



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
19.12.2001 Bulletin 2001/51

(51) Int Cl.7: **E01B 11/54, E01B 11/24**

(21) Application number: **01304841.8**

(22) Date of filing: **01.06.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR
 Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **12.06.2000 GB 0014318**

(71) Applicant: **Balfour Beatty PLC**
London SW1V 1LQ (GB)

(72) Inventor: **Tunley, Malcolm,**
c/o Balfour Beatty Rail Limited
Derby DE1 2SA (GB)

(74) Representative: **Ertl, Nicholas Justin**
Elkington and Fife, Prospect House, 8 Pembroke
Road
Sevenoaks, Kent TN13 1XR (GB)

Remarks:

Amended claims in accordance with Rule 86 (2) EPC.

(54) **Insulated rail joint**

(57) An insulated rail joint uses rail sections having head portion (20A) and a supporting portion (20B) having substantially the same width. The rail sections are terminated with a connection face (30) which extends at an angle to the plane perpendicular to the rail length, and the insulated joint is formed by sandwiching an in-

insulating member between the connection faces. The angled connection between rail sections results in a progressive transfer of force from one rail section to the other as the train passes over the joint. As the rail section has a substantially constant width, connection of the supporting portions of the two rails can achieve secure connection of the rail heads.

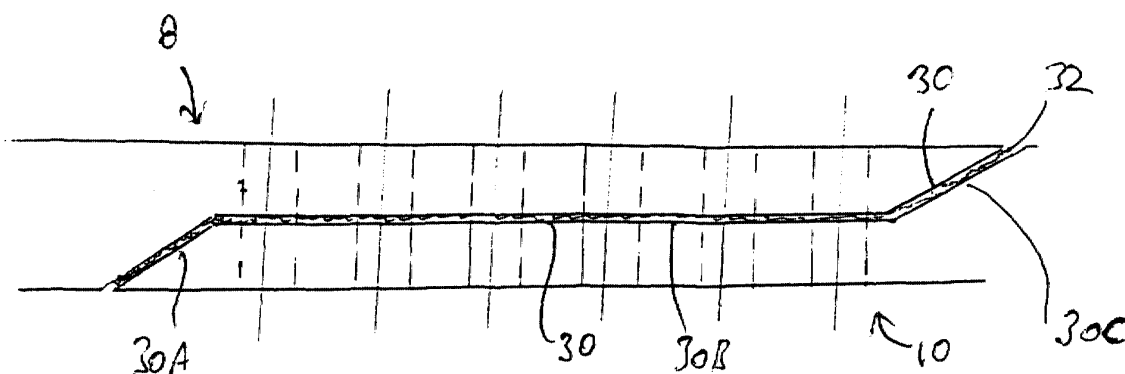


Fig 3

Description

[0001] This invention relates to insulated rail joints, for use as part of railway signalling systems, particularly in which the rails of the track are used as conductors for signalling purposes.

[0002] Signalling operations are performed based on knowledge of the position of trains on the track. Successive blocks of track can be electrically insulated from each other to enable independent detection of trains to take place in those blocks. This invention is concerned with the insulated railway track joints suitable for such railway signalling systems.

[0003] A conventional rail essentially comprises an I-beam, having a head, a narrow web and a base. A conventional insulated rail joint is achieved by cutting two rail sections perpendicularly to the length of the rail. An insulating plate is sandwiched between the two end faces, and the joint is secured using fish plates which are positioned on either side of the thinner web, and which span across the joint. The fish plates on either side are bolted together by bolts passing through both rail sections.

[0004] An assembled insulated rail joint is introduced into a rail network by taking a preassembled rail joint, and welding the remote ends of the two rail sections into place on site.

[0005] The rails are supported at regular intervals by the sleepers, and span the spacing between sleepers. The I-beam structure provides the required vertical strength of the rail across these spans. Insulated rail joints may be located at the position of the sleeper, or between sleepers. However, in either case, the joint is susceptible to wear and damage.

[0006] When the joint is suspended between sleepers, there is a tendency for the rails to dip as the train passes over, particularly as forces are transferred rapidly and abruptly from one side of the joint to the other as the train axles pass over. Similarly, there is a tendency for joints to open up when they are located over the sleepers. This leads to accelerated wear, requiring frequent replacement of the insulated joints.

