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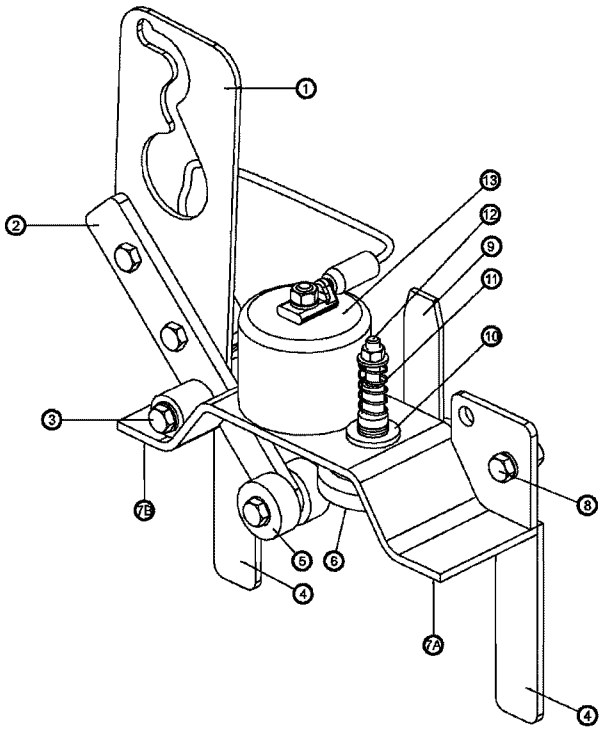
(56) Documents Cited:
CN 213905630 U **CN 210723399 U**
CN 113991330 A **JP 2017117588 A**

(58) Field of Search:
INT CL **H01R, H02G**
Other: **WPI, EPODOC, Patent Fulltext**

(54) Title of the Invention: **Earth clamp for ole structures**
Abstract Title: **Magnetically secured earth clamp**

(57) An earth clamp, suitable for overhead line structures, comprises a clamp frame comprising a curvilinear profile, having a flat contact point 7A,B at each end of the profile and a middle part at a different height than each contact point 7A,B at each end of the profile. A magnetic part 6 magnetically attaches the frame against a surface. The magnetic part 6 is situated towards the middle of the frame profile. The magnetic part 6 is arranged to move in relation to the frame around the level of the contact points 7A,B, allowing the earth clamp to be attached to a structure facilitating mechanical and electrical connection thereof with the overhead line structure through the magnetic part 6 and the contact points 7A,B. The clamp comprises a means 1,2,3 to move the magnetic part 6 away from the level of the contact points 7A,B so that the magnetic part 6 may attach to a structure on level with the contact points 7A,B. The magnetic part 6 may be moved away from the level of the contact points 7A,B by counteracting the magnetic force exerted to a structure.

