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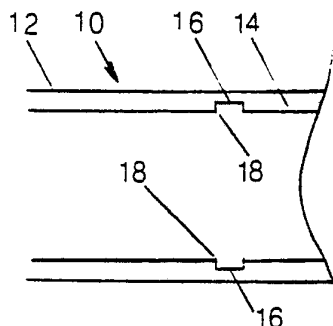
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(54) Title: COUPLINGS



(57) Abstract

A coupling for two tubular members (10, 40), one (40) of which is provided with a keyhole aperture (50) having a hole (52) intersected by a slot (54) and the other (10) of which is provided with an end plug (28) having an internally threaded bore (38), is effected by a bolt (20) in which a head (22) is separated from an externally threaded shaft (26) by a neck (24). The head (22) and shaft (26) are of such a size that they cannot pass through the slot (54), but the neck (24) is of lesser width and can pass through the slot (54). The head (22) is passed through the hole (52), and the neck (24) is slid into the slot (54). The internally threaded bore (38) of the plug (28) is then screwed onto the shaft (26). Means are provided for locking the bolt (20) in position, and preferably comprise a washer (60) having a hole (62) through which the shaft (26) may project and a pin (68) for engaging the hole (52).

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TITLE

Couplings

DESCRIPTION

5 The invention relates to couplings for the connection of a strut and a tie.

The invention provides a coupling for the connection of one end of a tubular first member to a tubular second member, the coupling comprising:

10 a bolt having a head, a threaded shaft and a neck portion, the neck portion being intermediate the head and the threaded shaft and narrower than either of them;

15 a keyhole aperture in the wall of the tubular second member, the keyhole aperture comprising a hole sufficiently large to receive the head of the bolt and a slot intersecting the hole and having a width greater than that of the neck portion of the bolt but less than those of the head and threaded shaft of the bolt;

20 means for locking the bolt in a position in which its head is disposed within the second member, its threaded shaft projects from the second member, and its neck portion is received in the slot of the keyhole aperture; and

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a plug rotatably received in one end of the first member and having an internally threaded part for co-operation with the threaded shaft of the bolt.

5 The tubular second member may be of any desired cross-section, including triangular, square, rectangular, hexagonal, octagonal and circular. The slot of the keyhole aperture preferably extends parallel to the axis of the second member. The ends of the second member may be closed by end caps. One end may alternatively be
10 provided with a foot member. The foot member may have an externally threaded portion for screwing into a nut secured in the end of the second member, and will be adjustable by regulating the length of the externally threaded portion which is screwed into the nut. The
15 reverse arrangement whereby the foot member has an internally threaded portion for co-operation with an externally threaded bolt secured in and projecting from the end of the second member is possible but is not preferred. Many other means of securing a foot member or
20 an end cap to the second member will be known to those skilled in the art, and accordingly they will not be described here.

The first member may be of any desired cross-section, but is preferably of square, rectangular or circular cross-section. The plug received in the end of the first
25 member may comprise a head portion for abutment to the end of the first member and a main portion for insertion into the end of the first member. The head portion is formed at one end of the main portion and is preferably
30 integral therewith. The other end of the main portion may terminate in a plurality of compressible legs delineated by axial slots in the said other end of the main portion, each leg carrying an upstanding detent member. The first member has an internal shoulder for co-

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-operation with the detent members. The internal shoulder may be formed by a groove in the internal wall of the first member.

The means for locking the bolt in the aforesaid position preferably comprises a locking washer having a hole through which the threaded shaft of the bolt may pass and a pin of a size such that it may be inserted in the hole of the keyhole aperture but not in the slot of the keyhole aperture. The faces of the locking washer are preferably shaped to correspond one with the outer surface of the second member and the other with the outer end of the head portion of the plug. An alternative means for locking the bolt comprises a rebate around the slot of the keyhole aperture for co-operation with a corresponding projection formed on the end of the plug.

