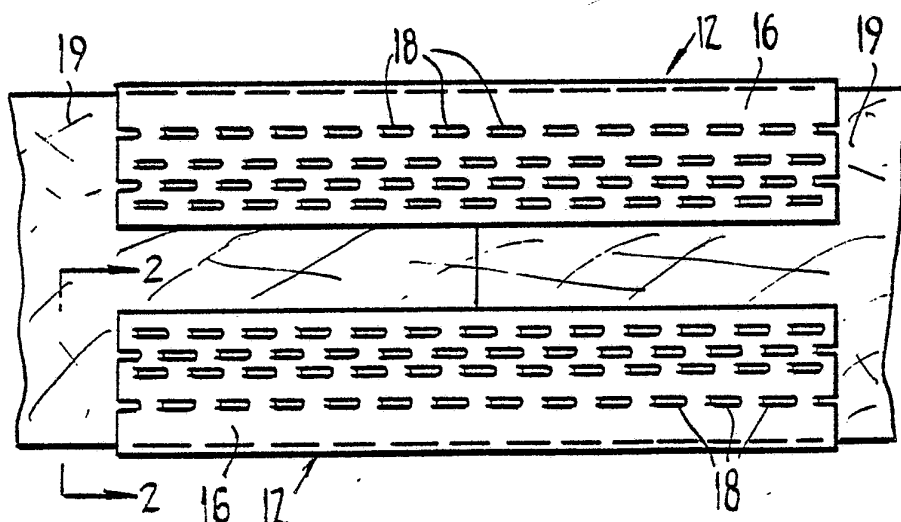




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(21) International Application Number:</b> PCT/AU84/00095 <b>(22) International Filing Date:</b> 25 May 1984 (25.05.84)  <b>(31) Priority Application Number:</b> PF 9598 <b>(32) Priority Date:</b> 30 May 1983 (30.05.83) <b>(33) Priority Country:</b> AU  <b>(71) Applicant (for all designated States except US):</b> EZARD DISTRIBUTORS PTY. LTD. [AU/AU]; McMillan Street, Bairnsdale, VIC 3875 (AU).  <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only) :</b> EZARD, Francis, Ian [AU/AU]; 94 George Street, East Melbourne, VIC 3002 (AU).  <b>(74) Agent:</b> COWIE, THOMSON & CARTER; 71 Queens Road, Melbourne, VIC 3004 (AU).		<b>(81) Designated States:</b> AU, DE, FI, GB, JP, NO, SE, US.  <b>Published</b> <i>With international search report.</i>

**(54) Title:** MANUFACTURE OF WOODEN BEAMS**(57) Abstract**

A timber beam is formed of butt-joined timber lengths (19) using at least one joining plate (12) which extends around three sides of the abutted timber lengths. The joining plate has a base section (14) and two side sections (16), at least the side sections each having a plurality of projections (17) extending therefrom. The base section has either additional projections (17) or holes (25) through which fasteners (20) engage to secure the base section to co-planar surfaces of the abutting timber lengths (19). The joining plate is formed with the base and side sections (14, 16) co-planar with the side sections (16) extending at an angle to the base section (14). A press plate (21) forces the base section (14) against the co-planar surfaces of the abutting timber lengths with any projections (17) extending therefrom embedded in the timber. Rollers (22) or presses (34, 37) act on the side sections to bend them around the timber lengths to embed the projections (17) extending therefrom into opposite sides of the abutted timber lengths.

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## MANUFACTURE OF WOODEN BEAMS

BACKGROUND OF THE INVENTION

This invention relates to improvements in the manufacture of wooden beams and relates particularly to improved methods and apparatus for manufacturing wooden beams with butt-joined or spliced timber lengths.

In many applications in the building industry it is necessary to provide lengths of timber of substantial width and length in relation to thickness, such as for use as structural beams, floor joists, lintel beams, roof beams, rafters and the like.

With present day timber shortages and environmental control regulations, it is becoming increasingly difficult to obtain desired solid timber in wide sections and long lengths, and in particular in defect-free quality.

In the past it has been known to provide spliced beams by edge gluing two or more separate lengths of timber. It has also been known to butt-join timber lengths using known nail plates on either side of the lengths of timber to be joined and/or by machining interlocking formations, such as dovetail formations, in the ends of the timber lengths to be butt-jointed. Experience has shown that spliced beams and butt-joined beams formed by these known methods are unsatisfactory and uneconomic and such beams are generally usable only for substantially load-free applications.

BACKGROUND ART

United States Patent Nos. 2,877,520, 3,011,226 and 3,016,586 and Australian Patent No. 291,878 all disclose forms of structural wooden joints formed of timber members connected solely by metal plates having nail-like projections or teeth struck out from the plane of the plate and embedded in the timber members. Such plates are very effective in the manufacture of trusses and similar timber structures having several timber members extending in different directions and being interconnected with each other by the disclosed nail plates, which are limited to flat connectors.



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United States Patent No. 3,305,252 discloses another form of nail plate useful as a corner connector to be applied to two or three surfaces of a structure which intersect at an angle with respect to one another.

5 United States Patent No. 3,365,222 discloses a wall brace having a U-shaped joist receiving member and a gusseted projection which is secured to a wall or the like. The joist receiving member has a number of inwardly extending teeth or fastening means which are driven or hammered into a joist to  
10 secure the joist relative to the wall or the like.

United States Patent No. 3,427,055 discloses another form of plate connector for a corner joint having teeth of varying height to facilitate engagement of the teeth within the timber members forming the corner joint without distortion  
15 of the plate connector.

United States Patent No. 4,318,628 discloses a device for assembling and connecting two or more construction elements, the device being formed with seats to receive the elements in the desired relationship, and one or more locking  
20 projections intended to penetrate into the elements. The projections extend from a bottom wall of each seat to engage and penetrate an end surface of the respective elements.