Figure 4



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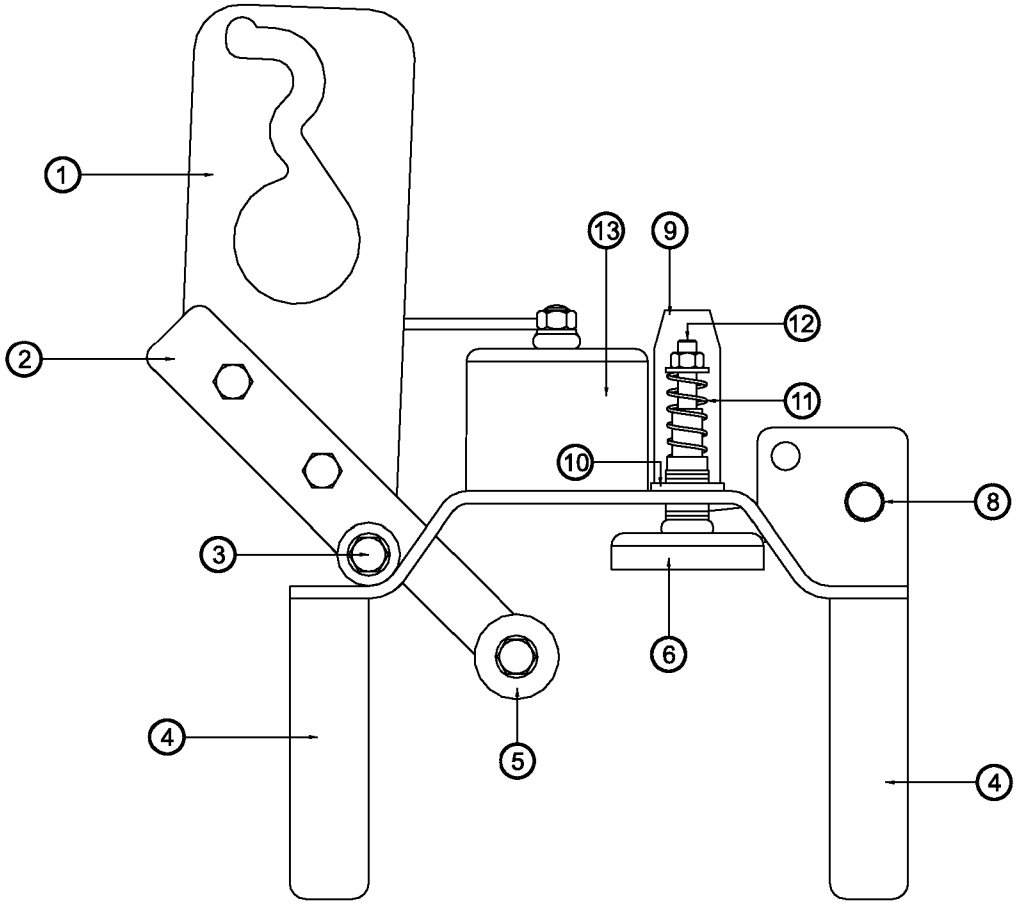