[0007] Another problem encountered in the mechanical insulated rail joint is that over time the metal of the rail displaces, and can even result in shorting between adjacent rail blocks, giving rise to track circuit failure.

[0008] According to a first aspect of the invention, there is provided an insulated rail joint comprising first and second rail sections, the cross sections of which, in the vicinity of the joint and perpendicular to the rail length, comprise a head portion and a supporting portion, the head and supporting portions having substantially the same width, the first and second rail sections being terminated with a connection face which extends at an angle to the plane perpendicular to the rail length, the insulated joint being formed by sandwiching an insulating member between the connection faces.

[0009] The angled connection between rail sections

results in a progressive transfer of force from one rail section to the other as the train passes over the joint. Furthermore, the risk of shorting resulting from deformation of the rail metal is also reduced. The supporting portion of the rail has substantially the same width as the rail head, so that the I-beam section is not used at the insulated joint. The substantially constant width of the rail cross section enables connection of the supporting portions of the two rails to achieve secure connection of the rail heads.

[0010] The rail joint may be received in a shell, which receives the joint and which supports the rail sections along most of the height of both lateral sides of the rail joint. With this shell arrangement, the first and second sections can be secured together either by countersunk transverse bolts or by transverse pins, with axial movement of the pins being restricted by the shell.

[0011] The connection between rail sections can comprise a straight angled joint. However, each connection face more preferably comprises a first portion extending from one side of the respective rail section to the centre of the rail section, a second portion extending parallel to the rail length along the centre of the rail section, and a third portion extending from the centre of the rail section to the other side of the rail section. This arrangement provides a region parallel with the rail direction through which perpendicular connection holes may be drilled.

[0012] These connection holes may be arranged in first and second rows, with the holes in one row being staggered with respect to the holes in the other row. In this way, the connections provide improved resistance to vertical bending.

[0013] The ends of the first and second rail sections away from the joint may have cross sections which are different to the cross sections in the vicinity of the joint. Thus, the joint of the invention may be used to replace a worn insulator joint in an existing rail network having different rail cross sections. For example, the cross sections of the ends of the first and second rail sections away from the joint may comprise a head portion, a narrower web portion and a base portion wider than the head portion, thus defining the conventional I-beam rail design. In this case, and with the joint received in a shell, the shell may have attachment portions having dimensions corresponding to the base portion. This enables the replacement joint to be fitted into an existing rail network using the same attachment clips as used for securing the rail base to the sleepers in that system.

[0014] The insulating member preferably has a uniform width and is made of a first material, and has a replaceable section of a second, harder material, the replaceable section being positioned so that it defines part of an exposed upper surface of the insulating member in the joint. The harder material can then define the region of the insulating member which is susceptible to greatest wear. For example, the replaceable section may be positioned at one side of the rail, particularly the

inner side (over which the wheel flange rides).

[0015] The replaceable section is preferably fitted to the remainder of the insulating member by a sliding connection in a widthwise direction of the insulating member. Thus, the clamping of the member between the rail sections fixes the replaceable section, but the replaceable section can easily be removed once the joint has been separated.

[0016] The main part of the insulating member may be formed from a nylon-based material and the replaceable section may be formed from a ceramic material.

[0017] According to a second aspect of the invention, there is provided an insulated rail joint comprising first and second rail sections each terminated with a connection face, the insulated joint being formed by sandwiching an insulating member between the connection faces, the insulating member having a substantially uniform width and being made of a first material, the member having a replaceable section of a second, harder material, the replaceable section being positioned so that it defines part of an exposed upper surface of the insulating member in the joint.

[0018] The second aspect of the invention also provides a replaceable ceramic component for forming part of an insulating member of an insulated rail joint, and comprising a sliding connection to enable the component to be connected in a widthwise direction to the remainder of the insulating member.

[0019] The component may define an upper corner of the insulating member, with respect to the orientation of the insulating member in situ in a joint.

