



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 577 439 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.09.2005 Bulletin 2005/38

(51) Int Cl.7: **E01B 11/02, E01B 29/32,
B61K 3/02**

(21) Application number: **05251658.0**

(22) Date of filing: **18.03.2005**

(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 MC NL PL PT RO SE SI SK TR**
Designated Extension States:
AL BA HR LV MK YU

(72) Inventors:
• **Saunders, Frederick Francis**
Dollar Fife FK14 7LR (GB)
• **Morris, Donald Turner**
Muirend Glasgow G44 3LR (GB)

(30) Priority: **18.03.2004 GB 0406098**

(74) Representative: **Murnane, Graham John et al**
Murgitroyd & Company
165-169 Scotland Street
Glasgow G5 8PL (GB)

(71) Applicant: **First Engineering Limited**
Glasgow, G4 OHG (GB)

(54) **Apparatus for lubricating railway fishplate equipment**

(57) The present invention relates to an apparatus for lubricating railway fishplate equipment (14,16), comprising a frame (20) removably supported on at least one railway rail, said frame (20) supporting: (i) a nut runner assembly (26) for selectively engaging and rotating fishplate nuts (27); (ii) a fishplate-engaging member (30) for prising a fishplate (14) away from a railway rail (10,12); and (iii) lubrication means for applying lubricant to fishplate equipment. The present invention also relates to a method of lubricating railway fishplate equipment (14,16) using the lubricating apparatus described above and comprising the steps of: (i) aligning the or each nut

runner assembly (26) with fishplate nuts (27); (ii) moving the or each nut runner assembly (26) into engagement with said nuts (27); (iii) rotating said nuts (27) to loosen their threaded engagement with their corresponding bolts; (iv) deploying the or each fishplate-engaging member (30) to move the fishplates (14) out of abutment with their corresponding rail (10,11); (v) dispensing a lubricant onto the bearing surfaces of each fishplate (14); (vi) disengaging the or each fishplate-engaging member (30) from the fishplates (14); (vii) rotating said nuts (27) to tighten their threaded engagement with their corresponding bolts; and (viii) disengaging the or each nut runner assembly (26).

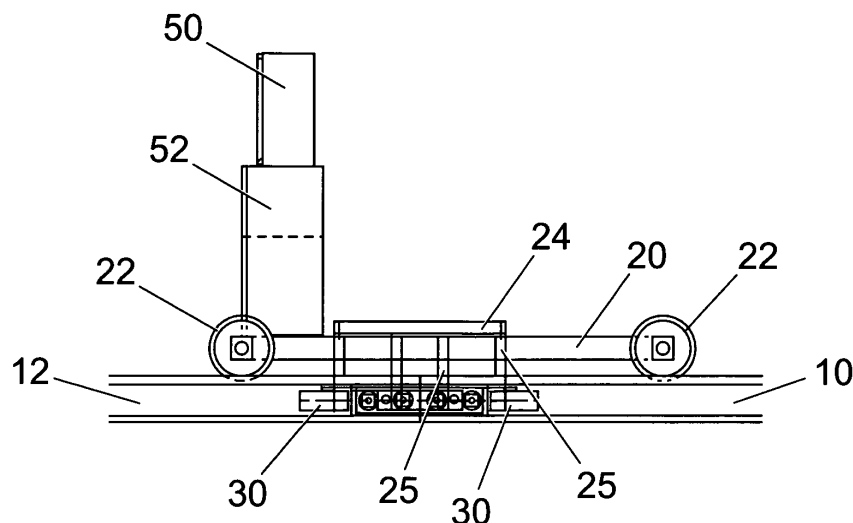


Fig. 2

EP 1 577 439 A1

Description

[0001] The present invention relates to railway maintenance apparatus and particularly, but not exclusively to apparatus for lubricating railway fishplate equipment connecting the distal ends of adjoining rails.

[0002] In the construction of a length of railway track it is necessary under certain circumstances to mechanically join individual lengths of track by means of fishplates which are bolted to the respective sides of adjoining rail stems and urged against the rail heads and rail foots.

[0003] In order to avoid buckling of the track, expansion gaps are provided between individual lengths of track. Fishplates must be designed in such a way that the adjacent rails are allowed to expand and contract longitudinally during extremes of temperature. To this end, the apertures through which the bolts are passed are elongated to allow a degree of movement between the fishplates and the rails. To facilitate such movement, it is essential that periodic lubrication of the bearing surfaces of the fishplates be performed in order to minimise oxidation and friction, and minimise wear and failure of the fishplate.