The bolt is preferably made from any suitable metal such as steel. The tubular members may be made of metal, but are preferably made of plastics material such as polyvinyl chloride. The locking washer and plug are preferably also made of plastics material, nylon or Delryn (Trade Mark) being suitable. The pin of the locking washer may be formed integrally with it. The internal threaded part of the plug may be integrally formed in the plug but is preferably provided by a metal nut secured in the head portion of the plug.

Usually, both ends of the first member will be provided with plugs as described above and there will be as plurality of keyhole apertures in the second member. These may be disposed along the length of the second member and also at differing radial orientations.

By using the second members as struts and the first members as ties, various structures may be assembled. By

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attaching other parts such as chair seats, table tops, shelves, wall members, door members and runners for supporting drawers, many items of furniture may be made. Other structural and display uses are also contemplated.

5 It should be noted that the first and second members are not necessarily straight, but could be curved or include bends. Both the first and second members may be formed with external grooves or channels for receiving panels.

The invention is illustrated by the drawings, of which:

10 Figure 1 is a cross-sectional view through a part of a first member, which itself is a part of a coupling according to the invention;

Figure 2 is a side elevation of a plug, which is another part of the coupling according to the invention;

15 Figure 3 is a side elevation of a bolt being a further part of the coupling according to the invention;

Figure 4 is a cross-sectional view of a part of a second member, which is a yet further part of the coupling according to the invention;

20 Figure 5 is a side elevation of a locking washer, which is a yet further part of the coupling according to the invention;

Figure 6 is an end elevation of the locking washer of Figure 5;

25 Figure 7 is a side elevation of a part of an alternative second member for use in another coupling according to the invention;

Figure 8 is a side elevation of an alternative plug for use in the said other coupling according to the invention;

30 Figure 9 is a perspective view of a structure built from struts and ties joined by couplings according to the invention; and

Figure 10 is a series of sketches illustrating in perspective various other structures which can be built

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from struts and ties joined by couplings according to the invention.

With reference to Figures 1 to 6 of the drawings, a first member 10 of a coupling according to the invention comprises a tube 12 (one end of which is shown in Figure 1) of circular cross-section. The tube 12 has a wall 14 in which is formed a groove 16. The groove 16 defines a shoulder 18, the purpose of which will be explained hereinafter.

A plug 28 (Figure 2) has a head portion 29 and a main portion 30. Four axial slots 32 in the end of the main portion 30 define four legs 34, upstanding from each of which is a detent 36. The main portion 30 is of such a size that it may be pushed into the end of the tube 12 with the legs 34 under resilient compression. When the head portion 29 abuts the end of the tube 12, the detents 36 will enter the groove 16 and the compression on the legs 34 will be released. The action of the detents 36 against the shoulder 18 will then prevent removal of the plug 28 from the tube 12. The plug 28 is provided with an internally threaded bore 38.

Referring now to Figure 3, a bolt 20 comprises a head 22, a threaded shaft 26 and a neck portion 24 intermediate the head 22 and shaft 26 and of smaller diameter than either of them.

A second member 40 (Figure 4) of a coupling according to the invention comprises a tube 42 of circular cross-section. The wall 44 of the tube 42 is provided with keyhole apertures 50 (two shown), each of which comprises a hole 52 intersected by a slot 54. The hole 52 is of a size such that the head 22 of the bolt 20 can pass through it. The slot 54 is of a lesser width, whereby it

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may accommodate the neck portion 24 of the bolt 20, but not allow the head 22 or the threaded shaft 26 of the bolt 20 to pass through it.

5 Figures 5 and 6 show a locking washer 60. The locking washer 60 has a central hole 62 through which the threaded shaft 26 of the bolt 20 can pass. Face 64 of the locking washer 60 is shaped for abutment to the outer surface of the wall 44 of the tube 42, while face 66 of the locking washer 60 is shaped for abutment to the free
10 end of the head portion 29 of the plug 28. Upstanding from the face 64 of the locking washer 60 is a pin 68 sized such that it may be inserted in the hole 52 but not the slot 54 of the keyhole aperture 50.

