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(54) **Building elements**

(57) This invention relates to a method for producing building elements, and the resulting building elements, in which the method comprises the following steps:

- fastening of a plurality of coupling devices (3,4) along at least one intermediate part (2), with an essentially equal mutual distance between them in the longitudinal direction of the intermediate part(s), the coupling devices each being adapted to couple two intermediate parts or one intermediate part (2) and one outer part (1),
- using per se known equipment pulling the coupling devices (3,4) transversely of the longitudinal direction of the intermediate parts, the intermediate parts thus obtaining a zigzag shape, and
- fastening of the outer parts (1) to the coupling devices (3) on each side of the intermediate part(s) (2).

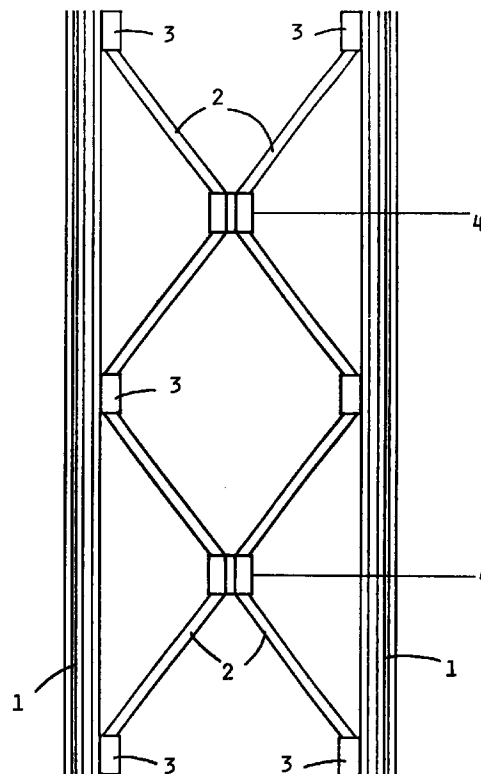


FIG. 2

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Description

This invention relates to a method for producing building elements, and a building element produced with this method.

In the use of beams, girders and masts a combination of strength and low weight is demanded. A much used solution in order to obtain this combination is based upon pairs of outer parts (booms) interconnected by intermediate parts (lattice bars) progressing in a zig-zag-path in the longitudinal direction of the building element. These, basically flat, building elements may be put together to form elongated building elements having triangular or rectangular cross sections. Examples of such constructions may for example be found e.g. in cranes. This provides strong and light-weight construction, but are time consuming and expensive to produce.

In smaller constructions another solution is known being based on a flat metal profile, usually comprising four pipes connected to each other by a thinner intermediate area. In addition the metal profile may comprise different coupling mechanisms in the edges for coupling to other building elements or constructions. The building elements are made from the profile by first removing most of the metal in the intermediate areas so that the pipes are periodically connected each other by a piece of metal. This recess is made so that the pipes at the edges are connected to the respective intermediate pipes at the same longitudinal, periodic positioned, while the intermediate pipes are connected to each other at longitudinal positions being halfway between the corresponding connection points between the outer pipes and the respective intermediate pipes. This way the intermediate pipes are alternately connected to each other and to the respective outer pipes. After this the profile is fastened in a bench and the outer pipes are drawn away from each other. This method provides a building element as shown in the accompanying figure 1.

A disadvantage related to the abovementioned solution is that there are limits for how much the material may be stretched before it loses its strength, especially because the angle at which the intermediate pipes are bent exceeds a certain limit. The angle will normally have a limit at approximately 24°, which in its turn, in combination with other parameters, sets a limit to the width of the building elements. However, the stability and strength of the building element is given by its width. Thus there is a need for building elements allowing a larger width, by enlarging the mentioned angle. It is an object of this invention to provide such a building element, and also a building element produced using this method.

The abovementioned object is obtained using a method as described in claim 1, and a resulting building element, as described in claim 3.

The invention will be described below with reference to a specific example of the invention shown in the

accompanying drawings.

Figure 1 shows an example of a known building element.

5 Figure 2 shows a finished building element produced according to the invention.

Figures 3A-D show cross sections of some of the parts used in the building element.

10 As mentioned before figure 1 shows a building element made according to the known art. Figure 2 shows a corresponding building element made according to the present invention. As is evident from the drawing this solution provides a possibility for a larger angle between the intermediate parts 2 and the outer parts 1.