[0004] Presently, the lubrication of the bearing surfaces of the fishplates is performed manually. The process involves (i) slackening and removing the four nuts which hold the fishplates in place; (ii) removing the corresponding bolts from the apertures provided in the rail and the fishplates; (iii) reinserting the bolts through the apertures from the other side of the rail (to provide visual proof that maintenance has been carried out) and rethreading the nuts; (iv) separating the bearing surfaces of the fishplates from the rails; (v) applying a lubricant to the bearing surfaces of the fishplates; and (vi) tightening the nuts with a torque wrench such that the fishplates revert to their original position against the rails. Such a process is clearly very labour intensive and has associated cost and time implications.

[0005] According to a first aspect of the present invention there is provided apparatus for lubricating railway fishplate equipment, comprising a frame removably supported on at least one railway rail, said frame supporting (i) a nut runner assembly for selectively engaging and rotating fishplate nuts; (ii) a fishplate-engaging member for prising a fishplate away from a railway rail; and (iii) lubrication means for applying lubricant to fishplate equipment.

[0006] Preferably at least two bearing members support the frame on said at least one railway rail.

[0007] Most preferably, four bearing members support the frame for movement along a pair of parallel rails.

[0008] Preferably the bearing members are wheels.

[0009] Preferably the lubrication means includes a lubricant container.

[0010] Preferably the frame supports at least two lubricant applicators each in fluidic communication with said lubricant container.

[0011] Alternatively the frame supports at least four pairs of lubricant applicators each in fluidic communication with said lubricant container.

[0012] Preferably each lubricant applicator is positioned on the frame to allow selective dispensing of lubricant onto bolt threads and/or bearing surfaces of a fishplate on both sides of a pair of parallel rails.

[0013] Preferably each lubricant applicator is fixed relative to a nut runner assembly.

[0014] Preferably each lubricant applicator dispenses lubricant through a spray nozzle.

[0015] Preferably lubricant is adapted to be hydraulically pumped from the container to each lubricant applicator through a conduit.

[0016] Preferably the frame supports at least two fishplate-engaging members.

[0017] Alternatively the frame supports at least four fishplate-engaging members.

[0018] Most preferably the frame supports four pairs of fishplate-engaging members.

[0019] Preferably each fishplate-engaging member comprises a head that is selectively deployable between a retracted and a fishplate-engaging and prising position.

[0020] Preferably the fishplate-engaging members are positioned on the frame to allow selective engagement and prising of a fishplate on both sides of a pair of parallel rails.

[0021] Preferably each head has a bevelled fishplate-engaging end.

[0022] Preferably the deployment of the head of each fishplate-engaging member is adapted to be pneumatically controlled.

[0023] Alternatively the deployment of the head of each fishplate-engaging member is adapted to be hydraulically controlled.

[0024] Preferably there are at least two nut runner assemblies.

[0025] Alternatively there are at least four nut runner assemblies.

[0026] Preferably each nut runner assembly comprises four nut engaging heads adapted for simultaneous rotation.

[0027] Preferably a distance corresponding to the standard separation of fishplate nuts separates each nut engaging head of each nut runner assembly.

[0028] Preferably each nut runner assembly is selectively moveable between a retracted and a nut-engaging position.

[0029] Preferably the nut runner assemblies are positioned on the frame to allow selective engagement of nuts on both sides of a pair of parallel rails.

[0030] Preferably each nut runner assembly is adapted to be pneumatically controlled.

[0031] Alternatively each nut runner assembly is adapted to be hydraulically controlled.

[0032] Preferably each nut runner assembly includes torque measuring means.

[0033] Preferably the frame supports positioning means adapted to align each lubricant applicator with fishplate equipment.

[0034] According to a second aspect of the present invention there is provided a method of lubricating railway fishplate equipment; said equipment including two or more fishplates secured to one or more rails by nuts and bolts; and said method using the lubricating apparatus of the first aspect and comprising the steps of:

- (i) aligning the or each nut runner assembly with fishplate nuts;
- (ii) moving the or each nut runner assembly into engagement with said nuts;
- (iii) rotating said nuts to loosen their threaded engagement with their corresponding bolts;
- (iv) deploying the or each fishplate-engaging member to move the fishplates out of abutment with their corresponding rail;
- (v) dispensing a lubricant onto the bearing surfaces of each fishplate;
- (vi) disengaging the or each fishplate-engaging member from the fishplates;
- (vii) rotating said nuts to tighten their threaded engagement with their corresponding bolts; and
- (viii) disengaging the or each nut runner assembly.

[0035] Preferably the steps are performed automatically and controlled by a control means.

[0036] Preferably the step of aligning the or each nut runner assembly is achieved by moving the lubricating apparatus along a pair of parallel rails on motor-driven wheels.

[0037] Alternatively the step of moving the lubricating apparatus along the rails is performed manually.