British Patent No. 1579794 relates to a modified form of nail plate fastener particularly useful for joining  
25 angularly related timber members. The fastener comprises a bent plate having teeth struck from each portion, at least some of the teeth having an angularly extending shank portion and a tip portion which projects from the shank towards the plate portion. This type of projection enables the fastener  
30 to be located in position before the tip portions of each tooth are driven into the timber members being connected, the shank portion then lying in the plane of the respective plate portion. Teeth of this type are commonly referred to as "knuckle nails".

35 While the prior art forms of fasteners may be used for joining timber members to form corners, trusses and the like, it has been found that such fasteners are ineffective for butt-joining timber lengths to produce structurally sound



beams as the strength of such beams is restricted by the holding power of the projections or teeth embedded in the timber sections.

It is therefore desirable to provide an improved fastener which is effective to produce structurally sound timber beams by butt joining or splicing timber lengths.

It is also desirable to provide improved methods and apparatus for producing spliced and/or butt-joined beams which are able to be used in load carrying applications.

It is also desirable to provide an improved method of forming a butt-joint between adjacent ends of lengths of timber which is economic and which results in a load carrying beam.

It is also desirable to provide methods and apparatus for producing spliced and/or butt-jointed beams which provide an alternative to solid timber beams of equivalent strength using more readily available component sections of better quality.

## SUMMARY OF THE INVENTION

According to one aspect of the invention there is provided a joining plate for butt-joining adjacent ends of timber lengths comprising a U-shaped plate having a base section and opposed side sections, at least the side sections each having a plurality of projections struck therefrom and extending, in use, into the space defined by the base and side sections, said base section having projections struck therefrom and extending into said defined space and/or holes to receive driven fasteners, those portions of the base and side sections immediately adjacent the corners of the U-shaped plate being free of any projections and holes.

Preferably, the base section has projections struck therefrom and projecting, in use, into the defined space. The projections of both side sections and base section may be of the "knuckle nail" type or may be of the tooth type commonly employed in other known forms of nail plate type fasteners.

The joining plate of the invention is preferably formed with the base and side sections substantially co-planar



although in a modified form, the side sections may extend at an angle to the base section. The base section is engaged with the timber lengths to be joined and the projections or driven fasteners are embedded into the timber lengths, which  
5 are maintained in end butted relationship. The side sections are then folded around the sides of the timber lengths and the projections struck from the side sections are embedded in the opposite sides of the timber lengths.

The butt-jointed timber lengths are thus firmly joined  
10 together with the joining plate engaging on three sides thereof, the projections or driven fasteners from the base section and the projections from the opposed side sections extending perpendicular to each other to interlock the joining plate to the timber sections.

15 The portions of the base and side sections immediately adjacent the corners of the U-shaped plate which are free of projections and holes provide structural integrity and rigidity of the joint by providing areas along the corners which are not weakened by holes or struck projections. The  
20 strength of the joining plate is therefore enhanced by the rigid corner parts and resist tensile and shear forces transmitted to the joining plate through the projections and/or driven fasteners.

Preferably, the projections are struck from the side  
25 sections of the joining plate to extend at approximately 90 degrees to the plane of the respective side, although the projection angle may vary but preferably by not more than 5 degrees from the right angle. In a preferred form, the number of projections on each side section amount to no more than  
30 five (5) projections per square inch of section area.

According to another aspect of the invention there is provided a method of forming a butt-joint between adjacent ends of timber lengths using a joining plate of the type described above comprising the steps of supporting the timber  
35 lengths in end-butting relationship, supporting the joining plate with a base section thereof engaged with co-planar surfaces of said timber lengths, embedding either the projections extending from the base section or fasteners



passing through holes in the base section into the abutted timber lengths and bending side sections of said joining plate about edges of the timber lengths to form said plate into a substantially U-shape with the projections extending from said side sections embedded in opposed sides of the timber lengths.

In one embodiment, said bending is performed by a rolling action using a forming roller which engages with the surface of one of the side sections opposite that surface from which the projections extend, the forming roller being moved in a direction perpendicular to the plane of the base section to roll the side section into engagement with the surface of the timber lengths. Preferably, a pair of forming rollers are used to simultaneously bend the side sections of the joining plate into engagement with the opposed side surfaces of the timber lengths.

In another arrangement, for use particularly when the joining plate is formed with the side sections extending at an angle to the base section, the side sections are bent to engage the sides of the timber length by opposed presses acting on the side sections and compressing the sections and timber lengths therebetween to force the projections into the timber.

The invention also includes apparatus for carrying out the method and comprising means for supporting the timber lengths in end-abutting relationship, means for forcing a base section of a joining plate into close engagement with coplanar surfaces of said abutted timber lengths with projections or fasteners, extending from said base section firmly embedded in the timber lengths, and roller means adapted to engage with side sections of said joining plate and movable to force said side sections into engagement with opposed side surfaces of said timber lengths with projections extending from said side sections embedded in the timber lengths.

In the most preferred arrangements according to the invention, the butt-jointed timber lengths are connected by a pair of joining plates the bases of which engage opposite sides of the timber lengths. The butt-jointed timber lengths can then be used in any orientation and under any loading situation.



The present invention also includes means for splicing together beams such as those produced as described above in edge-to-edge relationship comprising fastener elements of the corrugated strip type embedded in the adjacent timber lengths in such a fashion that the fastener elements may be embedded to an approximately equal extent in each of the timber lengths, the fastener element extending at an angle less than 80° or greater than 100° with respect to the plane of the engaged surfaces of the timber lengths, alternate fasteners, or alternate groups of fasteners extending at different angles.

Preferably, the fastener elements are formed of a strip of metal having at least the end portions thereof formed with corrugations. The central portion of the elements is preferably planar.

In order that the invention and its manner of performance may be more fully understood, reference will now be made to embodiments of the invention with reference to the accompanying drawings.

