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(54) Title: OVERHEAD ELECTRIFICATION LINE CANTILEVER ASSEMBLY

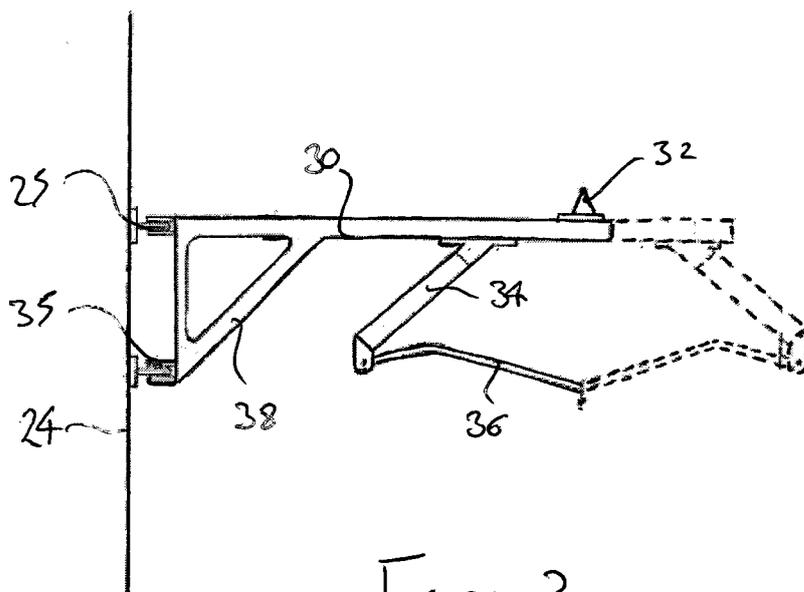


FIGURE 3

(57) Abstract: An overhead electrification line cantilever assembly including a catenary wire support arm having a catenary wire fixing point, and a registration arm coupled to the catenary wire support arm and having a contact wire fixing point, wherein at least one or more of the catenary wire support arm and the registration bracket is formed from of an electrically insulating material.

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Overhead Electrification Line Cantilever Assembly

Background to the Invention

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The electrification of transport vehicles is a well known means for providing power to transport vehicles, in particular public transport vehicles, and is becoming increasingly popular as the need grows to reduce carbon emissions. Overhead line electrification is an established means of providing this electrification.

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Overhead line electrification requires suspending one or more electrically energised cables above the vehicle path and transferring the energy to the vehicle by means of an electrical pick-up device, typically a pantograph. The electrically energised cables need to be electrically insulated from the surrounding environment for practical and safety reasons.

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Traditionally, this isolation is provided by inserting discreet insulators into the body of the supporting structures. The insertion of these insulators complicates the construction of the support structures and increases the cost of the overall system.

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A common configuration is to suspend the electrically energised cables off a cantilever that is in turn supported off a support structure, such as an adjacent building or dedicated support mast. The cantilever assembly can be optionally propped or tied to the support mast to provide additional support. Insulators are then introduced into the cantilever body and into the tie or prop.

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Summary of the Invention

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This application describes an overhead electrification line cantilever assembly including a catenary wire support arm having a catenary wire fixing point, and a registration bracket coupled to the catenary wire support arm and having a contact wire fixing point, wherein at least one of the catenary wire support arm and the registration bracket is formed of an electrically insulating material. In this arrangement, the electrically insulating material provides the desired isolation between the electrically energised catenary and contact wires and the surrounding environment, removing the need for separate insulators.

Preferably, the electrically insulating material comprises a fibre reinforced plastic.

5 Preferably, where the catenary wire support arm is conductive, the catenary wire fixing point is formed of the electrically insulating material. Alternatively or additionally, any catenary wire to be supported by the catenary wire support arm may be insulated to isolate such catenary wire from the catenary wire support arm.

10 The cantilever assembly may further include a tie bar coupled to the catenary wire support arm. The tie bar may be formed of the electrically insulating material.

15 Alternatively, the cantilever assembly may further include a prop bar coupled to the catenary wire support arm. The prop bar may be formed of an electrically insulating material. Preferably, the prop bar may be formed integrally with the catenary wire support arm.