15 The solution illustrated in figure 2 is made by first fastening a number of coupling devices 3,4 to two parallel, straight intermediate parts 2. The coupling devices are of two types in which the second coupling devices 4 make a coupling between the intermediate parts, and the first coupling devices 3 make a coupling between an intermediate part 2 and an outer part 1. The first coupling devices 3 are in this example positioned in pairs, so that they can connect the respective intermediate parts 2 with the corresponding outer parts 1 at the same positioned in the longitudinal direction. In the figure the building element is shown comprising outer parts 1 mounted thereon.

20 The coupling devices are positioned alternately and with equal distances along the intermediate parts, so that one second coupling device 4 is positioned halfway between two pairs of the first coupling devices, each being positioned in a similar way between two second coupling devices 4.

25 The coupling devices are fastened in their positions in any per se known way, which is not to be described here.

When the coupling devices have been positioned along the required length of the intermediate parts they are placed in an adapted bench, preferably fastened to the first coupling devices 3, being adapted to pull the pairs of the first coupling devices 3 away from each other. Each of the intermediate parts 2 thus being bent to obtain a zigzag-shape between the first and the second coupling devices 3,4. Normally this operation will also make the building element slightly shorter than the original intermediate parts, which may be foreseen in the production.

30 After this stretching operation the outer parts 1 may be mounted and fastened in a suitable way. The outer parts are shown in the drawings as elongated profiles, which normally will be the case when producing beams, girders or other building elements. Other solutions may, however, also be contemplated in which the outer elements have other forms, such as other, similar building elements or walls to be provided with a strong and light-weight building elements mounted thereon.

Figures 3A to 3D show cross sections of each of the

profiles in a preferred embodiment of the invention.

Figure 3A shows an example of an outer part 1 comprising traces 9 for connection to the first coupling devices 3 and/or other types of constructions. The profile also comprises a longitudinal opening with protruding edges 5. These may constitute fastening organs for screw or the like, so that the profiles for example may be fastened on a fixed structure. The longitudinal opening also makes the construction lighter.

Figure 3B shows the cross section of an intermediate part 2. The intermediate part is drawn with an octagonal outer profile which, when cooperating with a coupling device, may hinder twisting of the intermediate part during the stretching process. The intermediate part is also provided with a through-going opening with fastening organs 5 for screws.

Figure 3C shows the first coupling device 3 with a part 6 being formed to be able to cooperate with a corresponding recess in the outer part 1. The shown first coupling device also has an opening 7 for receiving an intermediate part, with a shape corresponding to the outer shape of the intermediate part 2.

Correspondingly the second coupling device shown in figure 3D has two openings 8 for receiving the intermediate parts 2. These openings are also adapted to the outer shape of the intermediate parts.

A number of embodiments other than the one illustrated in the drawings are of course also possible. One especially interesting one comprises only one intermediate part with one type of coupling devices positioned with equal distances along the intermediate part, possibly alternatively oriented different ways. In this embodiment the intermediate part will make a zigzag-shape between the connection point to the outer parts. Other variants with three or more intermediate parts are also possible.

The different parts of the building elements may be shaped in different types of materials, for example aluminum. Hardening and other characteristics may be chosen according to the element which is to be produced, but because a relatively large degree of deformation in the intermediate parts is required they will preferably be made slightly softer than the coupling devices. For the strength of the finished element it may, however, be advantageous if the coupling devices are somewhat deformed, so that the intermediate parts are sufficiently fastened to the coupling devices.

Claims

1. Method for producing building elements, **characterised** in comprising the following steps:

a) fastening of a plurality of coupling devices (3,4) along at least one intermediate part (2), with an essentially equal mutual distance between them in the longitudinal direction of the intermediate part(s), the coupling devices

each being adapted to couple two intermediate parts or one intermediate part (2) and one outer part (1),

b) using per se known equipment pulling the coupling devices (3,4) transversely of the longitudinal direction of the intermediate parts, the intermediate parts thus obtaining a zigzag shape, and

c) fastening of the outer parts (1) to the coupling devices (3) on each side of the intermediate part(s) (2).