## 20 DESCRIPTION OF THE DRAWINGS

Figure 1 is a side elevational view of butt-jointed timber lengths using a pair of joining plates of the present invention;

Figure 2 is a view taken along the lines 2-2 of Figure 1;

Figure 3 is an end elevational view of a pair of joining plates connected to abutted timber lengths, the plates being of a modified form;

Figure 4 is a perspective view of the modified form of joining plate before being engaged and secured to the abutted timber lengths;

Figure 5 is a view illustrating one method and apparatus for applying a joining plate to abutted end portions of timber lengths;

Figure 6 is a view illustrating a second form of apparatus;

Figure 7 is a view illustrating a third form of





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apparatus;

Figure 8 is a side elevational view illustrating the means for splicing beams together;

Figure 9 is an end view of one form of fastener  
5 element; and

Figure 10 is a plan view of the element of Figure 9.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figures 1 and 2 of the drawings, the joining plate 12 of this embodiment comprises, in its  
10 operative form, a base section 14 and side sections 16. Each of the base and side sections 14 and 16 have a plurality of projections 17 extending from the respective planes of the sections 14 and 16 and which are preferably formed from the plate material by a stamping operation. The formation of the  
15 projections 17 thus produces the plurality of slots 18 shown in Figure 1. As will be seen, the projections 17 extend substantially at right angles to the plane of the respective base and side sections 14 and 16, although deviations of up to 5° can occur.

20 With the joining plate 12 in operative engaged position on abutted end portions of two timber lengths 19, the projections 17 extending from the side sections 16 interlock with the projections 17 extending from the base section 14 to thereby securely fasten the joining plate 12 to the  
25 timber lengths 19. Any load applied to a timber beam formed of butt-joined sections in accordance with the invention gives rise to tensile and shear forces which are distributed evenly through the joining plate 12, the jointed timber sections acting very much as though the timber beam was of a single  
30 length. Naturally, the dimensions of the joining plate 12, the projections 17 and the timber lengths 19 should be selected to ensure proper engagement between the joining plate 12 and the timber lengths 19 to provide the necessary strength.

35 The joining plate 12 is shown in Figures 1 and 2 in operative engagement with the abutted timber lengths 19. The plate 12, however, will normally be constructed as a flat



plate having the desired projections struck from the plate material. In one form, the flat plate is continuously formed from a roll of steel in coil form which is passed through a stamping machine to form the projections. The plate material  
5 may then either be re-coiled or cut to desired lengths. The projections 17 may be of any suitable form known in the art. Thus, the projections 17 may be formed with barbs or teeth to more firmly engage in the timber lengths 19. The projections 17 each preferably lie in planes transverse to the  
10 longitudinal axis of the timber lengths 19. Other orientations of the projections, and the corresponding apertures 18 formed thereby, may be adopted if desired. The projections 17 may all be of one length or may be of varying lengths for particular purposes.

15 Referring to Figures 3 and 4, a modified construction of joining plate 12a is shown which is identical to that of the previous embodiment except that the base section 14a is provided with holes 25 instead of projections. The holes 25 enable fasteners, such as nails 20, to be used to secure the  
20 base section 14a to one side of the abutted timber lengths 19.

Further, the plate 12a is partially pre-bent, as shown in Figure 4, to facilitate its engagement with the timber lengths 19 prior to the side sections 16 being bent to the aperture engaged position as illustrated in Figure 3.

25 As will be seen in the drawings, the joining plate 12 and 12a of both embodiments have areas of metal on the base and side sections adjacent the corners which are free of holes 18 and 25, thus providing structural integrity of the plate along each corner which enhances plate rigidity and strength  
30 in use.

Further, the provision of such areas free of holes ensures that edges of the timber lengths joined are not split, and therefore weakened, by projections or nails positioned too close to the respective edges.

35 Referring to Figures 5 to 7, three different forms of apparatus for applying a joining plate of the invention to abutted timber lengths are illustrated.

Figure 5 illustrates apparatus for applying the



joining plate 12 to the timber lengths 19 using a press plate 21 and rollers 22. The joining plate 12 is initially formed as a planar plate with the plurality of projections 17 extending from one surface thereof. With the abutted end portions of the timber lengths 19 held together, the base section 14 of the plate 12 is engaged with side surfaces of the timber lengths 19. The press plate 21 which is hydraulically or pneumatically operated forces the base section 14 against the surfaces of the timber lengths 19 so that the projections 17 extending therefrom become embedded in the timber.

Form rollers 22 are then moved to engage the side sections 16 of the plate 12 and further movement of the form rollers 22 in the direction of the arrows shown in Figure 5 causes the side sections 16 to bend about the edges 23 of the timber lengths 19. The side sections 16 are finally rolled into engagement with the opposed side surfaces 24 of the timber lengths 19 with the projections 17 extending from both side sections 16 embedded in the timber.

It is a feature of this embodiment of the invention that the movement of the form rollers 22 initially bends both side sections 16 in such a way that the ends of the projections closest to the edges 23 engage with the side surfaces 24 a distance from the edges 23 which substantially corresponds with the distance between the projection ends and the edges 23 before engagement of the base section 14 on the timber sections 19. In other words, when the projections 17 closest to the edges 23 are rolled into the timber those projections remain substantially perpendicular to the side sections 16 and the rolling action causes a neat penetration resulting in the projections being firmly embedded.

Two stages of the rolling of the side sections 16 into engagement with the end portions 19 are illustrated in dotted lines in Figure 5.

Figure 6 illustrates a second form of apparatus designed for use with a joining plate 12, having pre-bent side sections 16 and projections 17 extending from the base section 14 and the side sections 16. The end-abutted timber lengths 19 to be joined are supported by means (not shown) to enable



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the press plate 32 to press the base section 16 against a side surface of the timber length 19 so that the depending projections 17 penetrate the timber.

The opposed press plates 33 and 34 are then moved  
5 together to press the side sections 16 against the timber surfaces with the depending projections 17 penetrating the timber to be secured thereto. It has been found that, subject to timber density, the side sections 16 tend to bend about  
10 the points of engagement of those projections 17 nearest the corners 23 before those projections are driven into the timber. This tends to ensure that the projections are driven in a substantially perpendicular direction.

Figure 7 shows apparatus similar to that of Figure 5 except that, instead of form rollers to bend and secure the  
15 side sections 16, press plates 36 and 37 are pivoted to opposite side edges of the central press plate 38. The pivot connections 39 ensure that the press plates 36 and 37 move in the necessary arc to bend and secure the side sections 14 of the joining plate 12 in position. A hydraulic or pneumatic  
20 cylinder 41, piston rods 42 and levers 43 transmit the required motion and securing forces to the press plates 36 and 37.