[0020] According to a third aspect of the invention, there is provided an insulated rail joint comprising first and second rail sections, the cross sections of which, in the vicinity of the joint and perpendicular to the rail length, comprise a head portion and a web portion, the first and second rail sections being terminated with a connection face, the insulated joint being formed by sandwiching an insulating member between the connection faces, the first and second rail sections being connected together by plates on either side of the web portion and extending across the joint, wherein the joint further comprises a shell, which receives the part of the joint having the plates and which supports the joint along most of the height of both lateral sides of the rail joint, an inner contour of the shell corresponding substantially to an outer contour of that part of the joint.

[0021] This enables a conventional fish plate type joint to be formed, but the shell limits the amount of relative displacement of the two rail sections as the train passes over, thereby reducing the rate at which the joint wears.

[0022] Examples of the invention will now be described in detail with reference to the accompanying drawings in which :

Figure 1 shows a known insulated rail joint design for an I-beam type rail;

Figure 2 shows a proposed alternative rail cross section to the more conventional rail shown in Figure 1;

Figure 3 shows an insulated rail joint of the invention, applied to a rail of the type shown in Figure 2; Figure 4 shows in greater detail the insulating member used in the joint of Figure 31

Figure 5 shows how a rail joint of the invention may be intergrated into an existing rail network; and Figure 6 shows how a rail joint of the invention may be secured using sleepers and clips of an existing rail network.

[0023] Figure 1 shows a conventional insulated rail joint. As shown, the rail cross section comprises a head 2, a narrow web 4 and a base 6. The base 6 is secured to sleepers by clips (not shown). This conventional rail cross section provides the necessary rigidity for the rail to span across adjacent sleepers, whilst reducing the amount of metal required to form the track. There are various precise definitions of the rail cross section in different rail networks, and these do not need to be described in this text.

[0024] Figure 1 shows two sections of rail 8, 10 which have end faces which are perpendicular to the rail length. An insulating plate 12 is sandwiched between these two end faces. A fish plate 14 is provided on each side of the rail and these are bolted together through the two rail sections 8, 10 to form the insulated rail joint. A row of bolts 16 clamp the two rail sections between the two fish plates 14.

[0025] Insulated rail joints of this type are prone to heavy wear at the joint, so that the joints require more frequent replacement than other parts of the track. Wear in the joints can also give rise to track circuit failures if a short circuit results between the two rail sections 8, 10.

[0026] Figure 2 shows an alternative rail design which has been proposed. The rail 20 is held in a shell 22 set in a bed or slab 24 of concrete. The shell 22 has an inner profile of an open channel to receive the rail 20 whilst also clamping the rail 20 in place. A resilient filler 26 is provided between the shell 22 and the rail 20.

[0027] The rail cross section comprises a head portion 20A and a supporting portion 20B. In the example shown in Figure 2, the top of the supporting portion 20B has a pinched part 28. To insert the rail 20 into the shell 22 the wider lower part of the supporting portion 20B has to pass through the pinched region of the fill 26, so that the rail must effectively be sprung into the shell with a snap-action fit.

[0028] Despite this pinched part 28 of the rail cross section, the head portion 20A and the supporting portion 20B have substantially the same width. The only differences in width are provided to enable the snap-action fitting of the rail into the shell as described above, and not to provide the I-beam cross section described with reference to Figure 1.

[0029] The bed or slab 24 is lower on one side of the

rail than on the other side, to allow the passage of the flange of a wheel of the railed vehicle. However, the shell 22 provides support for most of the height of the rail 20 on both sides of the rail. In particular, the shell 22 provides support for at least part of the head portion 20A on both sides of the rail, and over the entire height of the supporting portion 20B on both sides.

[0030] The rail design of Figure 2 is described in greater detail in WO 99/63160.

[0031] The shell 22 defines a continuous supporting structure for the rail 20, rather than the discontinuous sleeper arrangement of the more conventional rail of Figure 1.

[0032] Figure 3 shows an insulated rail joint of the invention, from above, and applied to a rail cross section corresponding to that shown in Figure 2. The joint comprises first and second rail sections 8, 10 each terminated with a connection face 30. However, the connection faces 30 do not extend perpendicularly to the rail direction, but instead extend at an angle to the plane perpendicular to the rail joint. An insulating member 32 is sandwiched between the two connection faces 30.

[0033] By providing the angled connection between the rail sections 8, 10 the load transfer between the two rail sections as the train passes over is progressive. In other words, there is a transitional period during which the load is shared across both rail sections 8, 10.