Figure 1

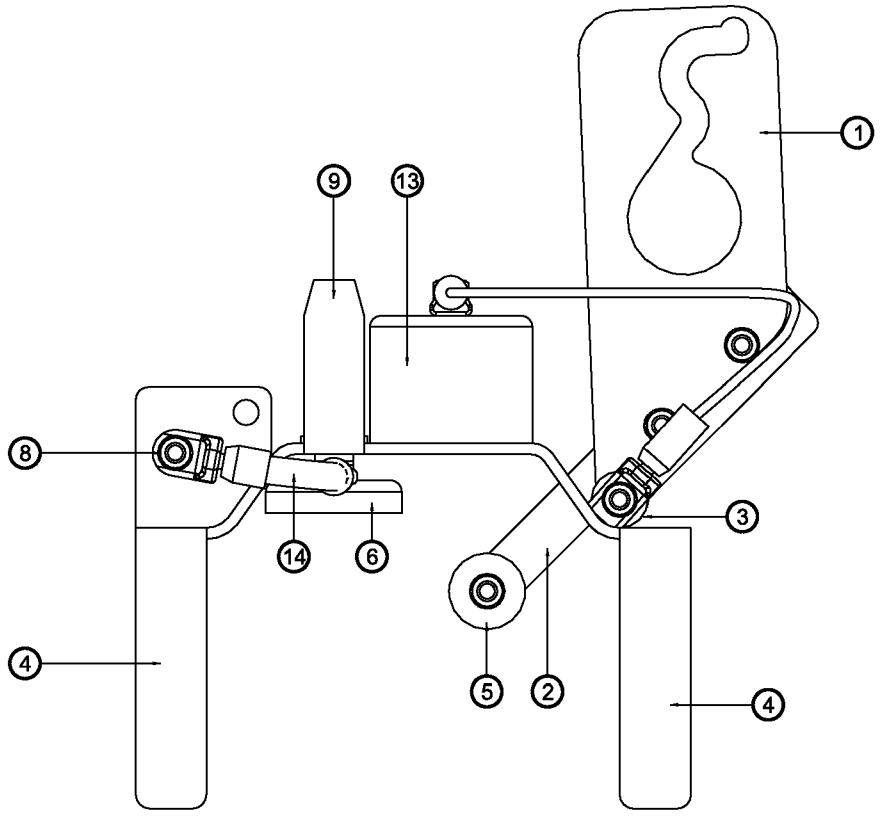

Figure 2

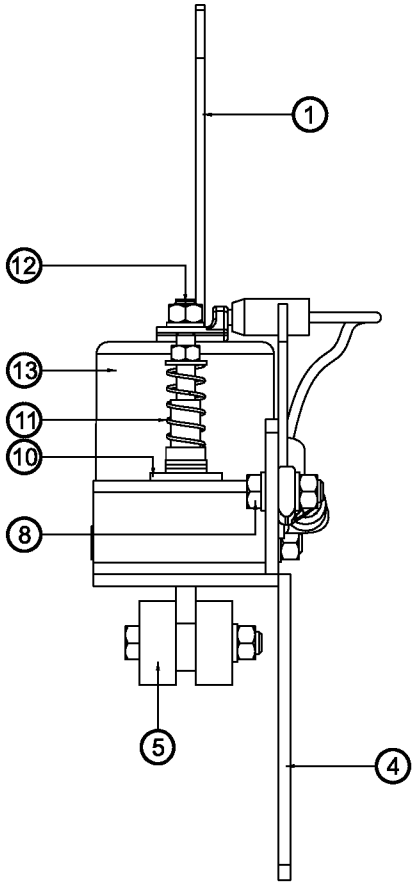

Figure 3

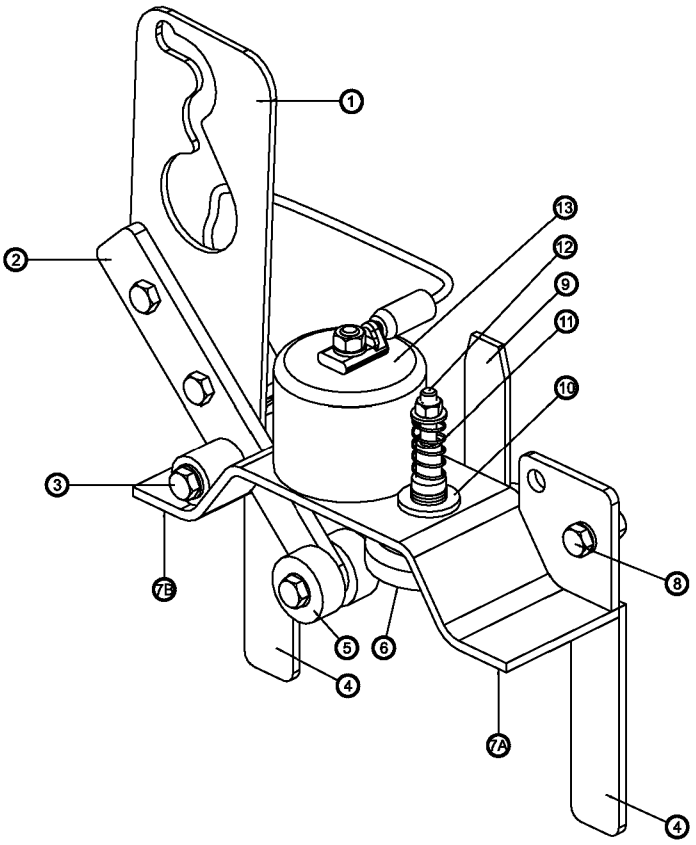

Figure 4

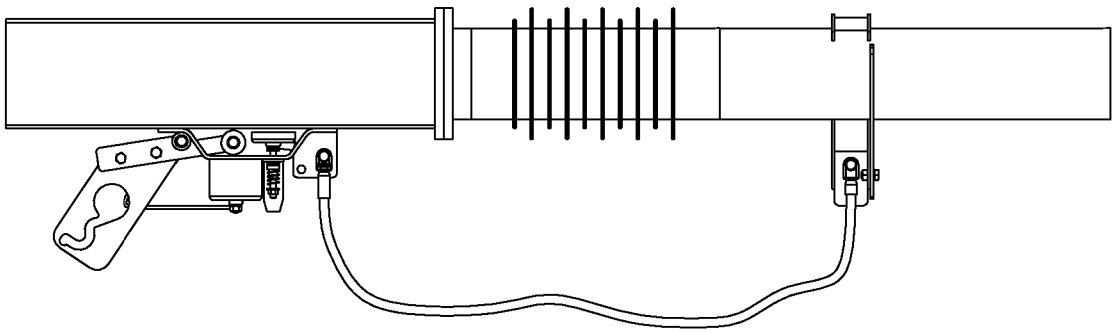

Figure 5

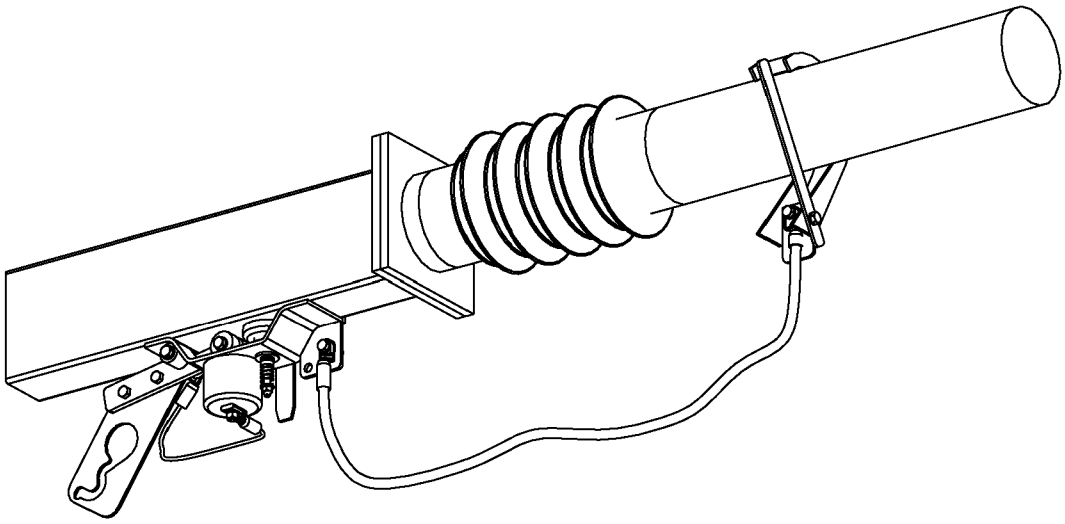

Figure 6

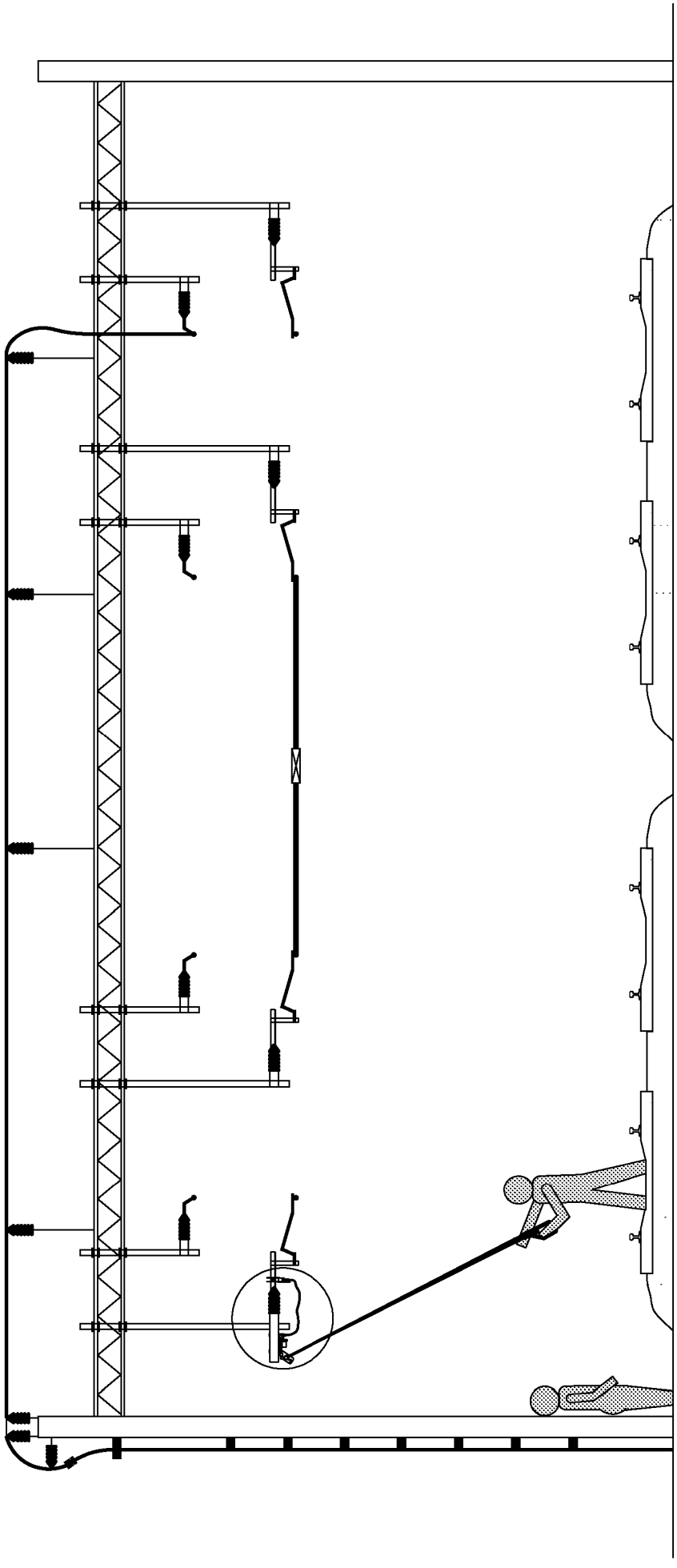

Figure 7

EARTH CLAMP FOR OLE STRUCTURES

FIELD OF THE INVENTION

Generally, the present invention relates to electromechanic arrangements for earthing overhead line structures. Particularly, however not exclusively, the invention pertains to a universal portable earth clamp.

BACKGROUND

Existing portable earthing solutions for Overhead Line Equipment (OLE) generally require the provision of structure mounted earth attachment points with associated fixings, which is usually in the form of a peg. The existing portable earthing solutions require structure mounted earth attachment points to apply a short portable earth. Such solutions are typically sprung jaw type in design. These solutions have the shortcoming of having to use earth attachment points, which can impact access and cause cancellation of work if earth attachment points are missing or broken since earth attachment points are typically only fitted 400 meters apart from each other. Since the earth attachment points are not provided at all structures this limits the overhead line structures where portable earths can be applied.

Hence, there is a need for a more universal type earth clamp solution that evades the use of earth attachment points and allows for associated safety, time and cost benefits be realised whilst optimising the time available to undertake work within very constrained railway infrastructure access windows.

SUMMARY OF THE INVENTION

The objective of the embodiments of the present invention is to at least alleviate one or more of the aforementioned drawbacks evident in the prior art arrangements. The objective is generally achieved with an arrangement and method in accordance with the claim set.

