



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.08.2007 Bulletin 2007/34

(51) Int Cl.:
E04B 5/14 (2006.01)

(21) Application number: **06075394.4**

(22) Date of filing: **20.02.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
 Designated Extension States:
AL BA HR MK YU

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(54) **Floor element**

(57) Floor element comprising at least one cross member and at least one longitudinal member having a length direction, the floor element having a height dimension and extending in a main plane, characterized in that

at least one of the cross members and of the longitudinal members is provided with a connection plate suitable for connecting the cross member and the longitudinal member to each other.

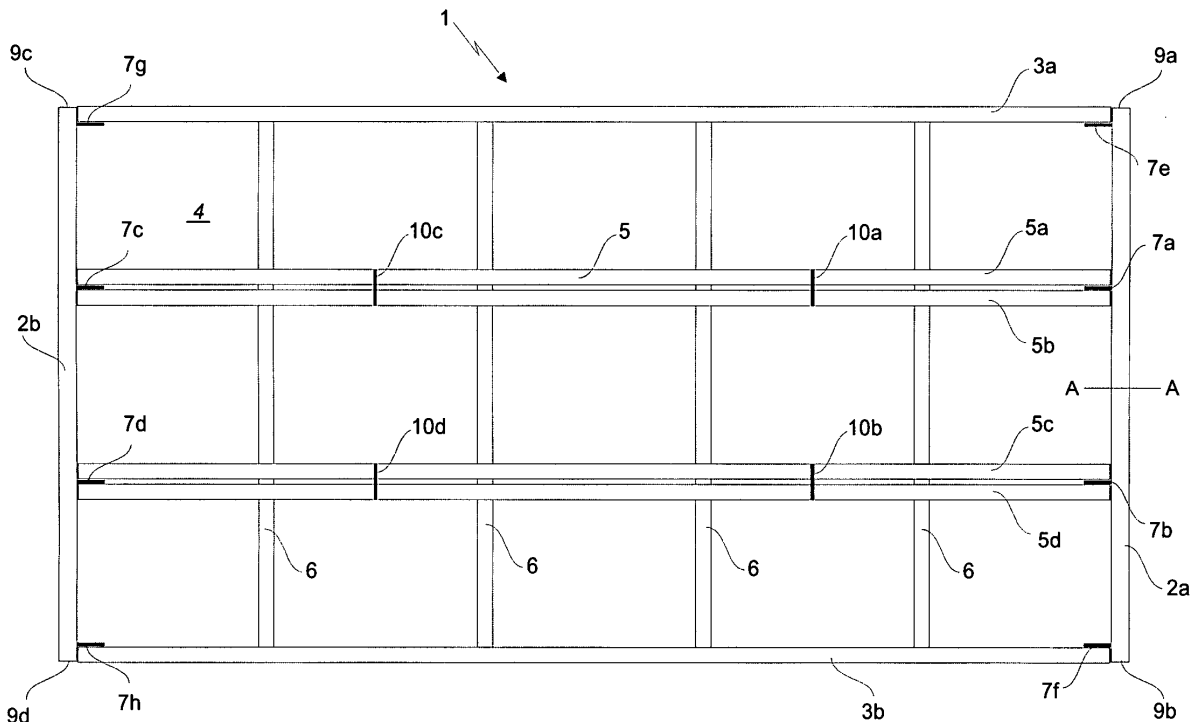


Fig. 1

Description

[0001] The invention relates to a floor element comprising at least one cross member and at least one longitudinal member having a length direction, the floor element having a height dimension and extending in a main plane.

[0002] Such floor element is known from European patent publication EP 1 443 156. This publication discloses a floor element having two cross members and multiple longitudinal members wherein the cross members and the longitudinal members have a generally U-shaped cross section. The cross members and two outer longitudinal members form a closed frame and enclose an interior space. The legs of the U-shaped cross members and outer longitudinal members are directed towards the interior space. The other longitudinal members extend in parallel to the outer longitudinal members and between the legs of the U-shaped cross members.