[0034] Whilst the connection faces can be flat, so that the connection is a straight line when viewed from above, the arrangement shown in Figure 3 is preferred. Each connection face comprises a first portion 30A extending from one side of the rail section to a centre line, a second portion 30B extending parallel to the rail length along the centre of the rail section, and a third portion 30C extending from the centre to the other side. The central section 30B provides a flat face through which connection holes can be drilled perpendicularly to the flat face.

[0035] The angled first and third portions 30A, 30C reduce the occurrence of short circuits resulting from flowing of the track metal over time.

[0036] The first and second rail sections 8, 10 can be secured together using bolts, and there is no need for any fish plates as the joint runs parallel to the rail length. In addition, if the rail joint is to be housed in a shell 22 as shown in Figure 2, counter sunk transverse bolts may be provided to maintain the outer contour of the rail, to enable the rail joint to be placed in the shell 22. Instead, the rail sections 8, 10 may be secured together by transverse pins if the shell arrangement provides the required lateral retention of the rail. The shell will then prevent axial movement of the pins so that bolts are not required.

[0037] Structural adhesive may be used in the joint, and if bolts are used, they preferably use locking nuts.

[0038] Figure 4 shows the insulating member 32 in greater detail. The insulating member has a uniform width (for example 6mm) and may be formed from nylon. As shown in Figure 4, a plurality of openings 34 are pro-

vided corresponding to the positions of the through holes for the transverse connecting bolts or pins. A greater height is available for positioning of the bolts or pins and they are preferably arranged in two rows as shown in Figure 4 with the holes in one row being staggered with respect to the holes in the other row. In this way, additional resistance to bending in the vertical plane is provided. Slots 36 are also provided to enable the insulating member to bend at the transition between the first and second portions 30A, 30B and between the second and third portions 30B, 30C.

[0039] The spacer of Figure 4 also has a replaceable section 38 made of a harder ceramic material. This replaceable section 38 is positioned so that it defines the upper surface of the insulating member 32 at the side of the rail where the wheel flange passes. This is the inner side of the rail. The replaceable section 38 is shaped to slot into the remainder of the insulating member 32 in the manner of a jigsaw. Thus, a sliding connection 40 is provided so that once the insulating member 32 is clamped between the rail sections 8, 10, the replaceable section 38 can no longer be removed.

[0040] The insulated rail joint of the invention may be used in new rail networks such as that shown in Figure 2. However, the invention may also be applied when replacing worn or damaged insulated joints in existing systems. Figure 5 shows one rail section 8 of an insulated rail joint of the invention which is adapted to be applied to an existing rail system, for example using rails of the type shown in Figure 1. For this purpose, the end 50 of the rail section 8 away from the joint has a cross section which is different to the cross section in the vicinity of the joint (namely at 52). Thus, the cross section at 52 corresponds to that shown in Figure 2 whereas the cross section at 50 corresponds to that shown in Figure 1. An insulated rail joint formed from rail sections of the type shown in Figure 5 will be joined before insertion into the existing rail system, and the ends 50 will then be welded in situ to the existing rail. In this example, the existing rail will be secured by clips provided on sleepers, whereas the insulated rail joint uses a shell 22 as explained with reference to Figure 2. To enable the insulated rail joint of the invention to be used for replacement of worn insulated joints of existing systems, an arrangement described with reference to Figure 6 may be employed.

[0041] The cross section of the existing rail is indicated at 60 and the cross section of the new rail to be used in the insulated rail joint is indicated at 62. The insulated rail joint is housed in a shell 64 in the manner described above. However, instead of the shell being buried in a concrete slab as shown in Figure 2, the shell 64 is provided with a base having dimensions corresponding to the base of the rail cross section 60. In this way, the shell 64 may be secured to existing sleepers using the conventional clips previously used for securing the rail having cross section 60. Strengthening webs 66 are provided between the locations of the clips. A length of shell 64 is then provided corresponding to the length only of

the insulated rail joint. Beyond the joint, the rail undergoes a transition in the manner shown in Figure 5 to enable the joint to be connected to the existing system.