The present invention provides an earth clamp especially usable for OLE structures that offer a suitable surface of ferromagnetic material. One ex-

ample of an application of the present invention is when a single earth or multiple earths are required at an OLE structure where there are no dedicated or specific earth attachment point pegs for the application of conventional earth clamps. Another example includes a situation where the earth attachment point pegs are damaged or missing preventing the application of conventional short portable earths. Some other applications include where long portable earths have been typically used. Some further applications include where a visible earth is required to be applied at a site of work to an OLE structure.

Benefits of the present invention comprise providing a short portable earth option that can be used on a number of overhead line structures having a suitable surface of ferromagnetic material without a requirement for earth attachment points to be fitted. Further, the present invention provides an alternative option to the use of long portable earths in certain cases thus offering a direct safety benefit due to the risks associated with long portable earths. Further, the present invention provides a short portable earth option that can be utilised in the case of broken or missing earth attachment points. Further, the present invention enables an optimised approach to earthing and the use of a single additional earth at an overhead line structure. Further, the present invention enables a visible earth to be applied at a site of work to an OLE structure to prove the equipment has been made dead. Further, the present invention is compatible with use of existing live working poles and associated dispensing/retrieval adaptors.

In accordance with one aspect of the present invention an earth clamp for overhead line structures, comprising:

- a clamp frame comprising a curvilinear profile, having a flat contact point at each end of the profile and a middle part at different height than each contact point at each end of the profile,
- a magnetic part arranged to the clamp frame for magnetically attaching the frame against a surface, said magnetic part being situated towards the middle of the frame profile,
    - wherein the magnetic part is arranged to move in relation to the frame between the level of the contact points and above the level defined by the contact points to allow the earth clamp to be attached to a structure facilitating mechanical

and electrical connection thereof with the overhead line structure through the magnetic part and the contact points, and

- comprising means to move the magnetic part at least away from the level of the contact points so that the magnetic part may attach to a structure on level with the contact points and that the magnetic part may be moved away from the level of the contact points by counteracting the magnetic force exerted to a structure.

In accordance with an embodiment of the present invention the earth clamp comprising mechanical actuation lever for moving the magnetic part at least away from the structure when the earth clamp is attached to a structure may be used with a dispensing head.

In accordance with an embodiment of the present invention the earth clamp wherein the mechanical actuation lever for moving the magnetic part at least away from the structure when the earth clamp is attached to a structure may be used with an existing type of dispensing head.

In accordance with an embodiment of the present invention the earth clamp comprises a spring connected with the magnetic part to facilitate counterforce to the magnetic part moving against a structure.

In accordance with an embodiment of the present invention the earth clamp wherein connection between the magnet and the spring assembly is electrically insulated from the clamp frame.

In accordance with an embodiment of the present invention the magnetic part is electrically bonded to the clamp frame via a flexible braid connection.

In accordance with an embodiment of the present invention the earth clamp frame incorporates two guides that aid correct positioning and application of the clamp frame at height with the use of a live working pole.

In accordance with an embodiment of the present invention the earth clamp comprises a permanently attached protective cover applied over the magnet that allows safe handling and storage when not in use.

In accordance with an embodiment of the present invention the earth clamp comprises a removable cover for the magnetic part.

In accordance with an aspect of the present invention a portable earth arrangement comprising the earth clamp arrangement of claim 1 and a line end connected thereto.

As briefly reviewed hereinbefore, the utility of the different aspects of the present invention arises from a plurality of issues depending on each particular embodiment.

The expression "a number of" may herein refer to any positive integer starting from one (1). The expression "a plurality of" may refer to any positive integer starting from two (2), respectively.

Different embodiments of the present invention are also disclosed in the attached dependent claims.