[0003] It is an object of the present invention to provide a floor element in which the longitudinal member can be rigidly fixed in the floor element.

[0004] It is another object of the present invention to provide a floor element in which the longitudinal member can be rigidly fixed in the floor element by simple fixing means using standard equipment.

[0005] It is a further object of the present invention to provide a floor element, which can be easily mounted on a supporting structure.

[0006] It is still another object of the present invention to provide a floor element with which it is possible to construct buildings having a given height of the passage of each storey but at a lower overall height of a storey.

[0007] It is a still further object of the present invention to provide a floor element, which is easy to assemble to a floor for buildings like car parks, platforms and office buildings.

[0008] These and other objects and further advantages are obtained with a floor element, which according to the invention is characterized in that at least one of the cross members and of the longitudinal members is provided with a connection plate suitable for connecting the cross member and the longitudinal member to each other.

[0009] The connection plate forms a rigid and sturdy support for connecting the longitudinal member to the cross member giving the floor element great stiffness.

[0010] Also the connection plate provides a simple means of connecting the longitudinal member to the cross member.

[0011] The connection plate can be fastened to the longitudinal or cross member by known fastening means, such as bolting, welding or riveting, but welding is preferred.

[0012] Longitudinal members or cross members can be pre-fabricated in standard sizes and provided with the connection plate. For this manufacturing method, welding is the preferred way of fastening the connection plate

to the relevant member. Welding is a very suitable and reliable process for manufacturing pre-fabricated members in an automated process in large quantities. The pre-fabricated members can be coated by any suitable coating process and with any suitable coating material. Preferably, in particular for external applications, the coating material is zinc or a zinc alloy and the coating process is a hot dip galvanizing process. For internal applications a primer coating will in general be sufficient.

[0013] In a subsequent step, the pre-fabricated members can be assembled to form the floor element. In a preferred embodiment of the invention, the connection plate is fastened to the cross member. A suitable fastening means is welding. This embodiment makes pre-fabricating and subsequent assembly of the floor element easy because generally flat connection plates can be used and cross members can be made at any length. The longitudinal members can simply be cut to the desired size from longer rolled profiles. The longitudinal member can be fastened to the connection plate by any suitable means such as bolting, welding or riveting, but bolting is preferred, in particular since no special equipment is required therefore. Also, in the event that the longitudinal member and/or the connection plate have been coated with coating material, this coating material is not damaged by bolting.

[0014] The floor element of the invention can have any form or shape. The most common shape is a rectangular shape, in particular also those shapes wherein the longitudinal member has a greater length than the cross member. Preferably, the connection plate is fastened to the cross member and preferably, in use, the cross member rests on a supporting structure. The longitudinal member provides the span. Also other shapes are possible, such as triangular, trapezoidal, polygonal shape or the shape of a sector.

[0015] Preferably the cross member and the longitudinal member are made of steel.

[0016] The floor element can extend in a flat plane but also in a plane, which is curved in one or more directions such as a hyperplane.

[0017] Preferably the connection plate is a generally flat plate, if wanted, provided with holes through which bolts can be inserted. Steel is a suitable material to make the connection plate from.

[0018] In a preferred embodiment the connection plate extends from the cross member or the longitudinal member substantially in the length direction of the longitudinal member.

[0019] Since the connection plate extends substantially in the length direction of the longitudinal member, load on the floor element is effectively transferred through the longitudinal member to the cross member. Because the connection plate extends in the length direction of the longitudinal member, no additional space is occupied by the connection plate and the forces exerted on the connection plate are mainly stress forces.

[0020] A particular useful embodiment of the floor el-

ement of the invention is characterized in that at least one cross member comprises a flange portion extending outwardly away from the longitudinal member.

[0021] This embodiment opens the way to constructing a building having a desired height of the passage of a storey but at a lower than usual overall height of a storey. The quantity of building materials needed for a building, in particular expensive components like wall panels, can be significantly reduced with the floor of our invention.

