A tag line insulator 2 is fitted on a tag line 54 between an operator or rigger 56 and a load 50 being lifted by a crane 52 to electrically insulate the rigger 56, so that in the case of the crane 52 being struck by lightning or touching an overhead electric cable the rigger 56 will not be electrocuted. The insulator 2 has a body (12, fig 2) with a number of ribs (72,74, fig 2) to help prevent water and dirt forming a path for electric current flow over the insulator 2. An electronic module (24, fig 3) may be provided to allow the insulator 2 to be tested for its insulating properties. An LED display may be provided to provide information regarding this. A clock may be provided to display how long the insulator 2 has been in use.

Fig 1
TAG LINE INSULATOR

Field of the Invention

The present invention relates to a tag line insulator, and in particular to a tag line insulator for interposition between a load supported by a lifting device and a rigger, so as to electrically isolate the rigger from the load.

Background

Where heavy loads are lifted by cranes or other similar mobile lifting apparatus, a particular danger exists from overhead power lines. If a part of a crane contacts a power line, a worker who is in electrical contact with the load, such as a rigger who may be controlling the lateral movement of the load, for example by means of ropes or tag lines, may be in danger of severe electrocution as current passes to earth. This is because the rope or tag line will become conductive if for example the rope becomes wet. A contact with a power line may be known as an electrical strike. Amongst fatalities in crane-related accidents, such electrocutions amount to a significant proportion of total fatalities. Accidents of this nature are known to give rise to many serious injuries each year.

Another problem arises where cranes or similar lifting apparatus are operated near radio frequency (RF) transmission sources, for example, radar or radio transmission towers. The crane may act as an antenna such that the RF energy creates an electromotive potential in the crane. Such a potential may cause injury to a worker who is in electrical contact with the crane. Such an injury may be a non-fatal shock, which may produce an RF burn. Although usually non-fatal, such RF shocks are still considered to be disadvantageous.

It has been previously proposed to incorporate a device to insulate a load from a lifting apparatus in the form of a device which is interposed into a loaded line.
Reference is made to UK patent number GB2274899B, granted to the applicant. This document describes an insulator unit which is interposed in a load transmission path between a lifting apparatus and a suspended load.

However, a load insulator interposed between the crane and the load would not give protection to a rigger where a power line is contacted by a load, the load suspended from an insulator, in the case where a tag line is made conductive because it is wet or contaminated by conductive substances such as mud, the rigger is in electrical contact with the power line. This contact is likely to result in the rigger being electrocuted. Thus, such a load insulator does not provide protection from electrocution to a rigger where a power line is contacted by any component hanging below the load insulator of the lifting apparatus.

Embodiments of the present invention aim to address the above problem.

**Summary of invention**

According to one aspect of the present invention, there is provided a tag line insulator for interposition into a tag line, said tag line being attached to a load and for cooperation with a rigger, said tag line insulator comprising: a first end for attachment to a load; a second end for attachment to a tag line; an insulator means arranged between the first and second ends to prevent conduction of electricity through the tag line insulator.

According to a second aspect of the present invention, there is provided the use of a tag line insulator in a tag line, wherein said tag line is attached to a load and said tag line insulator is electrically insulating.

**Brief description of the drawings**
Embodyments of the invention are described, by way of example only, with reference to the following drawings in which:

Figure 1 illustrates an embodiment of the present invention in use;
Figure 2 is a view of a first embodiment of the invention; and
Figure 3 shows schematically an electronic testing and monitoring system.

Detailed description of the preferred embodiments

Embodiments of the present invention may provide a tag line insulator which minimizes or eliminates the flow of current over the outside of the tag line insulator, thereby forcing most or all of the current to flow through the inside thereof. In addition, the exterior of the tag line insulator is completely covered with a water-proof seal to prevent entry of water or moisture into the interior of the tag line insulator.

In embodiments of the present invention, the tag line insulator may have an elongated body extending between and coupled to opposite end lugs. The body may have an electrically insulating and water-proof finish in the form of plastic or similar material. The result is an exterior having increased electrical resistance, which forces any current produced by exposure to high voltages to flow through the inside of the tag line insulator.

According to embodiments of the present invention, the tag line insulator may be of integral, one-piece construction that may comprise plastic or other appropriate material. One preferred material is polyurethane.

According to an alternative embodiment of the present invention, the elongated body of the tag line insulator is configured so as to have a plurality of surrounding ribs or sheds, which function to increase a creepage distance on an outside surface thereof. Selected ones of the ribs are larger and extend further from the body than the intervening ribs, and function to shield the smaller intervening ribs from rain and also to prevent the formation of a water coating over the entire outer surface of the body. In addition, the larger ribs function to prevent the formation of a coating of dirt over
the entire outer surface of the body if the tag line insulator is placed on the ground. Reduction in water and dirt coatings on the outside of the tag line insulator greatly reduces the conductivity of the outside surface of the tag line insulator, which causes any current to flow through the inside of the tag line insulator instead.