2. Method according to claim 1, **characterised** in that step a) comprises fastening of a number of first coupling devices (3), position in pairs with essentially the same positions in the longitudinal direction, to two essentially parallel intermediate parts (2), and fastening of a plurality of second coupling devices to both the intermediate parts (2), so that each of the second coupling devices (4) are fastened halfway between two adjacent pairs of the first coupling devices (3), and that step b) comprises drawing of the first coupling devices (3) in each pair of first coupling devices (3) in opposite directions perpendicular to the longitudinal direction, so that the intermediate parts (2) are bent to obtain a zigzag-shape between the first coupling devices and each other, respectively, defined by the positions of the coupling devices.
3. Building element produced using the method according to claim 1 or 2, **characterised** in that it comprises two outer parts (1) positioned on each side of at least one elongated intermediate part (2), that the intermediate part(s) (2) are coupled in alternating directions to the outer parts (1) and /or each other using coupling devices (3,4) being fastened with essentially equal mutual distance between each other in the longitudinal direction of the building element, and that the intermediate part(s) (2) have a zigzag-shape in the longitudinal direction between the subsequent coupling devices (3,4).
4. Building element according to claim 3, **characterised** in that it comprises two intermediate parts, each being connected to one outer part (1) using a plurality first coupling devices (3) fastened in corresponding positions in the longitudinal direction to the respective outer parts (1), and being connected to each other using a number second coupling devices (4) positioned in the longitudinal direction in positions being substantially halfway between the respective first coupling devices (3).
5. Building element according to claim 3 or 4, **characterised** in that the intermediate part(s) (2) is/are provided with a polygonal, e.g. hexagonal, cross

section, and that the coupling devices (3,4) are provided with through-going holes (7,8) with substantially the same shape for receipt of the intermediate part(s) (2).

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6. Building element according to one of claims 3-5, **characterised** in that the coupling devices (3,4) are made from a material being harder than the intermediate part(s) (2).

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7. Building element according to one of claims 3-6, **characterised** in that the outer parts (1) constitutes elongated profiles having recesses (9) for connecting to other corresponding profiles, for producing of three- four- or poly-sided girders, masts or similar.

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8. Building element according to one of claims 3-7, **characterised** in that the intermediate parts (2) are shaped as pipes provided with inner fastening organs (5) for screws.

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9. Building element according to one of claims 3-8, **characterised** in that the outer parts (1) comprises longitudinal holes, the holes being provided with inner fastening organs (5) for screws.

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10. Building element according to claim 8 and/or 9, **characterised** in that the inner fastening organs (5) are shaped as inwardly protruding, elongated edges stretching along at least part of the length of the pipes or holes.

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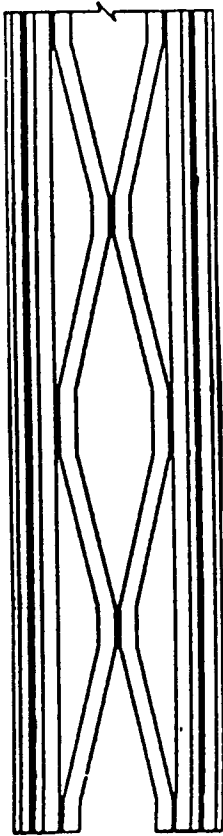