BRIEF DESCRIPTION OF THE RELATED DRAWINGS

Next, some exemplary embodiments of the present invention are reviewed more closely with reference to the attached drawings, wherein

Fig. 1 illustrates a front view of an embodiment of the earth clamp,
Fig. 2 illustrates a rear view of an embodiment of the earth clamp,
Fig. 3 illustrates a side view of an embodiment of the earth clamp,
Fig. 4 illustrates an isometric view of an embodiment of the earth clamp,
Fig. 5 illustrates a view wherein an embodiment of the earth clamp is attached to an overhead line structure, and
Fig. 6 illustrates a view wherein an embodiment of the earth clamp is attached to an overhead line structure,
Fig. 7 illustrates a general view of the earth clamp in use.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Figures 1-4 illustrate main aspects of the earth clamp.

The earth clamp in accordance with the illustrated embodiment comprises the following features.

(1) Retrieval bracket
(2) Release mechanism arm
(3) Release mechanism hinge point
(4) Guide
(5) Release mechanism roller
(6) Magnet
(7A) Clamp frame front contact point
(7B) Clamp frame rear contact point
(8) Earth cable connection terminal
(9) Application lug
(10) Insulation
(11) Spring
(12) Connection bolt
(13) Magnet cap stow cup
(14) Earth cable

The earth clamp comprises at least a clamp frame comprising a curvilinear profile, having a flat contact point (7A, 7B) at each end of the profile and a middle part at different height than each contact point (7A, 7B) at each end of the profile.

The earth clamp further comprises a magnetic part, such as a magnet (6), arranged to the clamp frame for magnetically attaching the frame against a surface, said magnetic part being situated towards the middle of the frame profile. The magnet (6) is arranged to move in relation to the frame between the level of the contact points (7A, 7B) and above the level defined by the contact points (7A, 7B) to allow the earth clamp to be attached to a structure facilitating mechanical and electrical connection thereof with the overhead line structure through the magnetic part and the contact points. The earth clamp also comprises means, such as a mechanical actuation lever formed by a retrieval bracket (1), release mechanism arm (2), a release mechanism hinge point (3) and release mechanism roller (5), to

move the magnet (6) at least away from the level of the contact points (7A, 7B). This way the magnet (6) may move against and attach to a ferromagnetic structure on level with the contact points attaching the earth clamp to the structure and the magnet (6) may also be moved away from connection by operation of the bracket (1) counteracting the magnetic force exerted to a structure and hence detaching the earth clamp from the structure. A protective cover, such as a magnet cap stow cup (13), may be used over the magnet that allows safe handling and storage when not in use. The protective cover may be permanently fixed or removable. The magnet (6) may be connected with a spring (11) via insulation (10) at the frame to help counteract the magnetic force exerted by the magnet (6). The insulation (10) is used to electrically insulate the magnet and the spring assembly from the clamp frame. As illustrated, the magnet (6) may be electrically bonded to the clamp frame via a flexible braid connection.

The earth clamp may further comprise guides (4) for easier operation and attachment of the earth clamp to an OLE structure. Such guides (4) are beneficial since the earth clamp is operated by a live working pole from a distance away and at height. Further, the earth clamp may comprise an application lug (9) or similar structure for hoisting the earth clamp with a live working pole at height.

The earth clamp further comprises an earth cable connection terminal (8) connected via an earth cable (14) to the magnet (6) for connecting the earth clamp with a line end.

Although not illustrated the earth clamp may comprise a housing or a removable cover

The earth clamp further comprises a connection means for connecting a line end with a line to the earth clamp.

The earth clamp is particularly suitable railway applications and related environments including on 25 kV AC, 12 kA rated systems.

Figures 5-6 illustrate the earth clamp attached to an OLE. Therein the earth clamp is shown to be attached to flat surface of ferromagnetic material. The earth clamp is shown to be connected to a line end, which may

comprise a conventional line end clamp operable at height by a live working pole the earth clamp and line end essentially constituting a portable earth. As illustrated, the live part is separated by the insulator from the rest of the OLE structure such as the mast to which the earth clamp may be connected. The cable connection between the line end clamp and the earth clamp may be kept substantially short.