[0038] Preferably the step of aligning the or each nut runner assembly with said nuts is performed automatically by optical or mechanical means.

[0039] Alternatively, the step of aligning the or each nut runner assembly with said nuts is performed manually.

[0040] Optionally, the step of rotating said nuts to loosen their threaded engagement with their corresponding bolts is preceded by dispensing a lubricant onto the bolt threads at their distal ends.

[0041] Optionally, the step of deploying the or each fishplate-engaging member is preceded by dispensing a lubricant onto the bolt threads between the loosened nuts and the fishplates.

[0042] Preferably the step of deploying the or each fishplate-engaging member to move each fishplate out of abutment with its corresponding rail joint involves introducing a bevelled head into a cavity between each fishplate and each rail adjacent to the distal ends of each fishplate.

[0043] Preferably the step of rotating said nuts to tighten their threaded engagement with their corresponding bolts is performed to a required measured

torque.

[0044] Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Fig. 1 is a side view of two adjoining rails joined by means of a fishplate in a conventional fashion.

Fig. 2 is a side view of the lubricating apparatus of the present invention;

Fig. 3 is a plan view of the lubricating apparatus of Fig. 1; and

Figs. 4a-f are cross-sectional views of a rail and a corresponding pair of fishplates during various stages of the lubricating process in accordance with the present invention.

[0045] Fig. 1 shows conventional fishplate equipment secured in overlapping engagement against two adjoining rails 10, 12. The fishplate equipment comprises an elongate plate 14 having four equally spaced apertures 16. These apertures are aligned with correspondingly spaced apertures in the adjoining rails and receive threaded bolts fastened by nuts to secure the elongate plate 14 against the respective rails 10, 12. Each rail joint is secured by two fishplates, one on each side of the rail stem (as is illustrated in Fig. 4).

[0046] Figs. 2 and 3 show the apparatus according to the present invention for lubricating railway fishplate equipment. The apparatus is in the form of a railway bogey and comprises a frame 20 supported for movement on each rail by two wheels 22.

[0047] The frame 20 supports a sub-frame 24 from which is suspended a support structure 25 lying below the frame 20 and adjacent the opposite longitudinal sides of each rail. The support structure 25 supports four nut runner assemblies 26 each having four nut engaging heads (not shown) which face the rails and are deployable between a retracted and a nut-engaging position. The nut engaging heads are separated by a distance corresponding to the standard separation of the fishplate apertures 16 (as shown in Fig. 1) and their deployment is either hydraulically or pneumatically controlled.

[0048] The nut runner assemblies 26 comprise sockets (not shown) to engage the nuts 27 (and bolt heads, if required), and drive means (not shown) to tighten and loosen the nuts 27. The sockets may be interchangeable/selective to accommodate different sized and shaped nuts/bolt heads.

[0049] There is no standard protocol in the railway industry which dictates the direction in which the nuts securing a fishplate should be directed (i.e. facing inwardly or outwardly). Indeed, during manual maintenance of fishplates it is customary to swap the orientation of the nuts as a means of providing visual proof that maintenance has in fact been carried out. Accordingly, it will

be appreciated by those skilled in the art that the apparatus of the present invention has been designed such that the nut runner assemblies 26 are positioned on the support structure 25 to allow selective engagement of nuts 27 (in Fig. 3) on either side of both rails.

[0050] The support structure 25 also supports eight fishplate-engaging members 30 each of which comprises a cylinder containing a bevelled or chisel-shaped head (not shown) which is deployable, either hydraulically or pneumatically between a retracted (non-engaging position) and a fishplate-engaging position to release or prise the fishplate away from the rails 10, 12. Whilst in their non-engaging positions, the heads are retracted within the cylinders 30 and face the rails at an acute angle. As with the nut runner assemblies 26, the fishplate engaging members 30 are also positioned on the support structure 25 to allow selective engagement of a fishplate on either side of both rails 10, 12.

[0051] The sub-frame 24 further supports lubrication means in the form of eight lubricant applicators (not shown) each of which is connected to a fluid container or lubricant container 32 mounted on the frame 20. The lubricant applicators are provided with spray nozzles and positioned on the support structure 25 to allow lubricant to be directed onto the bolt threads and/or the bearing surfaces of a fishplate. It is envisaged that the lubricant applicators would be fixed relative to the nut runner assemblies 26 since when the nut runner assemblies 26 engage the fishplate nuts 27 they would be in the correct position for the application of lubricant. The lubricant is hydraulically pumped from the container 32 to each spray nozzle by means of a series of conduits (not shown).

[0052] In use, the lubricating apparatus is moved along the rails (either motor driven or manually) until at least one of four nut runner assemblies 26 is aligned with the nuts 27 of the fishplates. It will be appreciated that the alignment of the nut runner assemblies with the fishplate nuts could be performed manually or automatically by optical or mechanical or electrical means (i.e. by means of proximity switches).