The coupling of the invention is assembled as follows.
15 The head 22 of the bolt 20 is passed through the hole 52 of the keyhole aperture 50. The neck portion 24 of the bolt 20 is then slid into the slot 54 of the keyhole aperture 20, leaving the head 22 within the tube 42 and the threaded shaft 26 projecting radially from the tube
20 42. The locking washer 60 is presented to this assemblage in such a way that the threaded shaft 26 passes through the central hole of the locking washer 60, the pin 68 enters the hole 52 of the keyhole aperture 50 and the face 64 of the locking washer 60 abuts the wall
25 44 of the tube 42. The threaded shaft 26 is then screwed into the threaded bore 38 of the plug 28 until the face 66 of the locking washer 60 abuts the end of the head portion 29 of the plug 28. The plug 28 may be engaged in the end of the tube 12 as above described either before
30 or after the last described operation.

In Figures 7 and 8 of the drawings there are shown an alternative tubular second member and an alternative plug. The same reference numerals are used for the parts

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which correspond to those of the tubular second member shown in Figure 4 and the plug shown in Figure 2. A rebate 70 is formed in the tubular second member around the slot 54, and the head portion 29 of the plug is differently shaped, including a projection 72. The tubular second member and plug of Figures 7 and 8 are used together with the tubular first member and bolt of Figures 1 and 3 (but omitting the locking washer of Figures 5 and 6) to form an alternative coupling according to the invention. The method of assembly comprises fitting the bolt 20 to the tubular second member as previously described and then screwing the plug 28 on to the threaded shaft 26 of the bolt 20 so that the projection 72 engages in the recess 70, preventing lateral movement of the bolt 20. The plug 28 can be engaged with the end of the tube 12 before it is screwed on to the threaded shaft 26 or afterwards.

The coupling of the invention is of particular use in joining struts and ties into useful structures. Examples are shown in Figures 9 and 10. In Figure 9, a corner of a top or shelf 90 is shown, illustrating how such a top or shelf can be fitted to the assembled structure.

CLAIMS:

1. A coupling for the connection of one end of a tubular first member to a tubular second member, the coupling comprising:

5 a bolt having a head, a threaded shaft and a neck portion, the neck portion being intermediate the head and the threaded shaft and narrower than either of them;

10 a keyhole aperture in the wall of the tubular second member, the keyhole aperture comprising a hole sufficiently large to receive the head of the bolt and a slot intersecting the hole and having a width greater than that of the neck portion of the bolt but less than those of the head and threaded shaft of the bolt;

15 means for locking the bolt in a position in which its head is disposed within the second member, its threaded shaft projects from the second member, and its neck portion is received in the slot of the keyhole aperture; and

20 a plug rotatably received in one end of the first member and having an internally threaded part for co-operation with the threaded shaft of the bolt.

2. A coupling according to claim 1 in which the means for locking the bolt in the position recited in claim 1 comprises a locking washer having a hole through which the threaded shaft of the bolt may pass and a pin of a size such that it may be inserted in the hole of the keyhole aperture but not in the slot of the keyhole aperture.

3. A coupling according to claim 1 in which the means for locking the bolt in the position recited in claim 1 comprises a projection formed on the end of the plug for co-operation with a rebate formed in the tubular second member around the slot of the keyhole aperture.

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4. A coupling according to any preceding claim in which the plug comprises a head portion for abutment to the end of the first member and a main portion for insertion into the end of the first member, the head portion being formed at one end of the main portion and the other end of the main portion terminating in a plurality of compressible legs delineated by axial slots in the said other end of the main portion, each leg carrying an upstanding detent member.

5. A coupling according to claim 4 in which the first member has an internal shoulder for co-operation with the detent members.