Figure 1 illustrates an embodiment of the present invention in use. A load 50 is suspended from a lifting apparatus 52. In figure 1 lifting apparatus 52 is a mobile crane. Tag line insulators 2 are interposed between the load 50 and tag lines 54, electrically insulating the tag lines 54 from the load 50. In particular, the riggers 56 are also electrically isolated from the lifting apparatus 52 and the load 50, such that if an electrical strike were to occur wherein a part of the load 50 or any part of the lifting apparatus 52 comes into contact with a power line, the rigger 56 is protected from electrocution.

The tag line insulators 54 additionally protect the riggers 56 from any electromotive potential induced in the lifting apparatus 52 or load 50 by the presence of radio frequency electromagnetic radiation.

A creepage distance is the shortest path between two electrically insulated conductive parts measured along the surface of an insulator placed therebetween. An adequate creepage distance protects against tracking, a process that produces a partially conducting path of localized deterioration on the surface of an insulator material as a result of the electric discharges on or close to an insulator surface. The voltage required to bring about insulator failure due to tracking is reduced by:

- the presence of humidity in the atmosphere in contact with the insulator device;
- the presence of contaminants on the surface of the insulator;
- the exposure of the insulator surface to corrosive chemicals; and
- the altitude at which the equipment is operated.

Figure 2 shows an embodiment of tag line insulator according to the present invention. A body portion 12 of the tag line insulator 30 is provided with a plurality of
ribs or sheds 72 and 74 which extend around the circumference thereof and increase the creepage distance. The smaller ribs 74 are of like size and tend to prevent formation of a continuous layer of water, such as from rain, or a continuous layer of dirt or other contamination, either of which forms a conductive path which encourages current flow over the outside of rather than through the inside of the tag line insulator. Nevertheless, if sufficient water forms, or if the tag line insulator is exposed to a substantial amount of dirt or contamination, such as by being laid on the ground, then there may still be a tendency for current to flow over the outside of the tag line insulator.

In accordance with the invention, the tag line insulator 30 is provided with at least one rib 72 which is substantially larger in diameter than the body 12 so as to extend outwardly therefrom. The at least one rib 72 protects an at least one smaller rib 74 from contamination by rain water. The at least one rib 72 also protects an at least one smaller rib 74 from contamination by mud and other contaminants if the tag line insulator 30 is placed on dirty ground.

The at least one rib of the tag line insulator 30 may be substantially square, substantially rounded or substantially polygonal in cross section. The at least one rib may alternatively have a cross section of any shape.

Typically the force to be supported by the tag line will be equivalent to the weight of the order of a few hundred pounds. Connecting lugs 14 & 42 are for attachment to a tag line suspended by a lifting apparatus and to a tag line, respectively. Thus, the tag line insulator is interposed in a tag line path between the suspended load and a rigger who is holding the tag line.

The tag line insulator is solid plastic or similar material. The material is electrically insulating at voltages which might occur should an electrical power line be contacted (typically, 110 volts to 56,000 volts). The material must also have reasonable strength properties. A suitable material is a composite of a plastics material such as synthetic polyurethane.
The tag line insulator would normally be used attached to a load with a tag line freely suspended therefrom. Alternatively, the tag line insulator may be attached between two lengths of tag line, a first length of tag line is attached between the load and the tag line insulator, the second length of tag line having one end attached to the tag line insulator and having the other end free for cooperation with a rigger. A rigger may cooperate with the tag line by holding it. A rigger may further cooperate with a tag line by holding it and applying a force to it by pulling on it.

The afore mentioned tag line insulator is intended to be a basic design to perform the role of providing an electrically insulating connection between a rigger coupled by a tag line to a suspended load.

In the further alternative embodiments of the present invention that follow, additional features are added to this basic device for increased functionality.

In an alternative embodiment of the present invention, the outer casing of the tag line insulator is difficult to hold by hand. This is realized by the presence of ribs on the surface of the tag line insulator. Sloping surfaces also make the tag line insulator difficult to hold by hand. This reduces the likelihood of the rigger holding the tag line insulator instead of the rope attached to it. It is disadvantageous for the rigger to hold the tag line insulator because this reduces the effectiveness of the tag line insulator by reducing the length of insulation between the rigger and the tag line.