[0022] A common way of constructing a building like an office building or a car park is to make a supporting structure comprising horizontal supporting beams on top of which floor elements rest.

[0023] With this embodiment of the invention it is possible to hang the floor element between adjacent supporting beams by which the outwardly extending flange portion rests on the supporting beams and a substantial part of the floor element is positioned between the supporting beams.

[0024] In a preferred embodiment the cross member comprises an angle beam having two legs, one of which extends away from the longitudinal member.

[0025] In this embodiment the outwardly extending leg can, in use, have the function of an outwardly extending flange portion suitable to rest on a supporting structure. The connection plates can be fastened to the other leg of the angle beam. The angle beam may in this way form the cross member which results in a simple construction of the floor element.

[0026] In a further embodiment of the floor of the invention the flange portion is positioned in use above the middle of the height dimension of the floor element.

[0027] By placing the outwardly extending flange portion above the middle of the height dimension of the floor element, a substantial part of the floor element is located between the beams. By suitably selecting the position of the outwardly extending leg sufficient space is kept available under the floor element and between the beams for piping, electrical circuitry and air ducts.

[0028] Another very effective embodiment of the invention is characterized in that the cross member comprises a generally U-shaped beam, extending in a beam longitudinal direction and having a web and two legs and a first and a second end, the legs extending away from the longitudinal member.

[0029] This embodiment of the invention exhibits a great stiffness of the cross member which makes it possible to concentrate the load on the floor near the first and second end, creating the possibility to use lighter supporting beams or only supporting columns which only locally support the cross member, preferably at the first and second end.

[0030] In a preferred embodiment the connection plates are fixed, preferably by welding, directly to the web of the U-shaped beam, which then forms the cross member. One of the legs of the U-shaped beam, preferably the lower one, in use can be used to rest on the supporting structure.

[0031] This embodiment of the invention is of particular interest in an embodiment the cross member is provided with a tubular element suitable for receiving a supporting column.

5 **[0032]** This embodiment is very suitable for use in a floor in which the floor element is only or substantially only supported by columns, which fit in the tubular elements. Preferably the cross members are not supported between the tubular elements. This type of floor is also known as "stick-floor".

10 **[0033]** The tubular elements can be positioned at the first and/or the second end, for stability reasons. It is also possible to position the tubular elements between the first and second end so as to reduce the span of the cross member between the supporting columns.

15 **[0034]** The tubular elements can have a cylindrical form but also other forms such as conical for self-centering, are possible.

20 **[0035]** In general, two or more floor elements will be assembled to form a floor of a desired shape by connecting the outer longitudinal members to each other. Preferably, the floor elements are connected to each other by bolting to prevent damage to a coating material applied to the floor element.

25 **[0036]** Any suitable cover material such as concrete, wood or tiles may cover the floor element.

30 **[0037]** Although the invention has been described on the basis of floor element, the invention can also be applied to wall elements, roof elements or building elements in general.

[0038] The invention will now be illustrated with reference to non-limiting embodiments as shown in the drawing in which

35 **[0039]** Fig. 1 shows in a diagrammatic form a floor element in which the invention is embodied.

[0040] Fig. 2 shows a detail of a floor element according to the invention in which the cross member comprises an angle beam.

40 **[0041]** Fig. 3 shows a detail of a further embodiment of the floor element of the invention.

[0042] Fig. 4 shows a detail of another embodiment of the floor element of the invention.

45 **[0043]** In the following identical reference numbers refer to identical elements or elements having an identical or similar function.

[0044] In Fig. 1 reference numeral 1 indicates in general a floor element in which the invention is embodied. The floor element has a rectangular shape and extends in a flat plane. It comprises two cross members 2a and 2b and two outer longitudinal members 3a and 3b. Preferably, the outer longitudinal members are U- or C-shaped sections, formed by roll forming of steel strip. The cross members and the outer longitudinal members enclose an interior space 4 in which two pairs of inner longitudinal members 5 respectively 5a, 5b and 5c, 5d extend from cross member 2a to the other cross member 2b in parallel to the outer longitudinal members 3a and 3b.