[0053] Usually two pairs of fishplates will be positioned substantially opposite one another, one pair on each respective rail. In such circumstances it will be possible to simultaneously align the nut engaging heads with the fishplate nuts 27 on both rails. Moreover, since two pairs of nut runner assemblies 26 are provided (i.e. corresponding to the inside and outside of each rail), the simultaneous alignment of the nut engaging heads and the nuts 27 is not affected by the orientation of the nuts 27 and their corresponding bolts (i.e. whether the nuts 27 are on the inside or outside of a rail).

[0054] Whilst two pairs of fishplates will often be found substantially opposite each other on each rail, it is unlikely that each fishplate nut/bolt will be exactly aligned with its corresponding nut/bolt on the other rail due to rail creep, temperature affects and rail traffic effects. Accordingly, it is envisaged that the nut runner assemblies

26 will be moveable longitudinally and/or transversely in order to accommodate any misalignment of the fishplate nuts/bolts. The adjusting movement of the nut runner assemblies 26 may be performed manually, hydraulically, pneumatically or electrically (i.e. by means of proximity switches).

[0055] It will be appreciated by those skilled in the art that by aligning the first or fourth nut engaging head with the respective first or fourth nut 27 of a fishplate, all other nut engaging heads will likewise be in alignment with their corresponding nuts 27. Once aligned, the lubricating apparatus is fixed in position on the rails and the sequence of operation of the apparatus is as illustrated in Figs. 4a-f.

[0056] Fig. 4a shows a pair of fishplates 40, 42 in a fully fastened state. Once the lubricating apparatus is positioned such that the nut runner heads are aligned with the nuts 27, each lubricant applicator directs lubricant onto a distal end 44 of a threaded bolt 46. The nut runner heads are then moved into fitting engagement with the nuts 27 and simultaneously rotated to loosen the threaded connection with the corresponding bolts 46 (See Fig. 4b).

[0057] It is to be appreciated that the bolt is adapted to be held in gripping engagement with the fishplates 40, 42 and rail stem 50 to prevent rotation of the bolt as the nut 27 is being loosened; otherwise the bolt and nut could rotate simultaneously without the nut being unthreaded. The gripping engagement is facilitated by virtue of teardrop-shaped apertures through which the bolt passes, and the bolt head having a teardrop-shaped portion; thus rotation of the bolt is prevented. It is also to be appreciated that the apparatus could be modified to prevent the bolt from rotating, for example, the nut runner assemblies could have interchangeable/selective sockets to match the size of the bolt head and nuts, such that one nut runner assembly rotates and loosens the nut 27, whilst the other nut runner assembly holds the bolt head stationary or rotates this in an opposite direction. Alternatively, the fishplate-engaging members could be engaged at the same time as the nut runner assemblies such that as the nut 27 is loosened, the fishplate-engaging members prise the fishplate against the nut 27, allowing the nut to be loosened.

[0058] In view of the fact that only four nuts are used to secure a fishplate to rails, it will be appreciated that four out of eight nut-engaging heads in a pair of nut runner assemblies will not engage a fishplate nut. Those nut-engaging heads which do not engage a fishplate nut can rotate freely around a bolt head and therefore no modification of the apparatus is necessary in order to accommodate the uncertainty in the orientation of fishplate nuts.

[0059] Once the nuts 27 are loosened, a portion 48 of each threaded bolt is exposed between the fishplate 42 and the nut 27. As illustrated by Fig. 4c, each lubricant applicator directs lubricant onto the exposed portion 48 to facilitate both the movement of the fishplate 42 away

from the rail stem 50 and the subsequent tightening of the nut 27.

[0060] Once lubricant has been directed onto the both parts (44 and 48) of each threaded bolt 46, the bevelled heads of the fishplate-engaging member 30 are deployed from their cylinders towards the two distal ends of each fishplate at an acute angle with respect to the longitudinal axes of the rails. The heads are introduced into cavities 52 defined by the surfaces of the rail stems 50 and the rail facing surfaces 54 of the fishplates 40, 42. The bevelled surfaces of the heads act to move the fishplates 40, 42 out of abutment with each rail head 56 and each rail foot 58 respectively and towards the loosened nuts 27 (See Fig. 4d). It may be possible to move each fishplate out of abutment with each rail by deploying only one fishplate engaging head into the cavity at one distal end of the fishplate. However, it will be appreciated that the use of two fishplate engaging heads increases reliability by ensuring that both ends of a fishplate are moved out of abutment with each rail head.