[0042] As a further alternative, the rail sections of the rail joint may be provided with perpendicular end faces, so that fish plates are again required to connect the two sections of the joint. However, the rail cross section in the vicinity of the joint may again be provided with a thinner web portion, and the fish plates may be designed to fill this web portion so that the outer contour of the rail in the vicinity of the joint, including the fish plates, again defines the contour shown as 62 in Figure 6. The use of the shell 22 assists in preventing relative displacement of one rail section with respect to the other despite the perpendicular join between rail sections.

[0043] A joint of this type may be coupled to the existing rail system in the same manner as described with reference to Figures 5 and 6.

[0044] Various modifications will be apparent to those skilled in the art.

Claims

1. An insulated rail joint comprising first and second rail sections, the cross sections of which, in the vicinity of the joint and perpendicular to the rail length, comprise a head portion and a supporting portion, the head and supporting portions having substantially the same width, the first and second rail sections being terminated with a connection face which extends at an angle to the plane perpendicular to the rail length, the insulated joint being formed by sandwiching an insulating member between the connection faces, the transverse members being arranged in first and second rows, with the members in one row being staggered with respect to the members in the other row.
2. A rail joint as claimed in claim 1, further comprising a shell, which receives the joint and which supports the rail sections along most of the height of both lateral sides of the rail joint.
3. A rail joint as claimed in claim 2, in which the first and second sections are secured together by countersunk transverse bolts.
4. A rail joint as claimed in claim 2, in which the first and second sections are secured together by transverse pins, axial movement of the pins being restricted by the shell.
5. A rail joint as claimed in any preceding claim, in which each connection face comprises a first portion extending from one side of the respective rail section to the centre of the rail section, a second portion extending parallel to the rail length along the centre of the rail section, and a third portion extending from the centre of the rail section to the other side of the rail section.
6. A rail joint as claimed in claim 5, in which the first and second sections are secured together by transverse members extending through the second portions of the two connection faces.
7. A rail joint as claimed in any preceding claim, in which the ends of the first and second rail sections away from the joint have cross sections which are different to the cross sections in the vicinity of the joint.
8. A rail joint as claimed in claim 7, in which the cross sections of the ends of the first and second rail sections away from the joint comprise a head portion, a narrower web portion and a base portion wider than the head portion.
9. A rail joint as claimed in claim 8, in which the joint is received in a shell, and in which the shell has attachment portions having dimensions corresponding to the base portion.
10. A rail joint as claimed in any preceding claim, in which the insulating member has a substantially uniform width and is made of a first material, and has a replaceable section of a second, harder material, the replaceable section being positioned so that it defines part of an exposed upper surface of the insulating member in the joint.
11. A rail joint as claimed 10, in which the part of the exposed upper surface of the insulating member is positioned at one side of the rail.
12. A rail joint as claimed in claim 10 or 11, in which the replaceable section is fitted to the remainder of the insulating member by a sliding connection in a widthwise direction of the spacer.
13. A rail joint as claimed in any one of claims 10 to 12, in which the first material is a nylon-based material and the second material is a ceramic material.
14. An insulated rail joint comprising first and second rail sections each terminated with a connection face, the insulated joint being formed by sandwiching an insulating member between the connection faces, the insulating member having a substantially uniform width and being made of a first material, the member having a replaceable section of a second, harder material, the replaceable section being positioned so that it defines part of an exposed upper surface of the insulating member in the joint.

15. A rail joint as claimed in claim 14, in which the connection faces extend at an angle to the plane perpendicular to the rail length.
16. A replaceable ceramic component for forming part of an insulating member of an insulated rail joint, and comprising a sliding connection to enable the component to be connected in a widthwise direction to the remainder of the insulating member. 5
10
17. A component as claimed in claim 16, in which the component defines an upper corner of the insulating member.
18. An insulated rail joint comprising first and second rail sections, the cross sections of which, in the vicinity of the joint and perpendicular to the rail length, comprise a head portion and a web portion, the first and second rail sections being terminated with a connection face, the insulated joint being formed by sandwiching an insulating member between the connection faces, the first and second rail sections being connected together by plates on either side of the web portion and extending across the joint, wherein the joint further comprises a shell, which receives the part of the joint having the plates and which supports the joint along most of the height of both lateral sides of the rail joint, an inner contour of the shell corresponding substantially to an outer contour of that part of the joint. 15
20
25
30