[0045] The floor element is further provided with stiff-

ening bars 6.

[0046] Cross element 2a is provided with inner connection plates 7a and 7b; cross element 2b with inner connection plates 7c and 7d. The inner connection plates 7a, 7b, 7c and 7d have been fastened to the cross elements 2a and 2b resp. by welding.

[0047] The inner longitudinal elements 5a and 5b are connected to the connection plate 7a by bolts 8 as is shown in more detail in Fig. 1a.

[0048] In a similar way inner longitudinal members 5a and 5b are connected to cross member 2b through inner connection plate 7c and inner longitudinal members 5c and 5d to cross members 2a and 2b through inner connection plates 7b and 7d respectively.

[0049] Cross member 2a is also provided with two outer mounting plates 7e and 7f; cross member 2b with two outer mounting plates 7g and 7h.

[0050] The outer mounting plates 7g and 7e carry outer longitudinal member 3a. Outer mounting plates 7f and 7h carry outer longitudinal member 3b. Outer mounting plates 7e, 7f, 7g and 7h are positioned such that the outer longitudinal elements 3a and 3b do not extend beyond the ends 9a, 9c resp. 9b, 9d of cross elements 2a and 2b. Outer longitudinal element 3a can then be mounted by bolting against outer longitudinal element 3b of a neighbouring floor panel. Two outer neighbouring longitudinal elements 3a, 3b then also have the same function as a pair of inner longitudinal elements 5a, 5b resp. 5c, 5d.

[0051] If desired, inner longitudinal elements 5a, 5b resp. 5c, 5d can be connected to each other by intermediate bolts 10a, 10b, 10c and 10d.

[0052] Typical sizes for a floor element are a length of the outer longitudinal element of 7200 mm, a length of the cross element of 3000 mm and a height, perpendicular to the plane of the figure of between 100 and 300 mm, dependent on the load.

[0053] If desired, the floor element is given a camber, such that the under its own weight or under a predetermined fixed load, the floor element extends in a flat plane.

[0054] Fig. 2 shows in more detail a cross section along the line A-A of an embodiment of the floor element of the invention, covered with a cover material.

[0055] In Fig. 2 the cross element 2a comprises an unequal angle beam preferably made of steel, comprising a first leg 11a in the form of a flange, extending outwardly away from the interior space 4 and from the longitudinal member 5b.

[0056] The second leg 11b of the unequal angle beam extends downwardly and is provided with inner connection plate 7a, which is fixed to the second leg by means of welds 12.

[0057] The inner connection plate 7a has mounting holes 13 through which bolts (not shown) can be inserted for fastening inner longitudinal elements 5a, 5b.

[0058] The floor element carries a cover layer 14 which can be any suitable material such as reinforced concrete, wooden shelves or tiles.

[0059] In use, the floor element rests with the first leg

11 a on a supporting structure 16.

[0060] The cover layer 14, upper side 18 of the angle beam and the supporting structure 16 are provided with holes 30, 31, 32 resp. which are positioned in line and through which a bolt may be inserted to fix the floor element to the supporting structure.

[0061] In the state of the art, the lower side of the cross member 2a would rest on the supporting structure 16 and the lower side 17b of inner longitudinal member 5b would be at about the same level as or on top of the upper side 18 of the supporting structure.

[0062] Generally, the underside 19 of the supporting structure, determines the height of the passage of a storey. With the floor element of the invention, part of the floor element is positioned between beams of the supporting structure, thereby lowering the floor element over a distance h (see Fig. 2). The distance between two successive floors is also reduced by the same distance h, which leads to a lower height of a storey and a corresponding reduction in building materials needed to erect a building.

[0063] Fig. 3 shows a detail of another embodiment of the floor element of the invention, seen in cross section along the line A-A.

[0064] In this embodiment the cross member comprises a U-shaped beam 20, having a web 21, an upper leg 22 and a lower leg 23.