[0061] Once the fishplates 40, 42 are moved out of abutment with the rails their bearing surfaces 60, 62 are exposed. The lubricant applicator then dispenses lubricant into the gaps 64 between the bearing surfaces 60, 62 and the rail heads 56 and rail feet 58 (See Fig. 4e).

[0062] Once the bearing surfaces 60, 62 are lubricated, the fishplate-engaging heads are retracted into their cylinders 30 and the nuts 27 tightened to a required measured torque by the nut runner heads to thus move the fishplates 40, 42 back into abutment with the rails (See Fig. 4e).

[0063] Finally, the nut runner heads are disengaged from the nuts 27 and the lubricating operation is completed. The lubricating apparatus can then be moved along the track to the next set of fishplates and the sequence of operation is repeated.

The various operations of the lubricating apparatus are controlled by means of a control panel 50, having an electrical cabinet 52 mounted on the frame.

[0064] It will be appreciated by those skilled in the art that the apparatus of the present invention provides a much more efficient means of performing the essential task of maintaining fishplate equipment.

[0065] Modifications and improvements can be made without departing from the scope of the present invention. For example, the lubricant applicators which dispense lubricant onto the bolt threads may be separate from those which dispense lubricant onto the bearing surfaces of the fishplates. For example, each nut runner head could be provided with its own lubricant applicator in order to lubricate the bolt threads whilst separate applicators direct lubricant onto the bearing surfaces of the fishplates.

[0066] The lubrication apparatus could be wholly automated instead of being manually controlled via the control panel.

Claims

1. Apparatus for lubricating railway fishplate equipment, comprising a frame removably supported on at least one railway rail, said frame supporting:
 - (i) a nut runner assembly for selectively engaging and rotating fishplate nuts; (ii) a fishplate-engaging member for prising a fishplate away from a railway rail; and (iii) lubrication means for applying lubricant to fishplate equipment.
2. Apparatus according to claim 1, wherein at least two bearing members support the frame on said at least one railway rail.
3. Apparatus according to claim 2, wherein four bearing members support the frame for movement along a pair of parallel rails.
4. Apparatus according to claim 2 or 3, wherein the bearing members are wheels.
5. Apparatus according to any preceding claim, wherein the lubrication means includes a lubricant container.
6. Apparatus according to claim 5, wherein the frame supports at least two lubricant applicators each in fluidic communication with said lubricant container.
7. Apparatus according to claim 5, wherein the frame supports at least four pairs of lubricant applicators each in fluidic communication with said lubricant container.
8. Apparatus according to claim 6 or 7, wherein each lubricant applicator is positioned on the frame to allow selective dispensing of lubricant onto bolt threads and/or bearing surfaces of a fishplate on both sides of a pair of parallel rails.
9. Apparatus according to any of claims 6 to 8, wherein each lubricant applicator is fixed relative to a nut runner assembly.
10. Apparatus according to any of claims 6 to 9, wherein each lubricant applicator dispenses lubricant through a spray nozzle.
11. Apparatus according to any of claims 6 to 10, wherein lubricant is adapted to be hydraulically pumped from the container to each lubricant applicator through a conduit.
12. Apparatus according to any preceding claim, wherein the frame supports at least two fishplate-engaging members.