Preferably, at least the catenary wire support arm includes one or more mounting assemblies arranged to fix the cantilever assembly to a support structure.

20 The catenary wire fixing point may be adjustably secured to the catenary wire support arm such that the catenary fixing point is securable to the catenary wire support arm at multiple points along at least a portion of the catenary wire support arm.

25 The registration bracket may be adjustably coupled to the catenary wire support arm such that the registration bracket is adjustably secured to the catenary wire support arm at multiple points along a portion of the catenary wire support arm.

The registration bracket is preferably arranged to be coupled to the catenary wire support arm in one of both a push-off and a pull-off configuration.

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The catenary support arm may further comprise one or more additional catenary wire fixing points, such that more than one catenary wire may be supported by the support arm.

Additionally, or alternatively, the assembly may comprises one or more additional registration brackets coupled to the catenary wire support arm.

5 The electrically inert structural form of the cantilever assembly provides several advantages over known electrically conductive structures. By eliminating the need for separate insulators, the complexity of the cantilever assembly is reduced, thus reducing the cost of the parts required to make up the assembly. Additionally, the assembly time of the cantilever assembly is reduced, which is significant as the time available on site to install such cantilever assemblies is typically limited. A further advantage is that the maintenance
10 requirements are reduced as there are less parts to inspect. All of these advantages result in a reduced life cost of the cantilever assembly.

Brief Description of the Drawings

15 Embodiments of the present invention will now be described, by non-limiting example only, with reference to the accompanying drawings, in which:

Figure 1 schematically illustrates a conductive cantilever assembly in accordance with the prior art;

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Figure 2 schematically illustrates a cantilever assembly according to an embodiment of the present invention;

Figure 3 schematically illustrates a further embodiment of the present invention.

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Description of Embodiments of the Invention

A conventional cantilever assembly is schematically illustrated in Figure 1. A horizontal beam 2 of electrically conductive material, such as aluminium or steel, is secured to a support mast 4 with a first, strut insulator 6 interposed between the support mast 4 and the
30 conductive horizontal beam 2. A tie bar 8, also of a conductive material, is attached at one end to a free end of the horizontal beam 2, the other end of the tie bar 8 extending back towards the support mast 4 and attaching to the support mast 4 above the attachment point

of the horizontal beam 2. A further insulator, tie insulator 10, is interposed between the tie bar 8 and the support mast 4. Located towards the free end of the horizontal beam 2 is an upstanding catenary wire clamp 12 arranged to support a catenary wire, not illustrated. Connected to the underside of the horizontal beam 2, again towards the free end of the horizontal beam 2, is a registration bracket 14, which is generally a further elongate rigid beam inclined downwards from the horizontal beam 2. A registration arm 16 is pivotally coupled to the free end of the registration bracket 14 such that the registration arm 16 is substantially horizontal. The registration bracket 14 and registration arm 16 are dimensioned and configured such that the free end of the registration arm 16 is substantially vertically aligned with the catenary wire clamp 12. A contact wire clamp 18 is located at the free end of the registration arm 16.

When fully installed as part of an overhead line electrification system, a catenary wire is connected between adjacent cantilevers by means of the catenary wire clamps 12 and an electrified contact wire is suspended from the catenary wire by a number of individual vertical "droppers" such that the electrified contact wire is maintained at a substantially even height above the underlying roadway or railway. In use, a rail locomotive or other electrified transport vehicle can be equipped with a suitable electrical contact, known as a pantograph, arranged to be urged into contact with the contact wire. The strut insulator 6 and tie bar insulator 10 are required to electrically isolate the electrically conductive horizontal beam 2, tie bar 8, registration bracket 14 and registration arm 16 of the cantilever assembly from the support mast 4 and therefore the surrounding environment. In typical railway applications, the contact wire is electrified to a voltage of 25kV.

As previously noted, the necessity to provide the insulators 6, 10 as part of the cantilever assembly complicates the erection and assembly of the cantilever when on site, as well as increasing the overall part count within the cantilever assembly, thus increasing cost.