[0065] The inner connection plate 7a is welded to the web 21 by welds 12. The lower leg 23 forms a flange extending outwardly away from the interior space of the floor element. It will be clear to the skilled person that the web 23 of the U-shaped profile can be shorter or longer than the height of the inner longitudinal member 5b, dependent on parameters like the load and space for which the floor element has been designed.

[0066] In use the lower leg 23 can rest on a supporting structure, similar to the one shown in Fig. 2.

[0067] Such support structure may comprise beams resting on columns, the beams being suitable to support the cross members.

[0068] Fig. 4 shows a detail of an embodiment of a floor element suitable for a so-called stick-floor in which the floor elements are supported by columns or sticks. In this embodiment, the floor element is provided with a tubular element 24, connected to a cross member 2a e.g. by welding. The tubular element further carries the outer connection plate 7f to which outer longitudinal element 3b is fixed by means of a bolt 25.

[0069] A supporting column 26 reaches into the tubular element 24 and is provided with a rib (not shown) on which the tubular element 24 rests. A second supporting column to support a higher-placed floor element can be placed on top of the supporting column 26.

[0070] The embodiment of the floor element having a U-shaped beam is particularly suitable for use in stick floor because of the stiffness of the U-shaped beam. Also in case of a stick-floor, floor elements can be placed side by side to form a floor. The tubular element can be posi-

tioned at any suitable place in the cross member.

Claims

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|---|----|
| | 5 |
| 1. Floor element comprising at least one cross member and at least one longitudinal member having a length direction, the floor element having a height dimension and extending in a main plane, characterized in that at least one of the cross members and of the longitudinal members is provided with a connection plate suitable for connecting the cross member and the longitudinal member to each other. | 10 |
| 2. Floor element according to claim 1 wherein the connection plate extends from the cross member or the longitudinal member substantially in the length direction of the longitudinal member. | 15 |
| 3. Floor element according to claim 1 or claim 2 wherein the connection plate is fastened to the cross member or the longitudinal member by welding. | 20 |
| 4. Floor element according to any of the preceding claims wherein the connection plate is fastened to the cross member. | 25 |
| 5. Floor element according to any of the preceding claims wherein at least one cross member comprises a flange portion extending outwardly away from the longitudinal member. | 30 |
| 6. Floor element according to any of the preceding claims wherein the cross member comprises an angle beam having two legs, one of which extends away from the longitudinal member. | 35 |
| 7. Floor element according to claim 5 or 6 wherein the flange portion is positioned in use above the middle of the height dimension of the floor element. | 40 |
| 8. Floor element according to any of the preceding claims wherein the cross member comprises a generally U-shaped beam, extending in a beam longitudinal direction and having a web and two legs and a first and a second end, the legs extending away from the longitudinal member. | 45 |
| 9. Floor element according to any of the preceding claims wherein the cross member is provided with a tubular element suitable for receiving a supporting column. | 50 |

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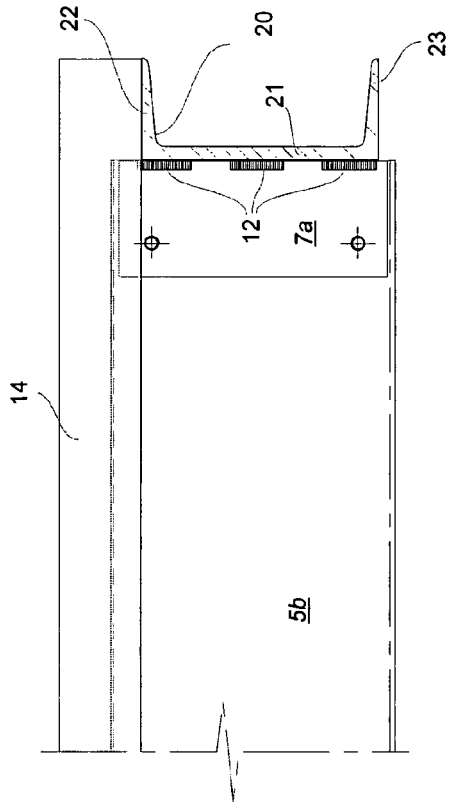