Referring to Figure 8 of the drawings, there is illustrated a spliced beam 26 having an upper chord 27 a lower  
25 chord 28 and intermediate timber sections 29. In the embodiment illustrated, the upper chord 27 is a single length of timber while the lower chord 28 is formed of a butt-jointed timber beam formed in accordance with any of the embodiments described with reference to Figures 1 to 7. The joining plate  
30 12 firmly joins together the two portions of timber lengths forming the lower chord 28.

The intermediate timber sections 29 are spliced to the upper and lower chords 27 and 28 by the use of fastener elements 31. The preferred fastener elements are illustrated  
35 in Figures 9 and 10 and comprise a variation of the known corrugated strip fasteners. As shown in Figures 9 and 10, the fastener elements of this embodiment have a central section free of corrugations and the corrugations at each end



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are not parallel but extend at an angle to each other of approximately  $2^\circ$ . The formation of the fastener in this manner means that, when the fastener is applied between lengths of timber, as shown in Figure 8, the fibres along the engaged timber surfaces do not directly carry any load, the loading being applied by the corrugations at points spaced from the surface. Further, the biasing of the corrugations relative to each other causes the timber lengths to be drawn together when the fasteners are driven into the timber sections.

As shown in Figure 8, the fastener elements 31 are driven into the timber sections 29 and the chords 27 and 28 so as to extend at an angle of approximately  $45^\circ$  to the plane of the engaged surfaces. Further, alternate fasteners extend in opposite directions to thereby distribute load applied to the beam between the chords 27 and 28 and the intermediate timber sections 29 without the fastener elements 31 being placed under pure shear forces. The angling of the fastener elements 31 means that the elements are placed in tension or compression and are thus able to more evenly distribute loads along the beam and, at the same time, prevent relative movement between the various beam parts. It is believed that the optimum angle for the fastener elements is  $45^\circ$ , as shown, but it is appreciated that angles greater or less than  $45^\circ$  may be used and still retain the benefit of the angular disposition of the fasteners relative to the plane of the engaged surfaces.

It will also be appreciated that groups of fasteners may extend in one direction and alternate groups of fasteners extend in the opposite direction. However, it is preferred that alternate fasteners extend in opposite directions so that a beam may be constructed of any length and then cut to a desired length without concern as to the direction taken by the fastener elements 31.

Using the fastener elements and joining plates of the invention in the manner described, it is possible to produce a beam of relatively large cross-sectional area from relatively short timber lengths of smaller cross-sectional



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area, the intermediate timber sections 29, in particular, being formed of off-cuts and other short lengths which would otherwise go to waste.

It will also be appreciated that, although it is not  
5 essential, the intermediate timber sections 29 may be butt-  
joined in the manner described herein.



Claims.

1. A joining plate for butt-joining adjacent ends of timber lengths comprising a base section and opposed side sections which, in use, form a U-shaped plate, at least the side sections each having a plurality of projections struck therefrom and extending, in use, into the space defined by the base section and the side sections, said base section having projections struck therefrom and extending into said defined space and/or having a plurality of holes to receive separate driven fasteners, those portions of the base and side sections immediately adjacent the corners of the U-shaped plate being free of any projections or holes.
2. A joining plate according to claim 1 wherein said base section has a plurality of projections struck therefrom and extending into said defined space.
3. A joining plate according to claim 1 or claims 2 wherein said projections extend from the respective base and/or side sections at right angles thereto.
4. A joining plate according to any one of claims 1 to 3 wherein the number of projections on each side section amounts to not more than five per square inch of section area.
5. A joining plate according to any one of the preceding claims wherein each said projection has a plane of orientation which extends substantially transversely of the length of the U-shaped plate.
6. A joining plate according to any one of the preceding claims wherein said base and side sections are substantially co-planar and said projections extend in rows along the respective base and/or side sections, said rows being spaced from the intersecting lines between the base and respective side sections.



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7. A method of forming a butt-joint between adjacent ends of abutting timber lengths using a joining plate having a base section and side sections along opposite side edges of the base section, at least the side sections having a plurality of projections extending therefrom, comprising the steps of supporting the timber lengths in end-butting relationship, supporting the joining plate with the base section engaged with co-planar side surfaces of the abutting timber lengths, embedding either projections extending from the base section or fasteners passing through the base section into the abutted timber lengths, and bending said side sections about opposite edges of said co-planar side surfaces of the timber lengths to form a substantially U-shaped plate with the projections extending from said side sections embedded in opposed sides of the abutted timber lengths.

8. A method according to claim 7 further comprising the steps of engaging a press member with said base section and pressing the base section against said co-planar side surfaces of the abutted timber lengths.

9. A method according to claim 8 further comprising the steps of engaging a pair of form rollers with said side sections, maintaining a predetermined spacing between said form rollers which is substantially equal to the distance between said opposed side surfaces of said abutted timber lengths plus the thickness of each side section, and moving said form rollers perpendicular to the plane of said base section to roll the side sections into operative engagement with said timber lengths.

10. A method according to claim 8 comprising the steps of partially bending the side sections relative to the base section, engaging a pair of opposed press members with the partially bent side sections, and moving the press members towards each other to press the side sections into operative engagement with said timber lengths.





11. Apparatus for forming a butt-joint between adjacent ends of abutting timber lengths comprising a joining plate having a base section and side sections along opposite side edges of the base section, at least the side sections each having a plurality of timber engaging projections extending therefrom, clamp means to hold said timber lengths in end butting relationship, press means to press said base sections of said joining plate into engagement with co-planar side surfaces of said timber lengths, and means to engage said side sections of said joining plate and to move said side sections into operative engagement with opposed side surfaces of said timber lengths with and to embed said projections into said timber lengths.

12. Apparatus according to claim 11, wherein additional projections extend from said base section, and said press means is movable relative to said timber lengths to embed said additional projections thereinto.