A cantilever assembly according to an embodiment of the present invention is schematically illustrated in Figure 2. In the embodiment illustrated, a separate substantially horizontal catenary wire support arm 20 having a catenary wire fixing (clamp) 22 at one end thereof is provided in an analogous fashion to the cantilever assembly shown in Figure 1. However, in contrast to that shown in Figure 1, the catenary wire support arm

20 is formed from an electrically insulating material, such as a fibre reinforced plastic (e.g. glass reinforced plastic). The support arm 20 is preferably provided with a further electrically insulating coating, such as PTFE or silicon rubber. The catenary wire support arm 20 is mounted to a suitable support structure 24, such as a support mast, by means of an appropriate bracket 25 formed on the end of the catenary wire support arm 20. The bracket 25 may be bolted to the end of the catenary wire support arm, integrally formed with the support arm during manufacture, or formed in any other way known to the person skilled in the art.

10 A tie bar 28 is connected between the support structure 24 and the catenary wire support arm 20 in an analogous fashion to the tie bar 8 of the cantilever assembly shown in Figure 1. However, in the particular embodiment illustrated in Figure 2, the tie bar 28 is also preferably formed of an electrically insulating material, such as the same fibre reinforced material as the catenary wire support arm 20. Alternatively, the tie bar 28 may be formed from a conductive material. The tie bar 28 may be formed of a flexible material.

By virtue of the catenary wire support arm 20, and optionally the tie bar 28, being formed from electrically insulating material, there is no requirement for a strut insulator, or optionally a tie bar insulator, interposed between the catenary wire support arm 20 and tie bar 28 respectively and the support structure 24.

A registration arm 26 and registration bracket 30 are connected to the underside of the catenary wire support arm 20 in a conventional manner to allow a contact wire to be suspended substantially vertically beneath the catenary wire fixed to the catenary wire clamp 22. In preferred embodiments, the registration bracket 30 is also formed of electrically insulating material, although electrically conductive materials may also be used. Whilst in embodiments described above the catenary support arm 20 is formed of an insulating material, in those embodiments where the registration bracket 30 is formed of electrically insulating material, the catenary support arm 20 may be made from a non-insulating material. In such circumstances, since the registration bracket 30 is formed of electrically insulating material, there is again no requirement for a strut insulator, or optionally a tie bar insulator.

Figure 3 schematically illustrates a further embodiment of the present invention. In this embodiment a catenary wire support arm 30, catenary wire clamp 32, registration arm 36 and registration bracket 34 are all provided in an analogous fashion to the embodiment illustrated in Figure 2. However, the particular embodiment illustrated in Figure 3, the catenary wire support arm 30 is provided with a support prop 38 that extends horizontally from the underside of the catenary wire support arm 30 to the support structure 24. In the particular embodiment illustrated, the support prop 38 is integrally formed with the catenary wire support arm 30 and is formed from the same electrically insulating material. However, in other embodiments the support prop 38 may be a separate element, although still preferably formed from an electrically insulating material. This arrangement may be preferred where overhead clearance above the catenary support arm is limited, preventing the use of a tie bar 28. A second mounting bracket 35 is located at the end of the support prop 38 closest to the support structure 24 and arranged to allow the support prop 38 to be attached to the support structure in an analogous fashion to the mounting bracket 25 provided directly on the end of the catenary wire support arm 30.

Also illustrated in Figure 3, in phantom, is a further arrangement of the cantilever in which the registration arm and registration bracket are configured in a substantially symmetrical manner to that illustrated in Figure 2 and in solid lines in Figure 3, with the phantom configuration generally being referred to as a "push-off" configuration, whilst the configuration shown in solid lines is generally referred to as a "pull-off" configuration. When installed as part of an overhead line electrification system, push-off and pull-off configured cantilevers may be provided in alternation along a line such that the contact wire is zigzagged slightly left and right of the centre of each successive cantilever support, thereby preventing the contact wire from wearing a groove in the pantograph(s) of electrified transport vehicles(s).

In practice, it is desirable for the catenary wire clamp 22, 32 and registration brackets 30, 34 to be adjustably secured to the catenary wire support arm 30 to accommodate variations in distance between the end of the catenary wire support arm and the support structure 24 to which it is attached, thereby ensuring that the catenary wire and contact wire are located as desired above the rail line or other transport roadway. This may be accomplished in any manner familiar to the person skilled in the art, for example by providing one or more

grooves or tracks located in both the upper and lower surfaces of the catenary wire support arm 30 along at least a portion of the support arm 30, such that the position of the catenary wire clamp and/or support bracket can be adjusted by sliding the clamp and/or bracket along the length of the mounting grooves or tracks prior to being fixed in the desired position.