FIG. 1

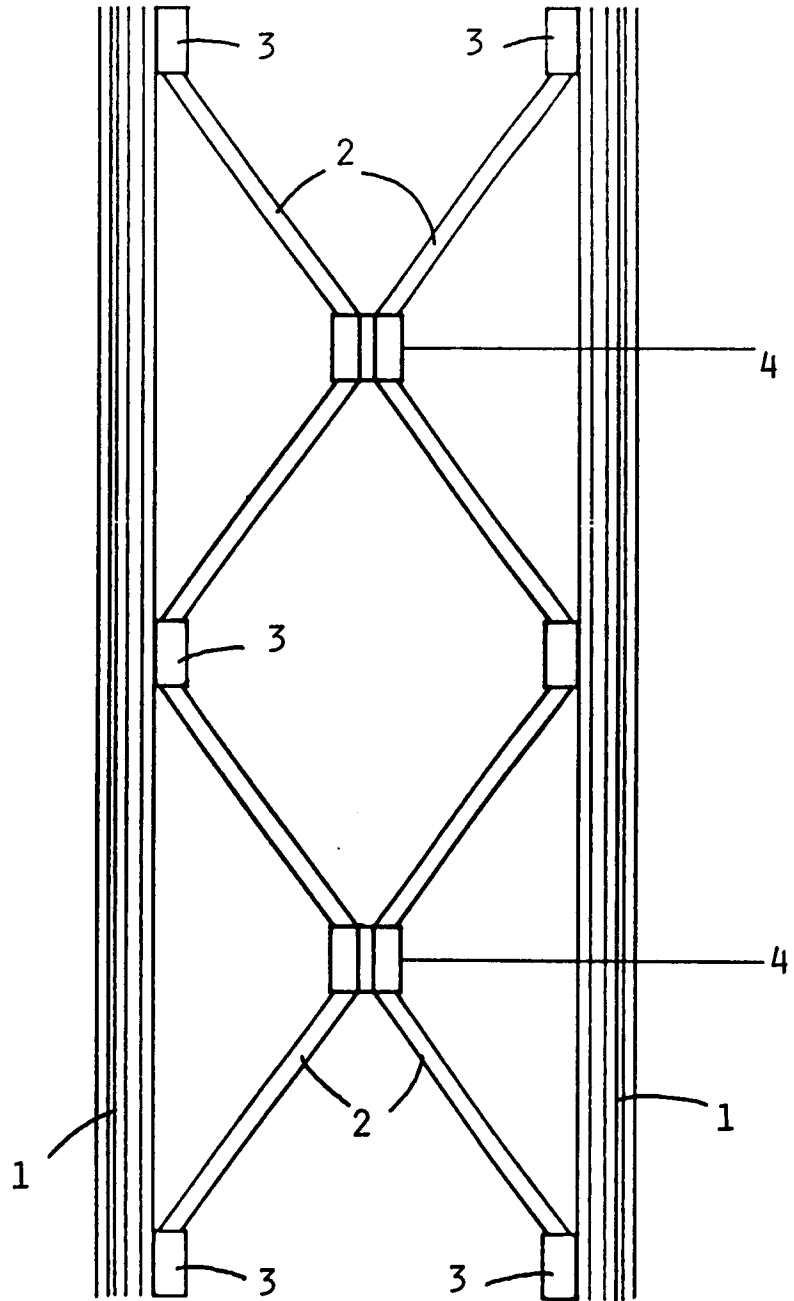


FIG. 2

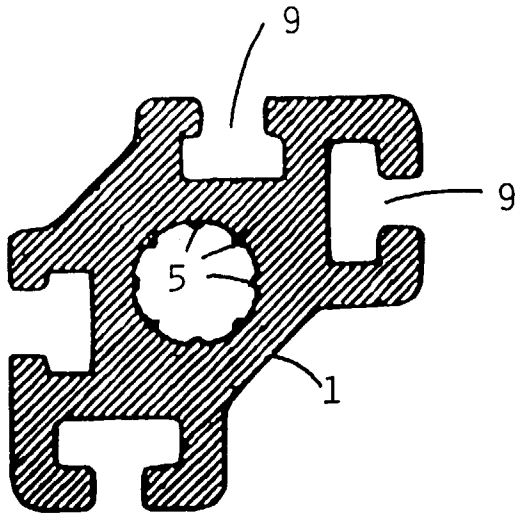


FIG. 3A

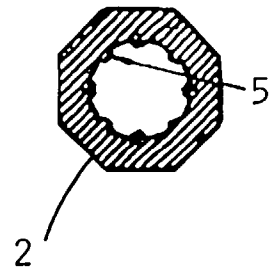


FIG. 3B

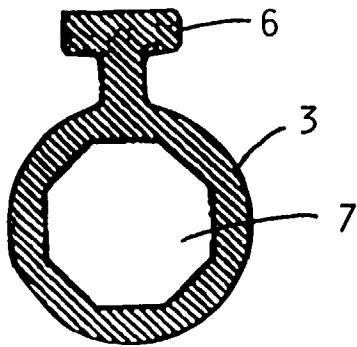


FIG. 3C

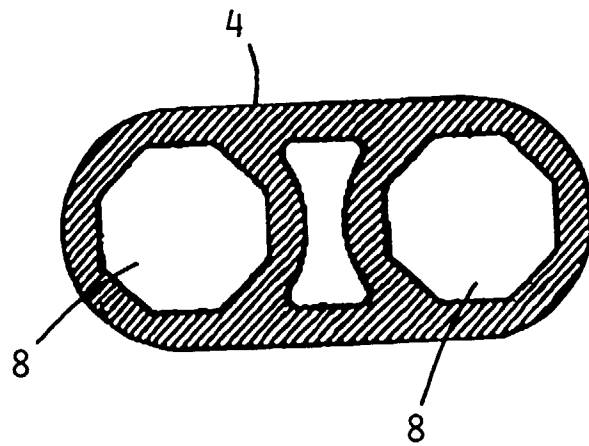


FIG. 3D