13. Apparatus according to claim 11 or claim 12 wherein said means to engage said side sections includes a pair of form rollers movable perpendicular to the plane of said base section.

14. Apparatus according to claim 11 or claim 12 wherein said means to engage said side sections includes a pair of press members movable towards each other.

15. Apparatus according to claim 14 wherein said press members are each pivoted relative to said press means and are movable about said pivots to bend said side sections about edges of said co-planar surfaces into engagement with the opposed sides of said timber lengths.

16. A timber beam formed of butt-joined timber sections and one or more joining plates as claimed in any one of claims 1 to 6.



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17. A timber beam formed of butt-joined timber sections according to the method of any one of claims 7 to 10.

18. A spliced timber beam comprising at least two timber beams in edge-to-edge relationship and a plurality of fastener elements embedded in the adjacent timber lengths, said fastener elements comprising corrugated strips and extending generally at an angle of less than 80° or greater than 100° with respect to the plane of the engaged timber surfaces, alternate fasteners or alternate groups of fasteners extending at different angles.

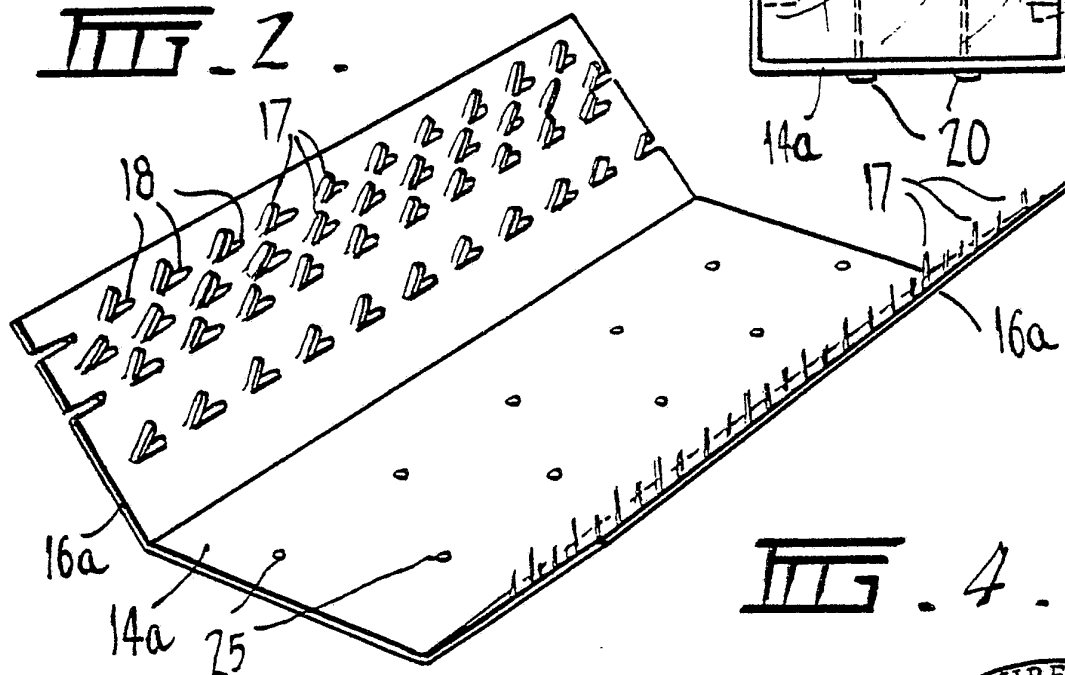
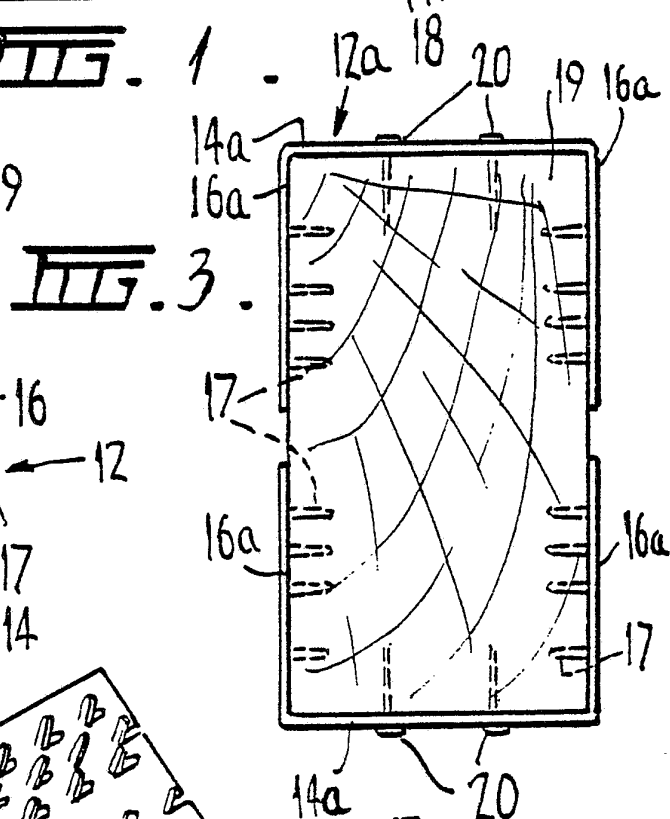
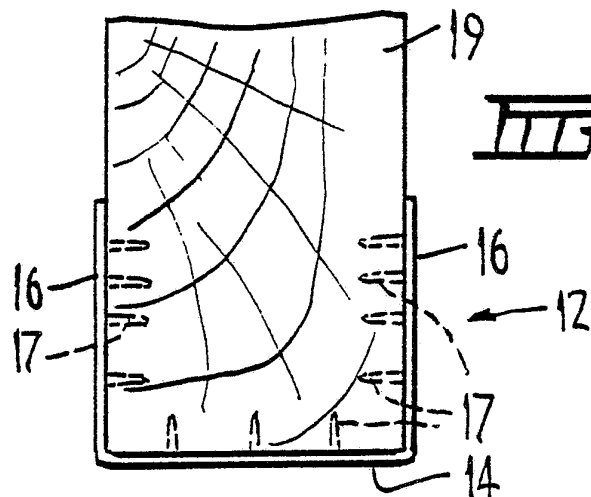
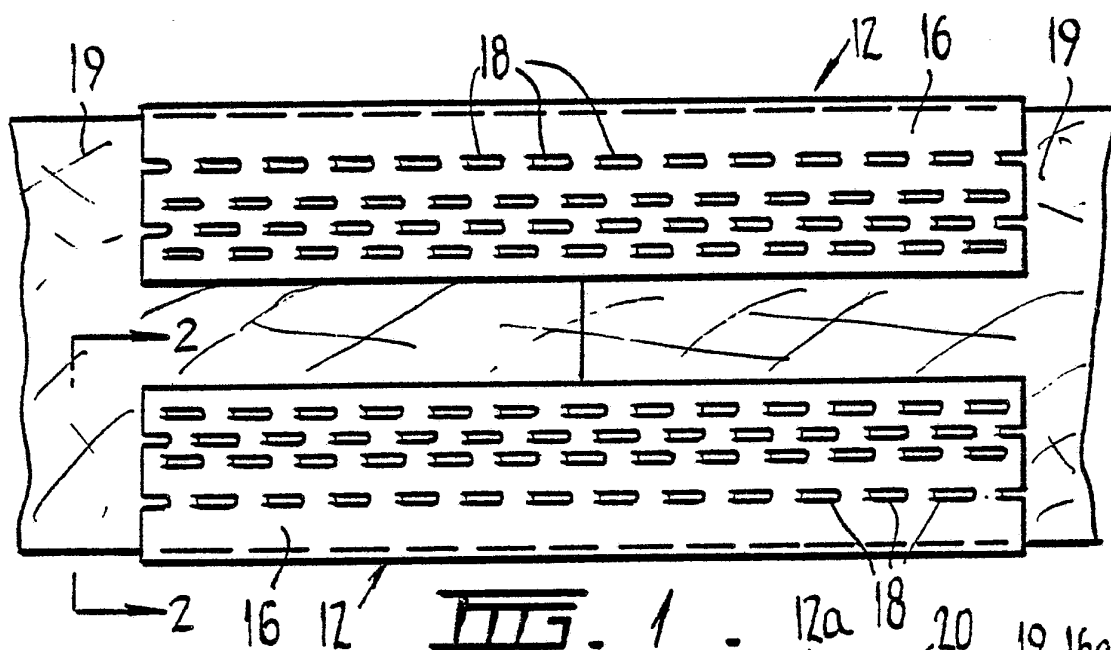
19. A spliced timber beam according to claim 18 wherein a central portion of said fastener elements is free of corrugations.