As with conventional cantilever assemblies, the registration arm 26, 36 of the embodiments of the present invention is pivotally coupled to the registration bracket 30, 34 to allow for a degree of vertical movement of the contact wire as the transport vehicle pantograph passes underneath.

It will be appreciated that whilst the assemblies shown in Figures 2 and 3 support a single catenary wire and a single contact wire, in other embodiments one or more additional catenary and contact wires may be supported by the support arms 20, 30 and registration arms 26, 36 respectively. For example, cantilever assemblies described herein may be operable to support the contact and catenary wires for two parallel transport lines, or may be configured to support multiple wires where catenary and contact wires terminate and/or start. Where multiple contact wires need to be supported, a single registration arm may be provided to support all contact wires, or alternatively multiple registration arms and brackets may be provided - one for each contact wire. Where multiple catenary wires are supported by a single support arm, the support arm may be provided with multiple catenary wire fixings (clamps) distributed along the support arm, or alternatively the plurality of catenary wires may be supported by a single fixing.

By providing a cantilever assembly in which at least one of the catenary wire support arm and the registration bracket is formed from an electrically insulating material, such as fibre reinforced plastic, a cantilever assembly having a reduced number of total parts, by virtue of the elimination of the individual insulators, can be achieved, thus simplifying both manufacture and installation.

Claims

1. An overhead electrification line cantilever assembly including a catenary wire support arm having a catenary wire fixing point, and a registration arm coupled to the catenary wire support arm and having a contact wire fixing point, wherein one or more of the catenary wire support arm and the registration bracket is formed of an electrically insulating material.
2. The cantilever assembly of claim 1, wherein the electrically insulating material comprising fibre reinforced plastic.
3. The cantilever assembly of claims 1 or 2, wherein the catenary wire fixing point is formed of the electrically insulating material.
4. The cantilever assembly of any preceding claim, further including a tie bar coupled to the catenary wire support arm.
5. The cantilever assembly of claim 4, wherein the tie bar is formed of the electrically insulating material.
6. The cantilever assembly of claims 4 or 5, wherein the tie bar is formed of a flexible material.
7. The cantilever assembly of any one of claims 1 to 6, further including a prop bar coupled to the catenary wire support arm.
8. The cantilever assembly of claim 7, wherein the prop bar is formed of the electrically insulating material.
9. The cantilever assembly of claims 7 or 8, wherein the prop bar is formed integrally with the catenary wire support arm.

10. The cantilever assembly of any preceding claim, wherein at least the catenary wire support arm includes one or more mounting assemblies arranged to fix the cantilever assembly to a support structure.

11. The cantilever assembly of any preceding claim, wherein the catenary wire fixing point is adjustably secured to the catenary wire support arm such that the catenary wire fixing point is securable to the catenary wire support arm at multiple points along at least a portion of the catenary wire support arm.

12. The cantilever assembly of any preceding claim, wherein the registration bracket is adjustably coupled to the catenary wire support arm such that the registration bracket is adjustably secured to the catenary wire support arm at multiple points along a portion of the catenary wire support arm.

13. The cantilever assembly of any preceding claim, wherein the registration bracket is arranged to be coupled to the catenary wire support arm in one of both a push-off and a pull-off configuration.

14. The cantilever assembly of any preceding claim, wherein the catenary wire support arm comprises one or more additional catenary wire fixing points.

15. The cantilever assembly of any preceding claim, further comprising one or more additional registration brackets coupled to the catenary wire support arm.

16. An overhead electrification line cantilever assembly substantially as shown and as described with reference to Figures 2 and 3.