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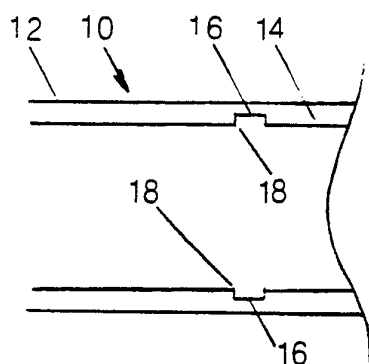


FIGURE 1 ✓

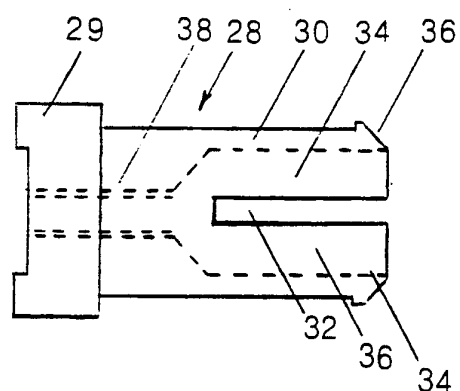


FIGURE 2

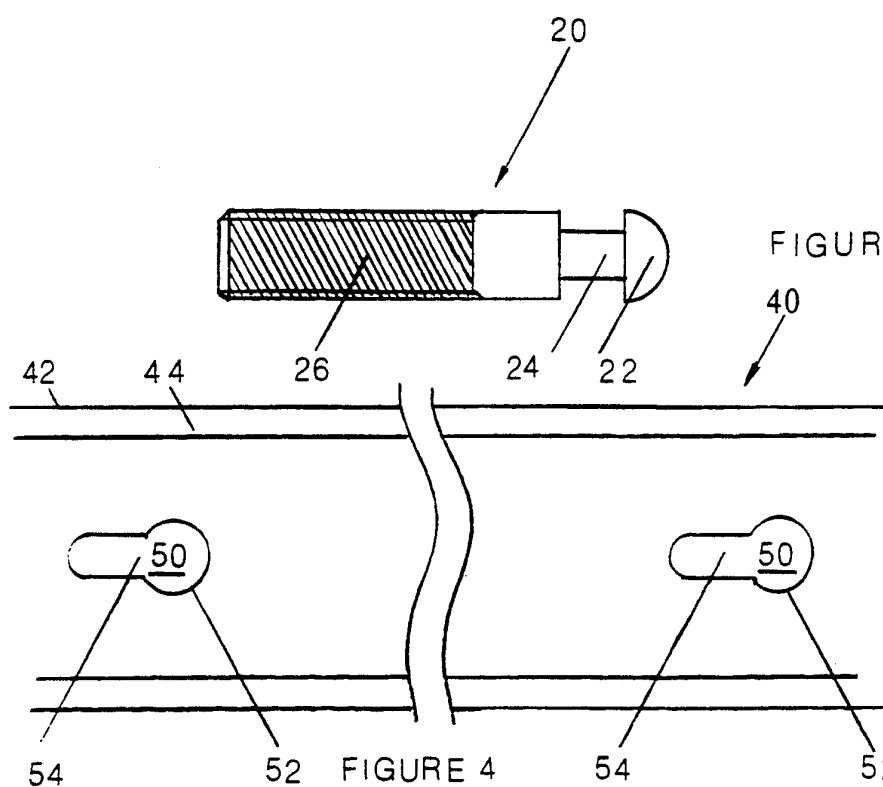


FIGURE 3