13. Apparatus according to any of claims 1 to 11, wherein the frame supports at least four fishplate-engaging members.
14. Apparatus according to any of claims 1 to 11, wherein the frame supports four pairs of fishplate-engaging members.
15. Apparatus according to any preceding claim, wherein each fishplate-engaging member comprises a head that is selectively deployable between a retracted and a fishplate-engaging and prising position.
16. Apparatus according to any preceding claim, wherein the fishplate-engaging members are positioned on the frame to allow selective engagement and prising of a fishplate on both sides of a pair of parallel rails.
17. Apparatus according to claim 15 or 16, wherein each head has a bevelled fishplate-engaging end.
18. Apparatus according to any of claims 15 to 17, wherein the deployment of the head of each fishplate-engaging member is adapted to be pneumatically or hydraulically controlled.
19. Apparatus according to any preceding claim, wherein there are at least two nut runner assemblies.
20. Apparatus according to any of claims 1 to 18, wherein there are at least four nut runner assemblies.
21. Apparatus according to any preceding claim, wherein each nut runner assembly comprises four nut engaging heads adapted for simultaneous rotation.
22. Apparatus according to any preceding claim, wherein a distance corresponding to the standard separation of fishplate nuts separates each nut engaging head of each nut runner assembly.
23. Apparatus according to any preceding claim, wherein each nut runner assembly is selectively moveable between a retracted and a nut-engaging position.
24. Apparatus according to any preceding claim, wherein the nut runner assemblies are positioned on the frame to allow selective engagement of nuts on both sides of a pair of parallel rails.
25. Apparatus according to any preceding claim, wherein each nut runner assembly is adapted to be pneumatically or hydraulically controlled.
26. Apparatus according to any preceding claim, wherein each nut runner assembly includes torque measuring means.
27. Apparatus according to any preceding claim, wherein the frame supports positioning means adapted to align each lubricant applicator with fishplate equipment.
28. A method of lubricating railway fishplate equipment; said equipment including two or more fishplates secured to one or more rails by nuts and bolts; and said method using the lubricating apparatus according to any of claims 1 to 27 and comprising the steps of:
- (i) aligning the or each nut runner assembly with fishplate nuts;
 - (ii) moving the or each nut runner assembly into engagement with said nuts;
 - (iii) rotating said nuts to loosen their threaded engagement with their corresponding bolts;
 - (iv) deploying the or each fishplate-engaging member to move the fishplates out of abutment with their corresponding rail;
 - (v) dispensing a lubricant onto the bearing surfaces of each fishplate;
 - (vi) disengaging the or each fishplate-engaging member from the fishplates;
 - (vii) rotating said nuts to tighten their threaded engagement with their corresponding bolts;
 - and
 - (viii) disengaging the or each nut runner assembly.
29. Method according to claim 28, wherein the steps are performed automatically and controlled by a control means.
30. Method according to claim 28 or 29, wherein the step of aligning the or each nut runner assembly is achieved by moving the lubricating apparatus along a pair of parallel rails on motor-driven wheels.
31. Method according to claim 30, wherein the step of moving the lubricating apparatus along the rails is performed manually.
32. Method according to any of claims 28 to 31, wherein the step of aligning the or each nut runner assembly with said nuts is performed manually, or automatically by optical or mechanical means.
33. Method according to any of claims 28 to 32, wherein the step of rotating said nuts to loosen their threaded engagement with their corresponding bolts is

preceded by dispensing a lubricant onto the bolt threads at their distal ends.

- 34.** Method according to any of claims 28 to 33, wherein the step of deploying the or each fishplate-engaging member is preceded by dispensing a lubricant onto the bolt threads between the loosened nuts and the fishplates. 5
- 35.** Method according to any of claims 28 to 34, wherein the step of deploying the or each fishplate-engaging member to move each fishplate out of abutment with its corresponding rail joint involves introducing a bevelled head into a cavity between each fishplate and each rail adjacent to the distal ends of each fishplate. 10 15
- 36.** Method according to any of claims 28 to 35, wherein the step of rotating said nuts to tighten their threaded engagement with their corresponding bolts is performed to a required measured torque. 20