Figure 7 illustrates an example setting of the earth clamp in use. In this application an overhead line equipment structure for railways is shown for which the operator uses the earth clamp. The operator may use a conventional live working pole with suitable dispensing and retrieval adaptors, such as a dispensing head or other operating sockets, to attach and detach the earth clamp at height and at a preferred location having a surface of ferromagnetic material. The operation is convenient since placing the earth clamp at a certain part is simple since only a sufficiently flat ferromagnetic surface is needed. Due to the magnetic force the earth clamp attaches automatically to a ferromagnetic surface and removal is also simple since the magnetic force can be easily counteracted via the mechanical actuation lever, which the operator can operate with the live working pole. As can be seen from the figure 7 the earth clamp provides for a visible earth which can be applied at a site of work to prove the overhead line equipment has been made dead. Since the earth clamp may be attached on any substantially flat ferromagnetic surface the earthing can be done at height avoiding the need for a long portable earth.

The scope of the invention is determined by the attached claims together with the equivalents thereof. The skilled persons will again appreciate the fact that the disclosed embodiments were constructed for illustrative purposes only, and the innovative fulcrum reviewed herein will cover further embodiments, embodiment combinations, variations and equivalents that better suit each particular use case of the invention.

Claims

1. An earth clamp for overhead line structures, comprising

- a clamp frame comprising a curvilinear profile, having a flat contact point at each end of the profile and a middle part at different height than each contact point at each end of the profile,
- a magnetic part arranged to the clamp frame for magnetically attaching the frame against a surface, said magnetic part being situated towards the middle of the frame profile,
    - wherein the magnetic part is arranged to move in relation to the frame between the level of the contact points and above the level defined by the contact points to allow the earth clamp to be attached to a structure facilitating mechanical and electrical connection thereof with the overhead line structure through the magnetic part and the contact points, and
    - comprising means to move the magnetic part at least away from the level of the contact points so that the magnetic part may attach to a structure on level with the contact points and that the magnetic part may be moved away from the level of the contact points by counteracting the magnetic force exerted to a structure.

2. The arrangement of claim 1 wherein the earth clamp comprising mechanical actuation lever for moving the magnetic part in a direction away from a structure when the earth clamp is attached to the structure.

3. The arrangement of any preceding claim wherein the mechanical actuation lever for moving the magnetic part at least away from the structure when the earth clamp is attached to a structure may be used with a dispensing head.

4. The arrangement of any preceding claim wherein the earth clamp comprises a spring connected with the magnetic part to facilitate counterforce to the magnetic part moving against a structure.

5. The arrangement of any preceding claim wherein the connection between the magnet and the spring assembly is electrically insulated from the clamp frame.

6. The arrangement of any preceding claim wherein the magnetic part is electrically bonded to the clamp frame via a flexible braid connection.

7. The arrangement of any preceding claim wherein the earth clamp frame incorporates a number of guides that aid correct positioning and application of the clamp frame.

8. The arrangement of any preceding claim wherein the earth clamp comprises a permanently attached protective cover applied over the magnet that allows safe handling and storage when not in use.

9. The arrangement of any preceding claim wherein the earth clamp comprises a removable cover for the magnetic part.

10. A portable earth comprising the earth clamp arrangement of claim 1 and a line end connected thereto.

Intellectual Property Office

Application No:	GB2203745.1	**Examiner:**	Dr Harry Proud
Claims searched:	1-10	**Date of search:**	18 August 2022

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
A	-	CN 113991330 A (STATE GRID CORP) See the whole document.
A	-	CN 213905630 U (STATE GRID CORP) See figure 2 and related portions of the description.
A	-	CN 210723399 U (WU) See the whole document.
A	-	JP 2017117588 A (CHUGOKU ELECTRIC POWER) See the whole document.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

H01R; H02G

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC, Patent Fulltext

International Classification:

Subclass	Subgroup	Valid From
H02G	0007/22	01/01/2006
H01R	0011/14	01/01/2006
H02G	0007/05	01/01/2006
H02G	0007/20	01/01/2006