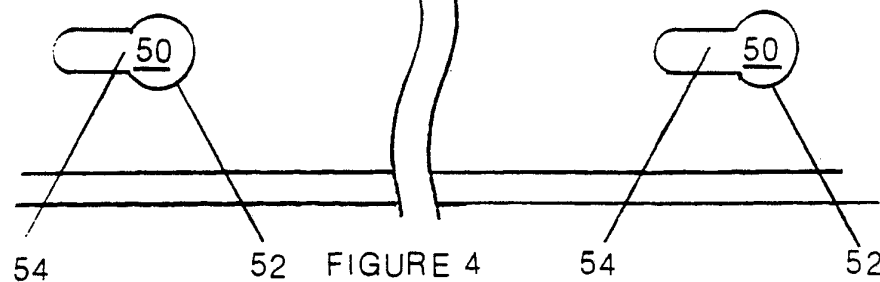


FIGURE 4

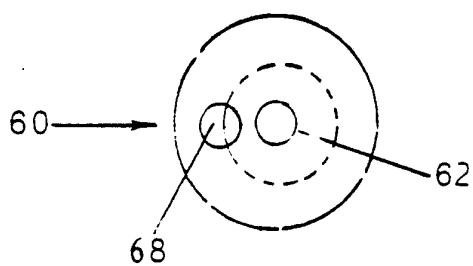


FIGURE 6

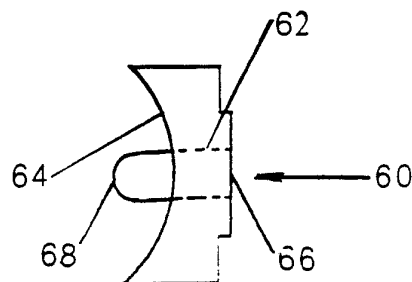
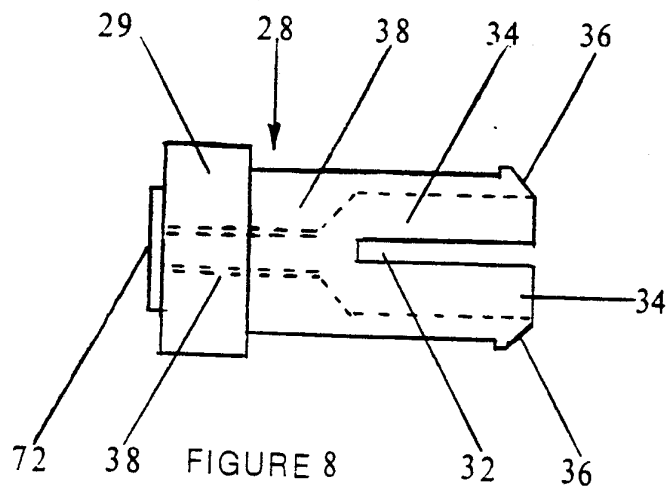
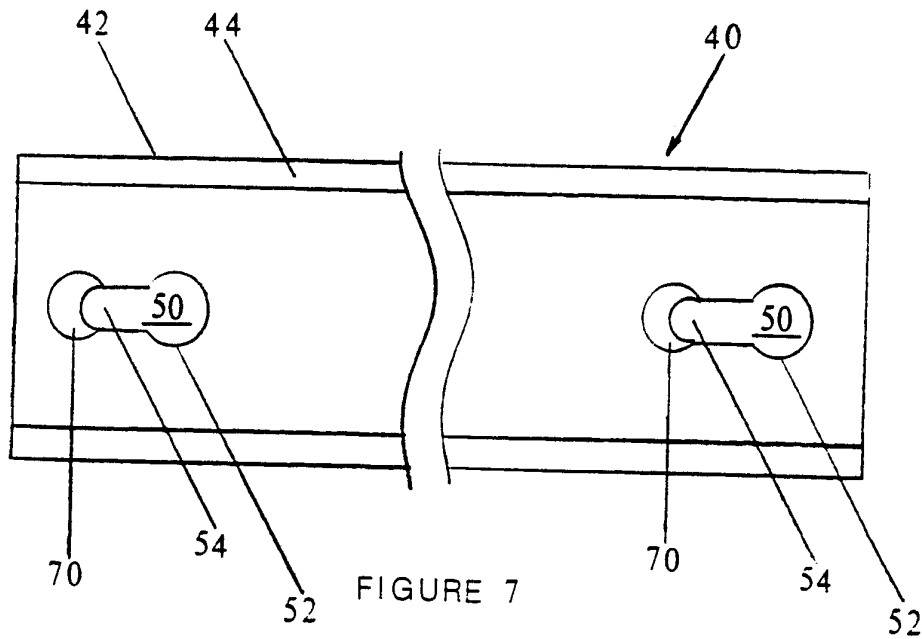