35

40

45

50

55

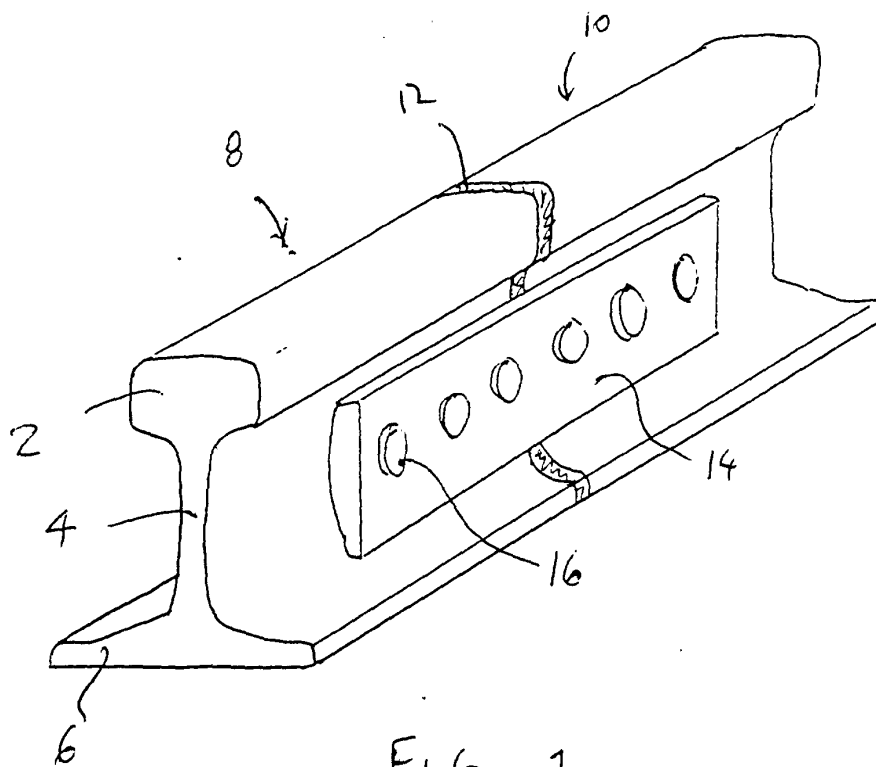


FIG 1

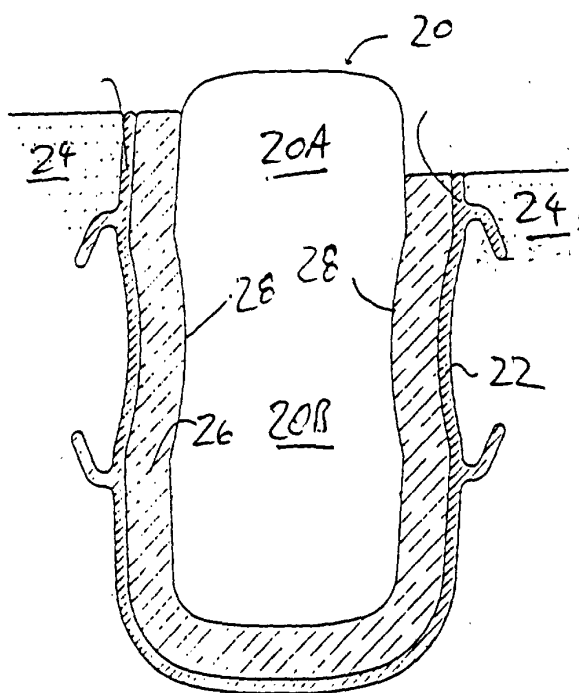


FIG 2

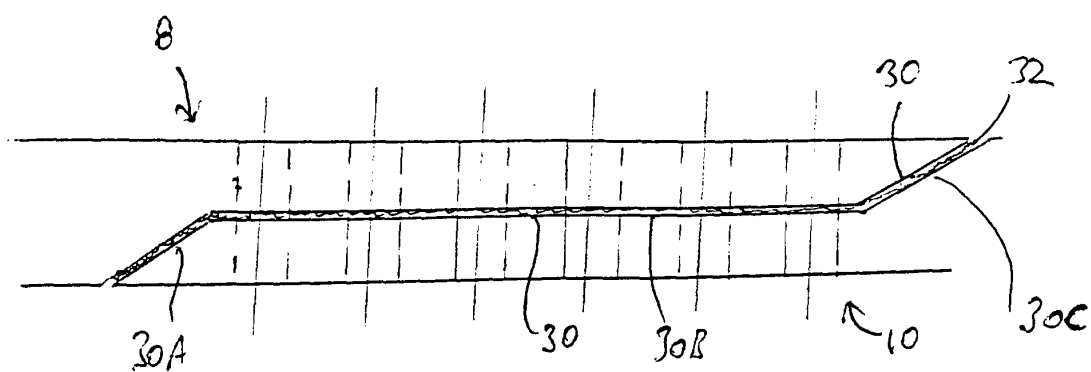


Fig 3

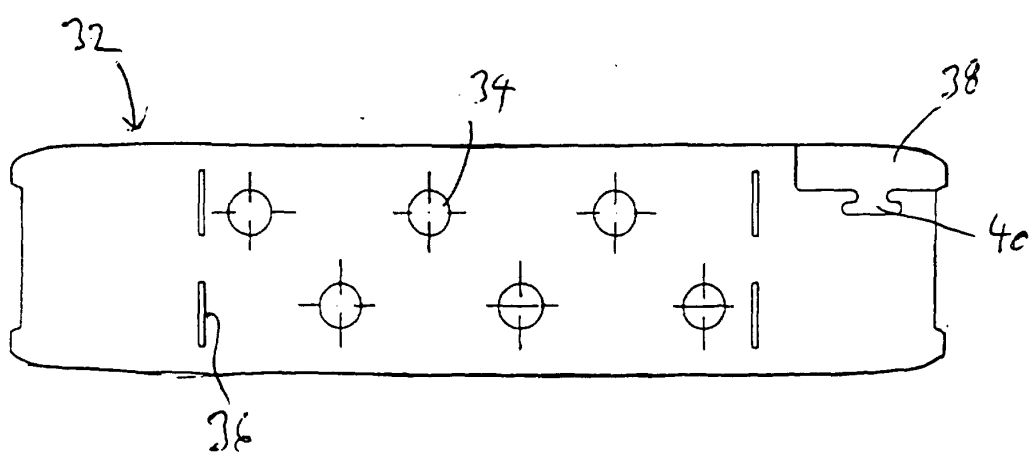


Fig 4

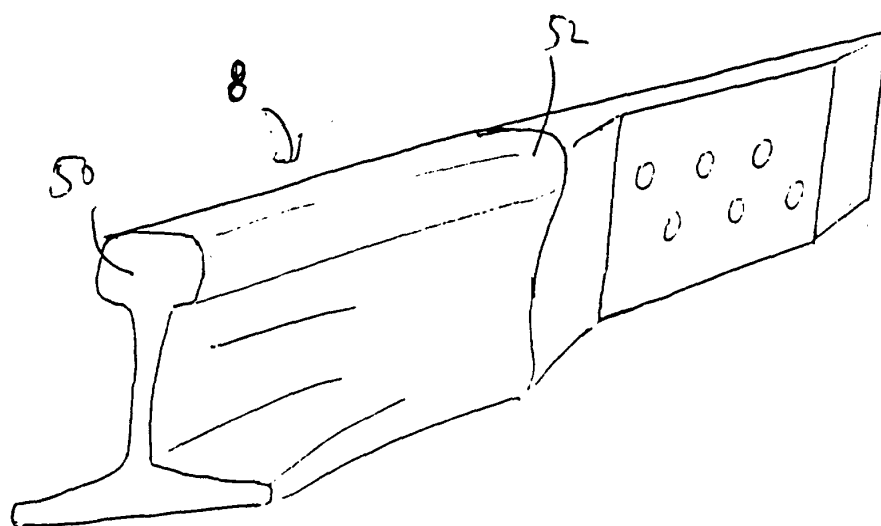
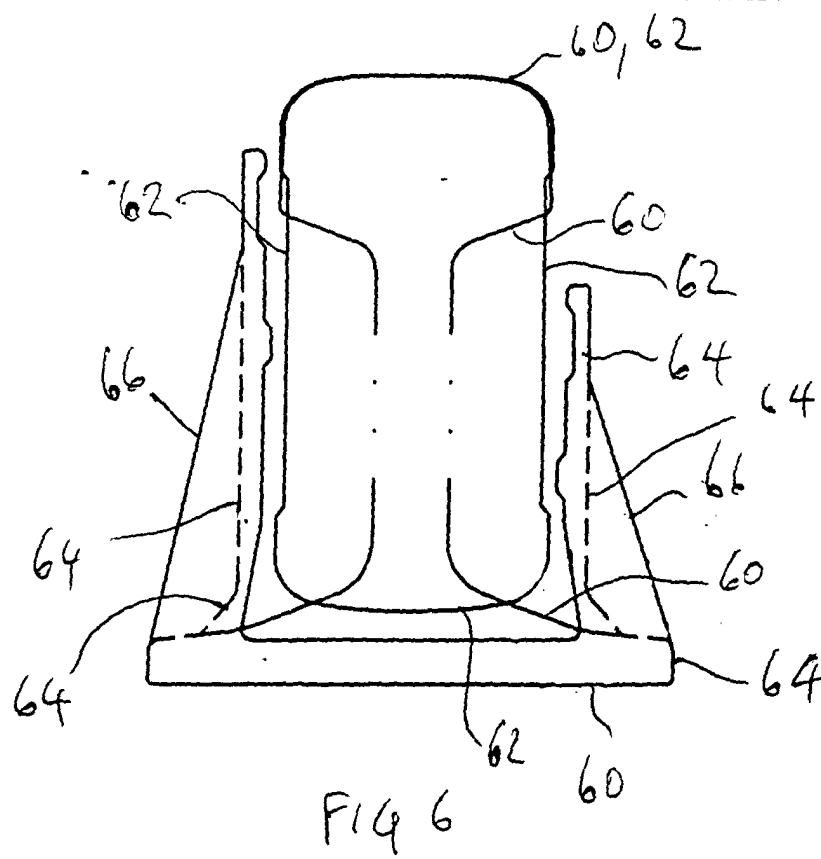


Fig 5





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 30 4841

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X A	GB 2 309 476 A (WOOD TIMOTHY A) 30 July 1997 (1997-07-30) * page 4, line 4 - page 7; figures 2,3 *	1,5,6 3,15,16, 19	E01B11/54 E01B11/24
X A	US 1 369 226 A (C. A. DISBROW) 22 February 1921 (1921-02-22) * page 1, line 63 - page 2, line 60; figures 1-6 *	15 11,17,18	