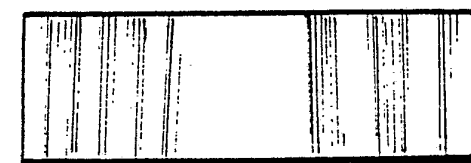
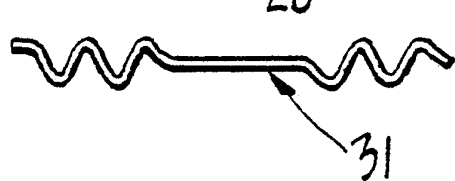
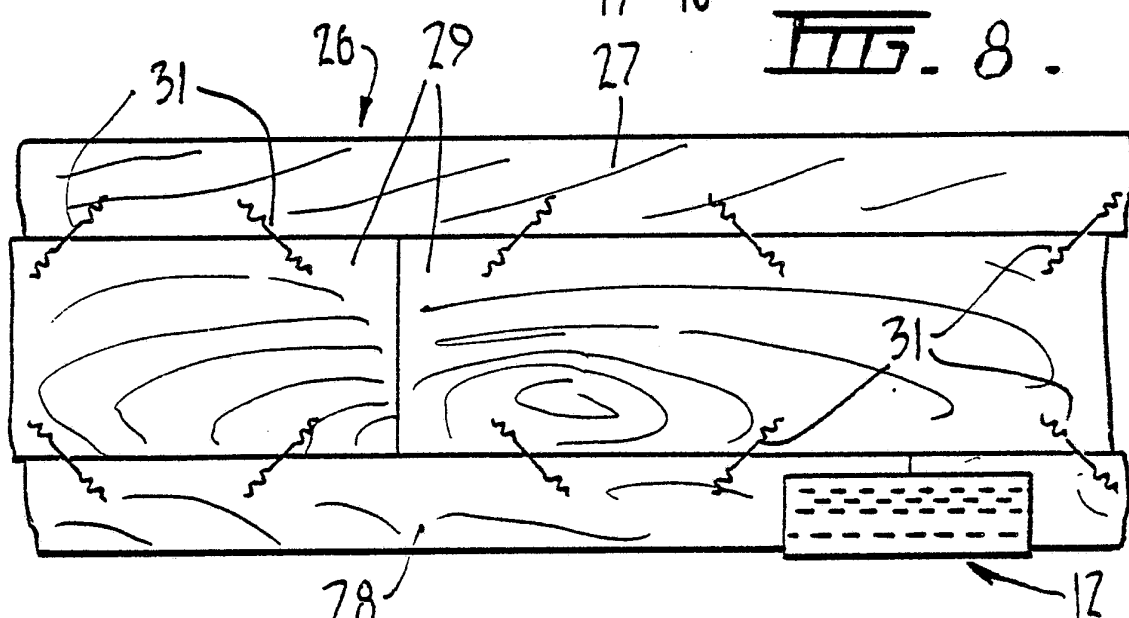
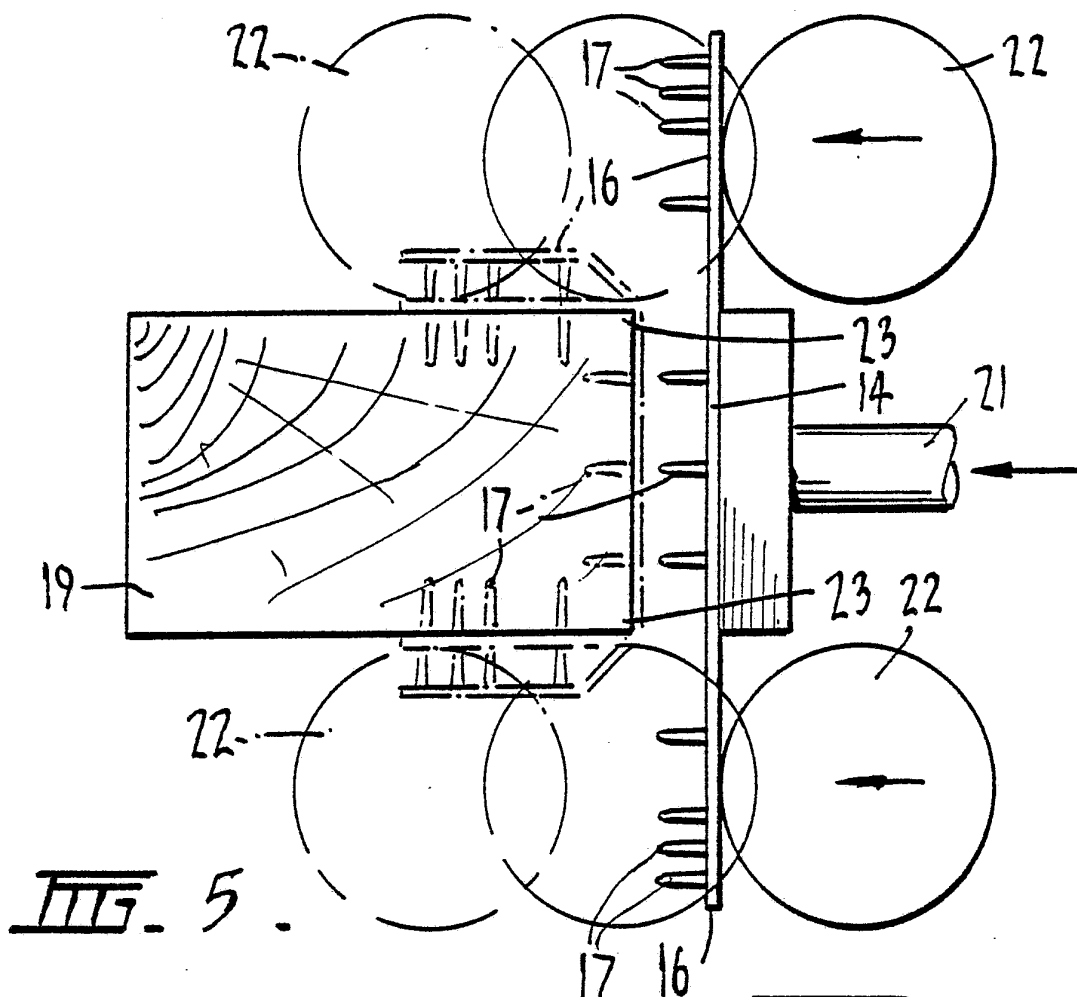
20. A spliced timber beam according to claim 18 or claim 19 wherein the corrugations at one end of each fastener extend at an angle to corrugations at the other end of each fastener.