FIGURE 5

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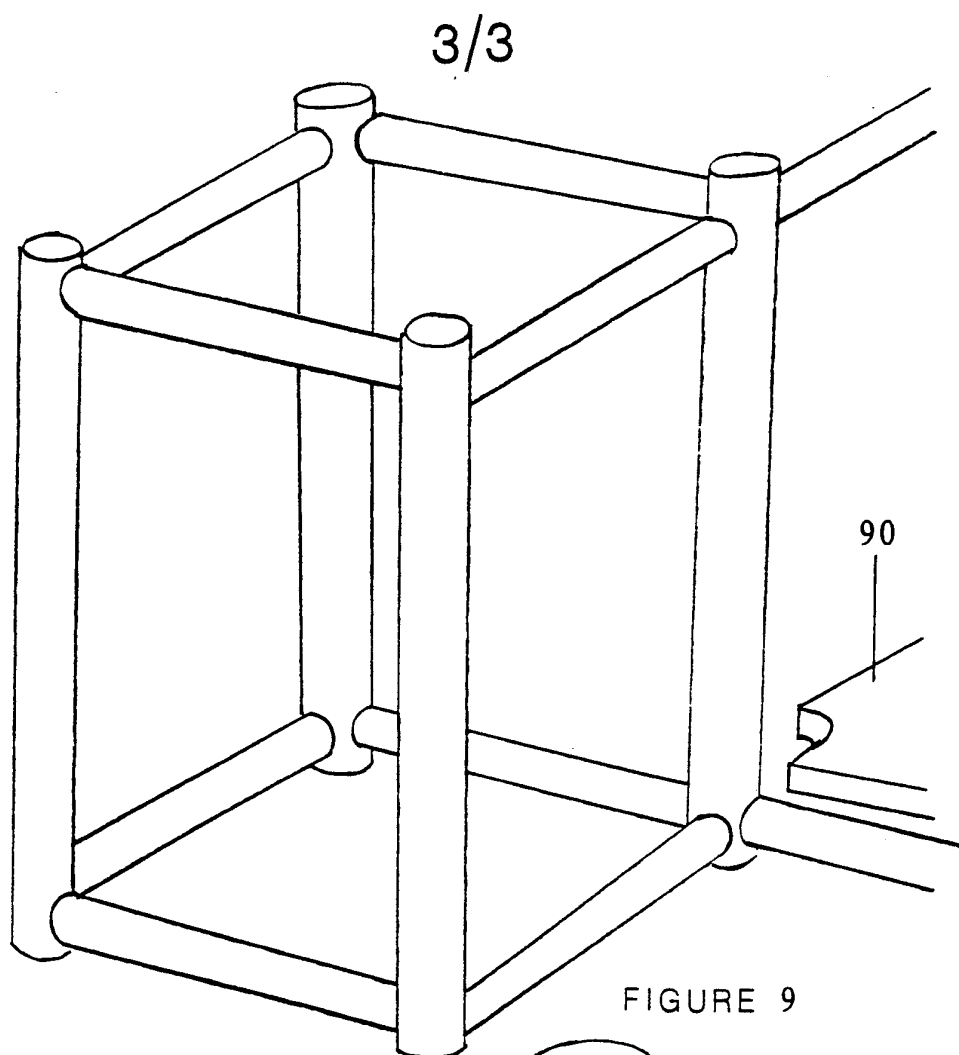


