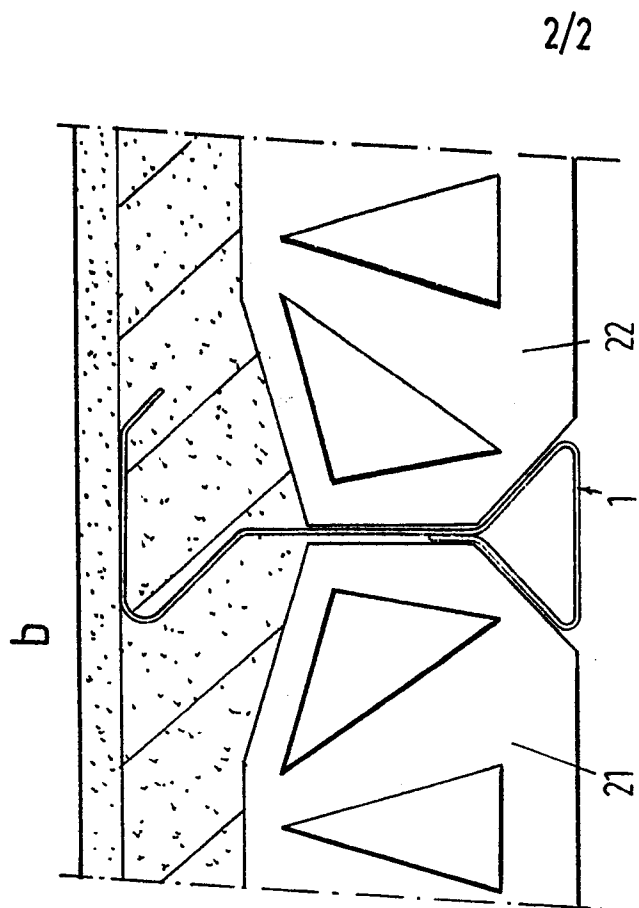
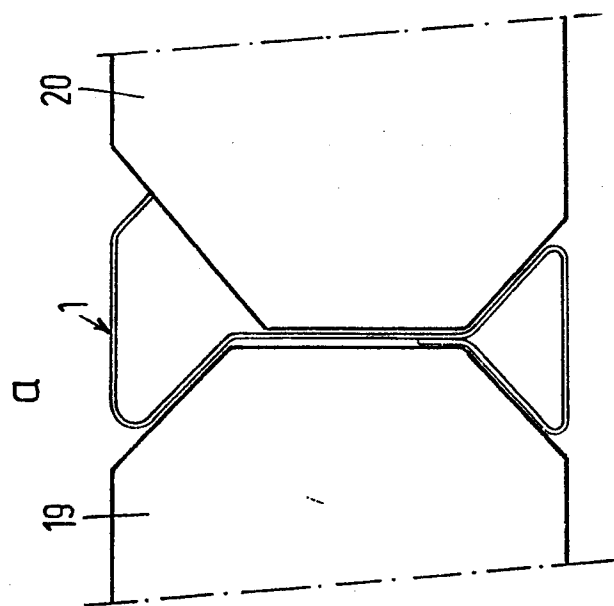
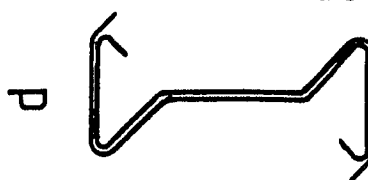
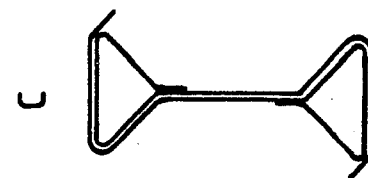
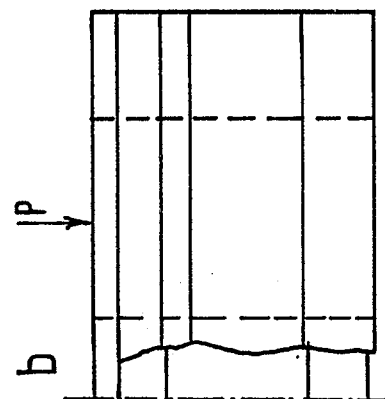
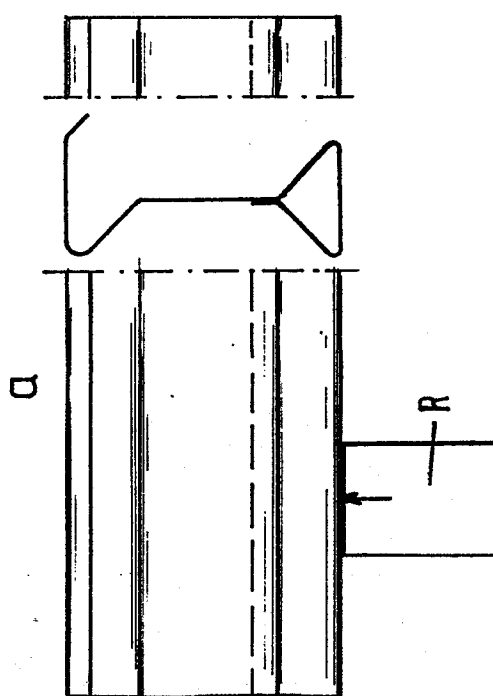


FIG. 6



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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Y	GB-A-1 476 324 (WARD BROTHERS) * Page 1, lines 28-61; page 2, lines 15-58; claims 1,2,4; figure 2 *	1	E 04 C 3/07 E 04 B 5/29
Y	BE-A- 872 513 (SMITS) * Page 1, paragraphs 1,2; figure 1 *	1	
A	GB-A-1 562 688 (WARD BROTHERS) * Page 2, lines 1-20; figures 13,14,16,17 *	1	
A	US-A-3 225 872 (O'BRIEN) * Column 1, lines 54-72; column 2, lines 1-23, 64-72; column 3, lines 1-17; figures 1-3 *	1,2	
A	FR-A-1 534 870 (LE PROFIL) * Page 1, column 2, paragraph 9; figures 1,4 *	1,2	
A	US-A-3 342 007 (MERSON) * Column 1, lines 60-61; column 2, lines 4-14, 28-41; claim; figures 1,4 *	1,4	
A	FR-A-2 362 259 (BEACHLEY) * Page 3, lines 1-7; figures 8,9 *	1,3	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 14-08-1984	Examiner HENDRICKX X.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			



DOCUMENTS CONSIDERED TO BE RELEVANT			Page 2
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
A	GB-A-2 093 886 (ANGLIA JAY PURLIN) * Page 3, lines 13-27, 92-98; figures 1-5 *	1,5	
A	CH-A- 151 212 (JAKLIN) * Page 2, column 1, paragraph 6; figure 1a * -----	5	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 14-08-1984	Examiner HENDRICKX X.
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X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	