21. A spliced timber beam according to any one of claims 18 to 20 wherein at least one of said timber beams comprises a butt-joined beam according to claim 16 or 17.

22. A corrugated fastener element substantially as hereinbefore described with reference to Figures 8 to 10 of the accompanying drawings.







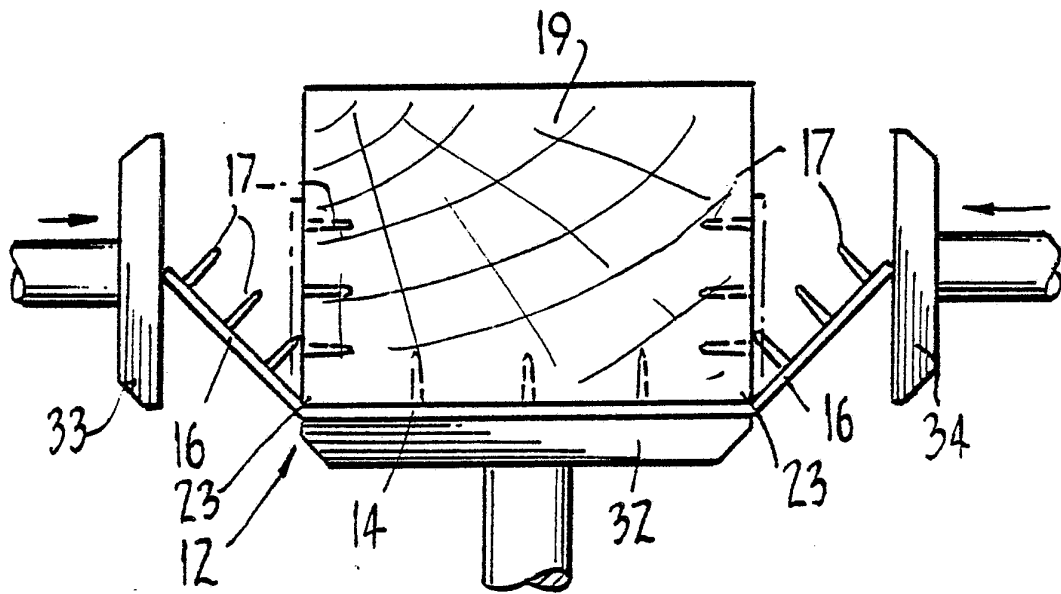


FIG. 6.