25

30

35

40

45

50

55

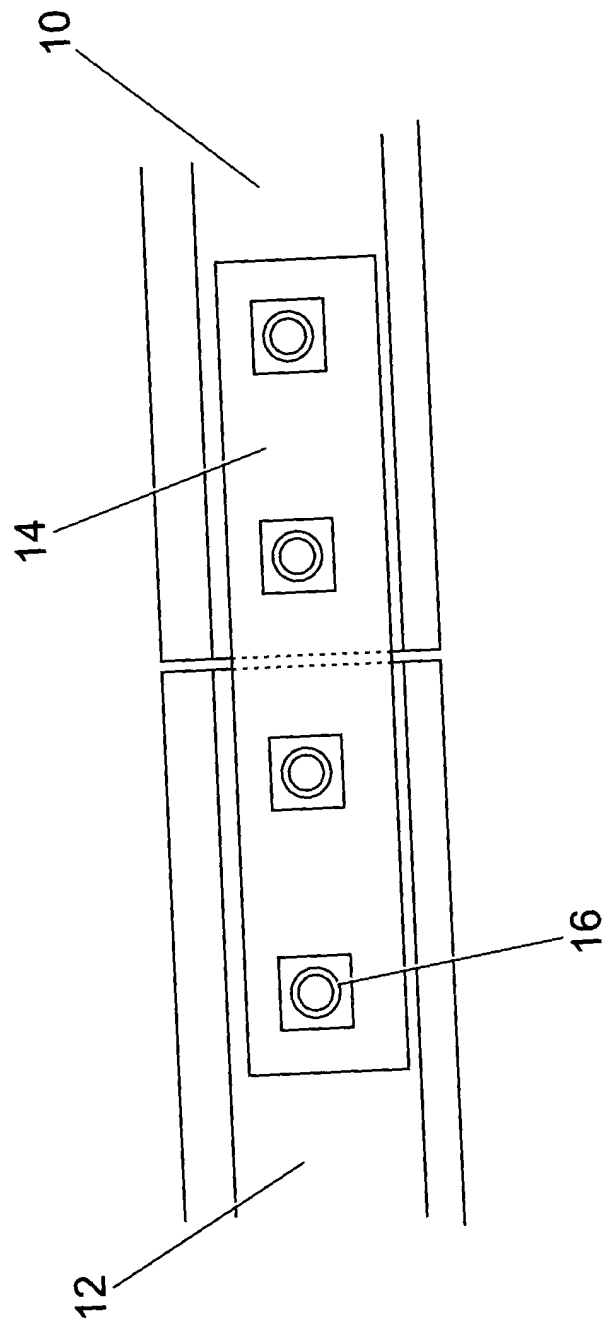


Fig. 1

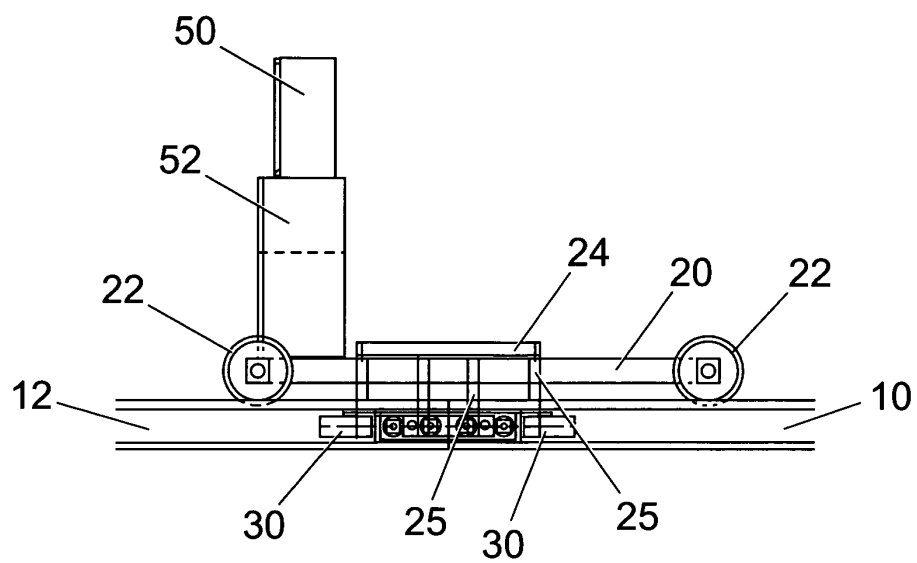


Fig. 2

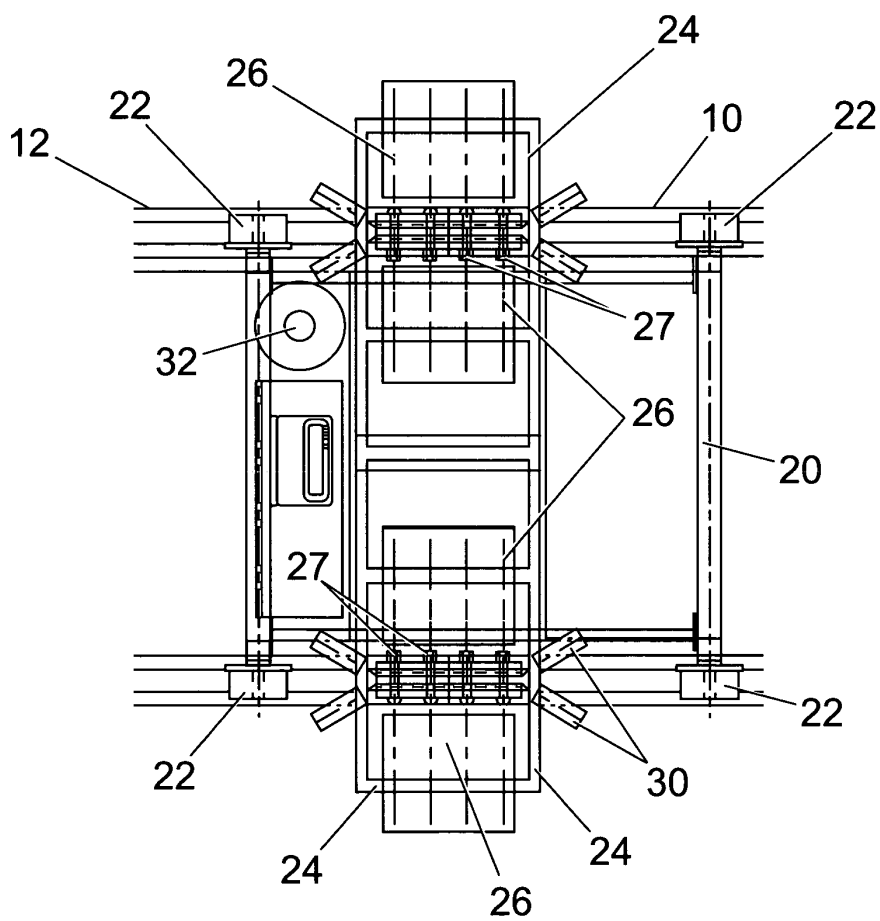


Fig. 3

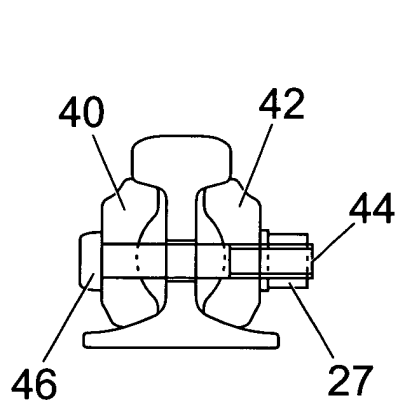


Fig. 4a

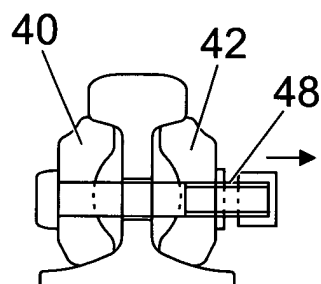


Fig. 4b

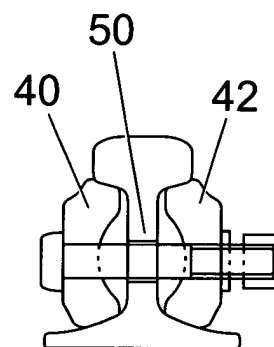


Fig. 4c

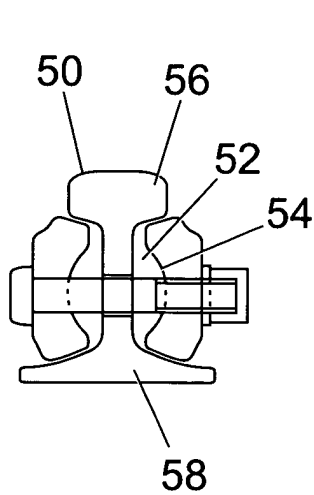


Fig. 4d

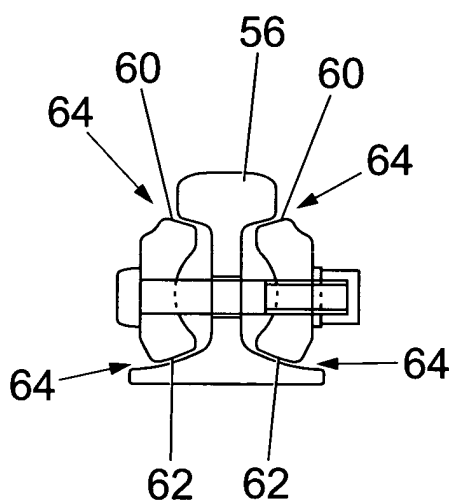


Fig. 4e

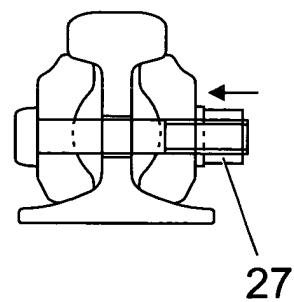


Fig. 4f



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 25 1658

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)
A	PATENT ABSTRACTS OF JAPAN vol. 2002, no. 02, 2 April 2002 (2002-04-02) & JP 2001 278044 A (OYODO DIESEL KK), 10 October 2001 (2001-10-10) * abstract *	1-6,10, 11,28	E01B11/02 E01B29/32 B61K3/02
A	DE 28 12 425 A1 (LICENTIA PATENT-VERWALTUNGS-GMBH) 4 October 1979 (1979-10-04) * claim 1; figure 1 *	1,2,4-6, 10,11	
A	US 1 754 768 A (PROTZELLER HARRY W) 15 April 1930 (1930-04-15) * page 1, lines 49-70; figure 1 *	1,5,6, 10,28,31	
A	US 1 707 434 A (KEOUGH ROBERT EMMET) 2 April 1929 (1929-04-02) * page 2, lines 89-105; figures 1,4,5 *	1,28,31	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			E01B B61K
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 29 June 2005	Examiner Fernandez, E
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			

1
EPO FORM 1503 03.82 (P04C01)

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

EP 05 25 1658

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.

29-06-2005

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2001278044 A	10-10-2001	NONE	
DE 2812425 A1	04-10-1979	NONE	
US 1754768 A	15-04-1930	NONE	
US 1707434 A	02-04-1929	US 1707436 A US 1707438 A	02-04-1929 02-04-1929