FIGURE 9

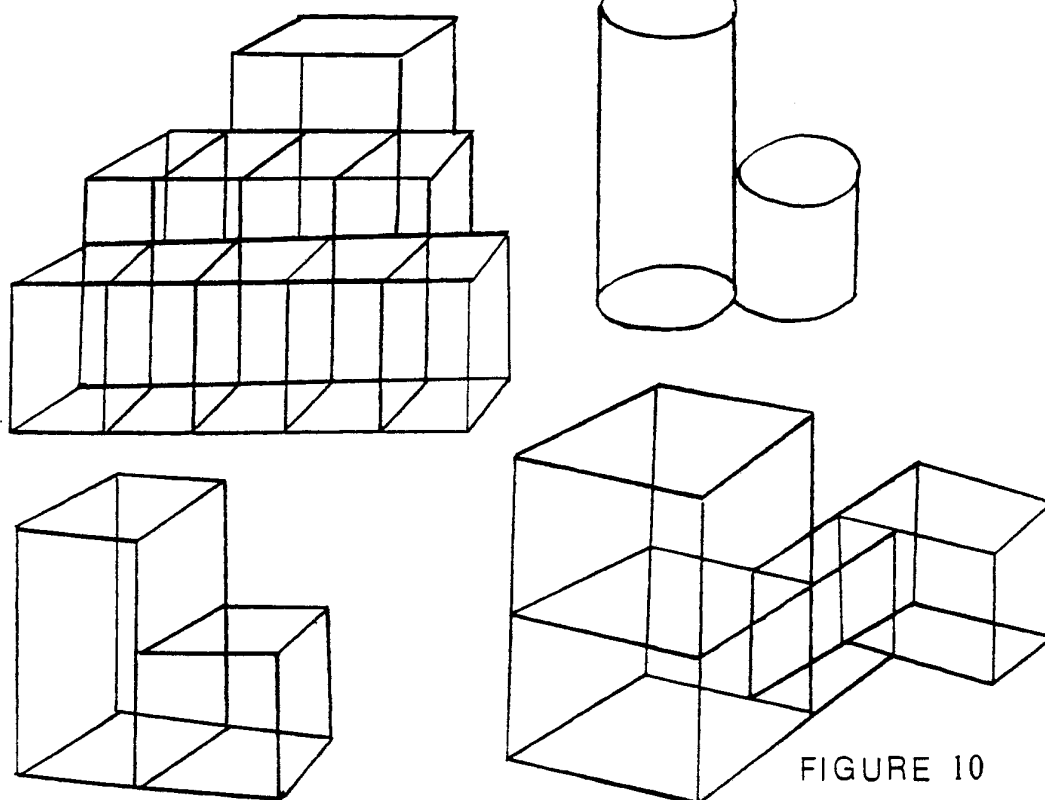


FIGURE 10

INTERNATIONAL SEARCH REPORT

PCT/GB 92/00113

International Application No

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. 5 F16B21/09; F16B7/04; F16B12/40; //16B12/22 //F16B12/34//E06B3/96		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl. 5	F16B ; E06B	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	FR,A,1 218 933 (VOGEL) 13 May 1960	1,3
Y	see the whole document	2,4,5
Y	US,A,2 393 431 (TORBURN) 22 January 1946 see page 1, right column, line 41 - page 2, left column, line 11; figures 1-4	2
Y	GB,A,1 004 044 (THE BRITISH ALUMINIUM COMPANY LIMITED) 8 September 1965 see page 2, line 9 - line 94; figures 1,4	4,5
X	GB,A,683 386 (EVANS ET AL.) 26 November 1952 see page 2, line 109 - page 3, line 21; figures 13-19	1
A	EP,A,0 072 358 (AMICHETTI ET AL.) 16 February 1983	-
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IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
09 APRIL 1992	15. 04. 92	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	CALAMIDA G. <i>G. Calamida</i>	

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

GB 9200113
SA 55573

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR-A-1218933		None	
US-A-2393431		None	
GB-A-1004044		US-A- 3314699	
GB-A-683386		None	
EP-A-0072358	16-02-83	DE-A- 3278217	14-04-88