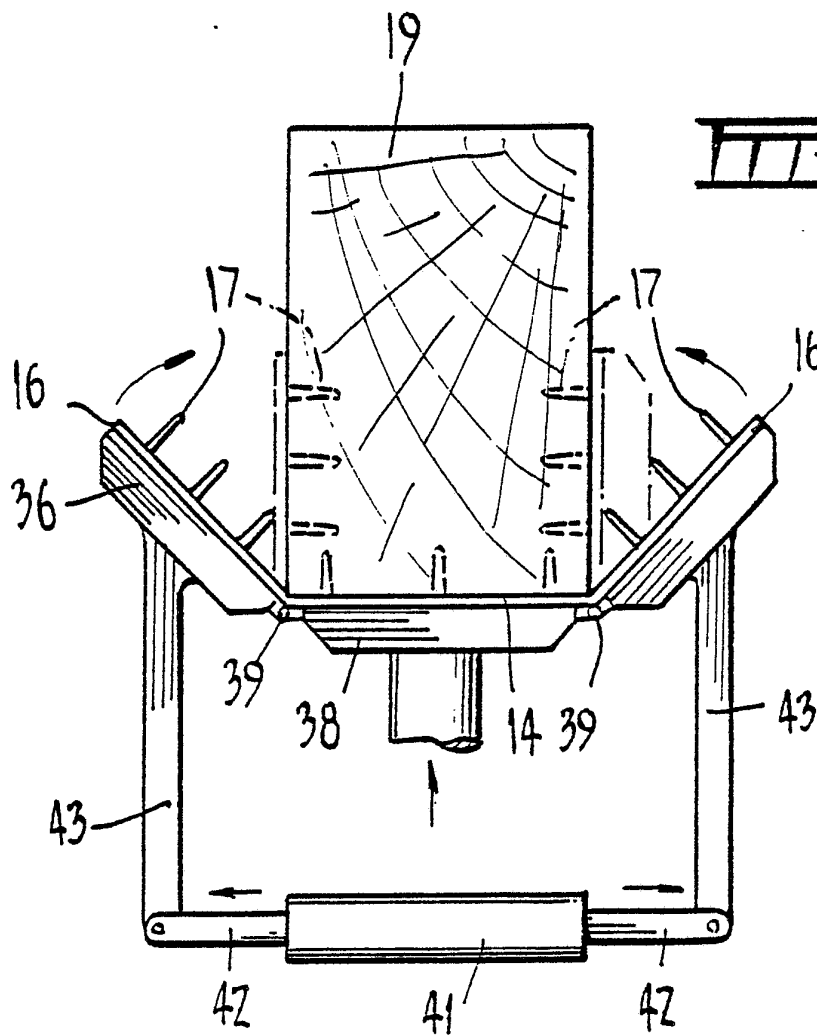


FIG. 7.

# INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 84/00095

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>3</sup> According to International Patent Classification (IPC) or to both National Classification and IPC  <div style="text-align: center; font-size: 1.2em;">Int.Cl.<sup>3</sup> F16B 15/00</div>						
<b>II. FIELDS SEARCHED</b>  <div style="text-align: center; font-size: 0.8em;">Minimum Documentation Searched <sup>4</sup></div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%; text-align: left; padding: 2px;">Classification System</th> <th style="text-align: left; padding: 2px;">Classification Symbols</th> </tr> <tr> <td style="text-align: center; padding: 5px;">IPC</td> <td style="padding: 5px;">F16B 15/00</td> </tr> </table> <div style="text-align: center; font-size: 0.8em; margin-top: 5px;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>5</sup></div>			Classification System	Classification Symbols	IPC	F16B 15/00
Classification System	Classification Symbols					
IPC	F16B 15/00					
AU: IPC as above						
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>						
Category <sup>*</sup>	Citation of Document, <sup>15</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>				
X	US, A, 4318628 (MANCINI) 9 March 1982 (09.03.82)					
X	US, A, 3365222 (POLYAK) 23 January 1968 (23.01.68)					
Y	US, A, 2396030 (TERRY) 5 March 1946 (05.03.46)					
Y	GB, A, 1462482 (NEFAB PLYWOOD <del>EMB</del> BALLAGE AB) 26 January 1977 (26.01.77)					
Y	GB, A, 1579794 (AUTOMATED BUILDING COMPONENTS INC.) 26 November 1980 (26.11.80)					
Y	AU, B, 27114/77 (517416) (McMILLAN) 25 January 1979 (25.01.79)					
Y	AU, B, 70045/74 (495333) (TURNER) 18 December 1975 (18.12.75)					
X	AU, B, 60441/69 (448117) (KUPERSMIT) 4 March 1971 (04.03.71)					
Y	AU, B, 46681/64 (291878) (AUTOMATED BUILDING COMPONENTS INC.) 13 January 1966 (13.01.66)					
<div style="font-size: 0.8em;"> <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p><sup>*</sup> Special categories of cited documents: <sup>15</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 48%;"> <p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"Z" document member of the same patent family</p> </div> </div> </div>						
<b>IV. CERTIFICATION</b>						
Date of the Actual Completion of the International Search <sup>1</sup> <div style="text-align: center; font-size: 1.1em;">23 July 1984 (23.07.84)</div>	Date of Mailing of this International Search Report <sup>2</sup> <div style="text-align: center; font-size: 1.2em;">3rd Aug 1984 (3-3-1984)</div>					
International Searching Authority <sup>1</sup> <div style="text-align: center; font-weight: bold;">AUSTRALIAN PATENT OFFICE</div>	Signature of Authorized Officer <sup>19</sup> <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center; font-size: 1.5em;">A.A. Moore</div> <div style="text-align: right;">A.S. MOORE</div> </div>					

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON  
INTERNATIONAL APPLICATION NO. PCT/AU 84/00095

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Members			
US	4318628	CA 1133565 FR 2439323	CH 635906 GB 2033044	DE 2941800	
GB	1579794	AU 30963/77 JP 53105658 US 811027	DE 2754519 NZ 185759	FR 2373710 SE 7713255	
AU	70045/74	JP 50124416	ZA 743895		
GB	1462482	AT 10754/73 CA 1000478 DK 135883 FR 2213202 JP 49098761 SE 374714	AU 64234/74 CH 578901 ES 422182 IE 38673 NL 7400366	BE 809590 DE 2364670 FI 52448 IT 1009090 NO 138717	
AU	46681/64	NO 119699			

END OF ANNEX