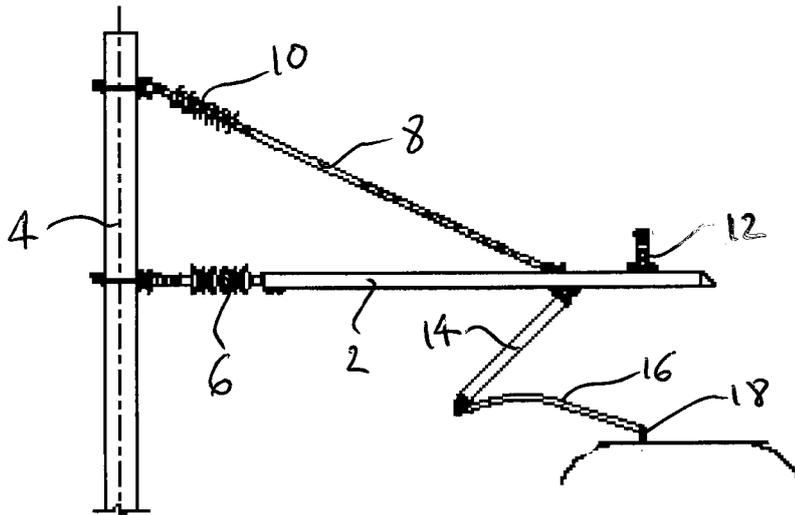


FIGURE 1
(PRIOR ART)

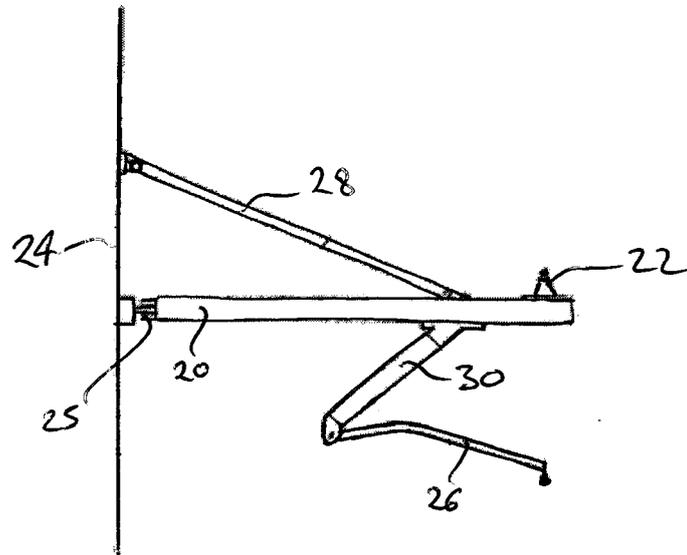


FIGURE 2

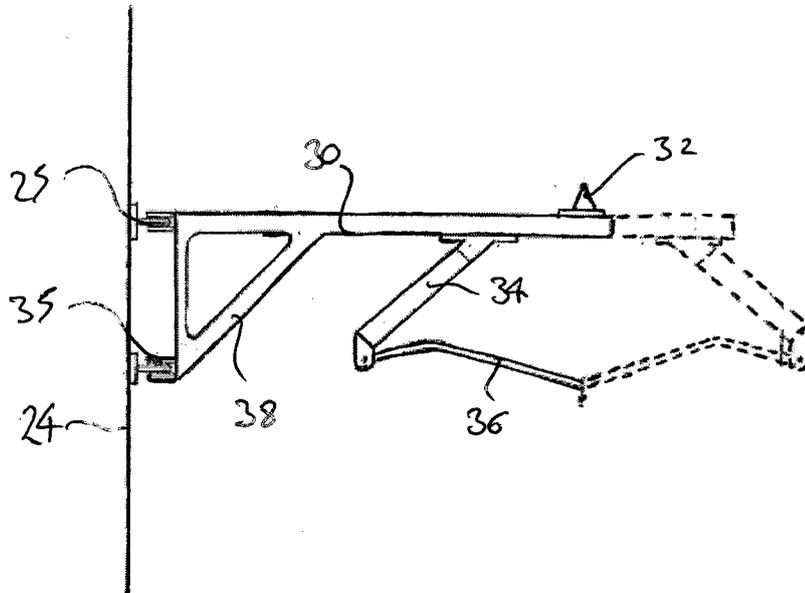


FIGURE 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2014/053757

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60M1/20
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
B60M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.

See patent family annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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