X A	GB 718 009 A (NELSON KAY MOSES) 3 November 1954 (1954-11-03) * page 2, line 10 - line 87; figures 1,3,5 *	19	
X A	DE 19 81 329 U (KLÖCKNER-WERKE) 21 March 1968 (1968-03-21) * claim 1; figure 1 *	1	
D,A A	FR 1 365 416 A (LA FIBRE DIAMOND) 3 November 1964 (1964-11-03) * page 1, paragraph 8 - page 5, line 17; figures 1,2 *	11,14, 15,17,18	TECHNICAL FIELDS SEARCHED (Int.Cl.7) E01B
D,A A	WO 99 63160 A (PENNY CHARLES) 9 December 1999 (1999-12-09) * abstract; figure 1 *	2,19	
A	US 3 877 641 A (PLOURDE JOSEPH ROLLAND) 15 April 1975 (1975-04-15) * figure 1 *	5	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 14 September 2001	Examiner De Neef, K
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503.03.92 (P04C01)

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

EP 01 30 4841

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-09-2001

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
GB 2309476	A	30-07-1997	AU WO	1550897 A 9727367 A1	20-08-1997 31-07-1997

US 1369226	A	22-02-1921	NONE		

GB 718009	A	03-11-1954	NONE		

DE 1981329	U		NONE		

FR 1365416	A	03-11-1964	NONE		

WO 9963160	A	09-12-1999	AU CN WO NO	4155699 A 1310775 T 9963160 A1 20006045 A	20-12-1999 29-08-2001 09-12-1999 30-01-2001

US 3877641	A	15-04-1975	NONE		