Fig. 3

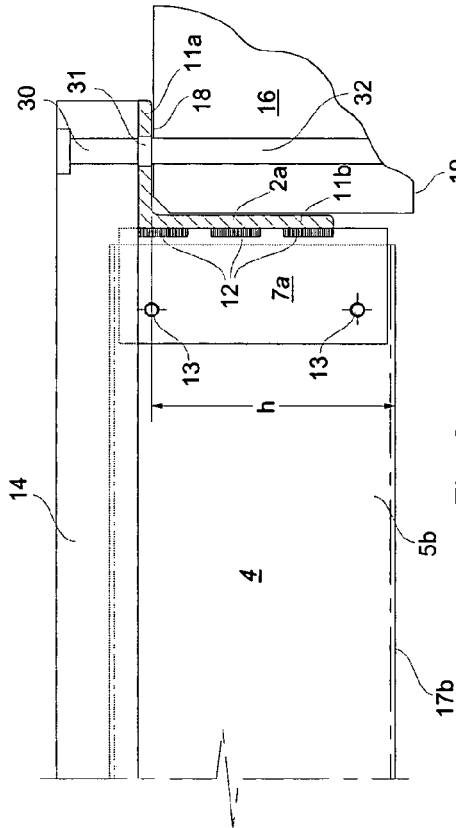


Fig. 2

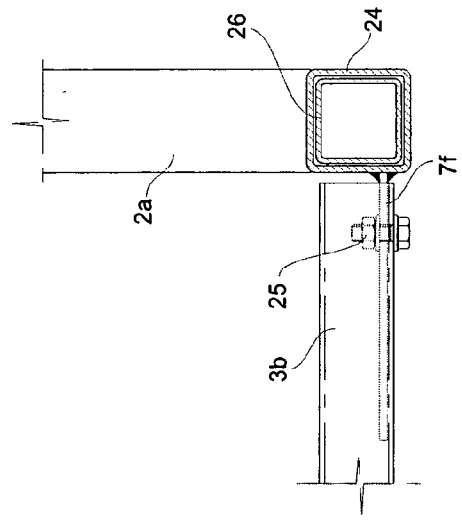


Fig. 4

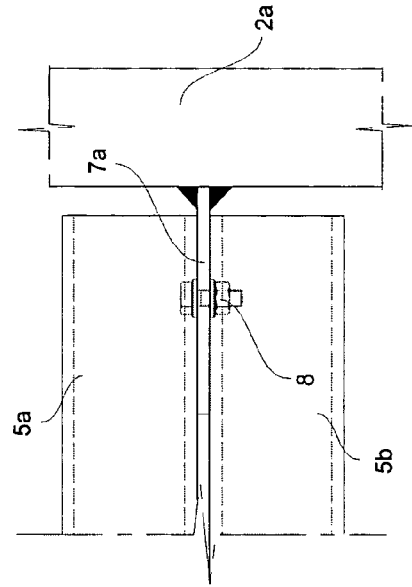


Fig. 1a



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 23 14 373 A1 (8033 PLANEGG; ELSNER ULRICH DIPL-ING; WILHELM ROLF DIPL ING) 14 November 1974 (1974-11-14) * the whole document * -----	1-9	INV. E04B5/14
X	EP 1 031 669 A (SADEF NV [BE]) 30 August 2000 (2000-08-30) * the whole document * -----	1-8	
X	US 2002/005022 A1 (MATTHEWS LEROY [US]) 17 January 2002 (2002-01-17) * figures 7a,9 * -----	1,2,4	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			E04B E04C
Place of search		Date of completion of the search	Examiner
Munich		29 September 2006	Nilsson, Lars
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EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 07 5394

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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29-09-2006

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 2314373	A1	14-11-1974	NONE	

EP 1031669	A	30-08-2000	NONE	

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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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Patent documents cited in the description

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