In alternative embodiments of the present invention, the tag line insulator 2 is provided with associated electronics which serve three primary functions: first, to provide monitoring of the insulating properties; secondly, to allow for recording of incidences of electrical strikes; and thirdly, to provide a lifetime expiry indication to limit the period of use of the tag line insulator 2 for safety reasons.

Figure 3 shows a schematic of a circuit means for providing these functions. An electronic module 24 is connected to opposite ends of the tag line insulator via
connections 26. The opposite ends of the tag line insulator may comprise the regions of the tag line insulator around each connecting lug 14 and 42. The module 24 includes means for applying a voltage 36 across the tag line insulator, and means for measuring the current leakage 38, which will be indicative of the resistance and hence insulating condition of the tag line insulator. The apparatus may be arranged such that the insulating condition is continuously monitored. Alternatively, the insulating condition is only monitored prior to use: a test mode may be initiated prior to use by manually closing switch S1. When the tag line insulator condition is monitored, the tag line insulator resistance is measured; if this is above a predetermined value, an "OK" signal is output to a display 28, indicating to a user that the tag line insulator 2 is safe for use. The display 28 may be an LED or LCD display or sounder 48. The sounder 48 may be adapted to sound if the insulating condition of the tag line insulator is faulty.

The electronic module 24 also includes voltage measuring means and a microprocessor having memory means arranged to record the electrical history of the device, and in particular whether a device has been subjected to an electrical strike, detected by the voltage measuring means, and if so recording the day and time of the event. Data ports 30 allow for external communication with the microprocessor to retrieve the device history. Clock means are provided to indicate via the display 28 when the device has been used for a predetermined period of time, or for a predetermined number of times. It may be arranged that the display or sounder 48 merely indicates to a user that the device must be returned to the manufacturers for recalibration and testing purposes, for example annually, or alternatively it might be arranged that the device is made inoperative. This provides an important safety function.

The applicant hereby discloses in isolation each individual feature described herein and any combination of two or more such features, to the extent that such features or combinations are capable of being carried out based on the present specification as a whole in the light of the common general knowledge of a person skilled in the art, irrespective of whether such features or combinations of features solve any problems
disclosed herein, and without limitation to the scope of the claims. The applicant indicates that aspects of the present invention may consist of any such individual feature or combination of features. In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention.
Claims

1. A tag line insulator for interposition into a tag line, said tag line being attached to a load and for cooperation with a rigger, said tag line insulator comprising:
   a first end for attachment to a load;
   a second end for attachment to a tag line;
   an insulator means arranged between the first and second ends to prevent conduction of electricity through the tag line insulator.

2. A tag line insulator as claimed in claim 1, wherein said insulator means has an outer surface, said outer surface comprising at least one rib.

3. A tag line insulator as claimed in claim 2, wherein said outer surface is waterproof.

4. A tag line insulator as claimed in claim 2, wherein said at least one rib extends from the casing in a plane substantially perpendicular to an axis between the first and second end.

5. A tag line insulator as claimed in claim 4, wherein said tag line insulator has at least two ribs, at least one of the ribs being a large rib that extends further from the axis between the first and second end than an at least one small rib.

6. A tag line insulator as claimed in claim 5, wherein said at least one large rib protects at least one small rib from contamination.

7. A tag line insulator as claimed in claim 2, wherein said at least one rib is adapted to increase a creepage distance between the first and second end on the outer surface of the tag line insulator.

8. A tag line insulator as claimed in claim 2, wherein said at least one rib is adapted to reduce the electrical conductivity of the tag line insulator.
9. A tag line insulator as claimed in claim 2, wherein said at least one rib is substantially square in cross section.

10. A tag line insulator as claimed in claim 2, wherein said at least one rib is substantially rounded in cross section.

11. A tag line insulator as claimed in claim 2, wherein said at least one rib is substantially polygonal in cross section.

12. A tag line insulator as claimed in any preceding claim, wherein said insulator means comprises a plastic material.

13. A tag line insulator as claimed in any preceding claim, wherein said insulator means comprises a composite of plastic materials.

14. A tag line insulator as claimed in any preceding claim, wherein said insulator means comprises synthetic polyurethane.

15. A tag line insulator as claimed in any preceding claim, wherein said first end, said second end and said insulator means are parts of a single item.

16. A tag line insulator unit according to any preceding claim further comprising a microprocessor and a warning means adapted to output a warning signal if the detected resistance drops below a predetermined value.

17. A tag line insulator according to claim 16, wherein the warning means comprises a display, and a switch means for actuation by a user prior to use of the tag line insulator unit to actuate a test of the resistance of the insulator means, such that a warning signal is displayed on the display means if the resistance is below the predetermined value.
18. A tag line insulator as claimed in any preceding claim, further comprising a microprocessor means, a clock, and a display means, said tag line insulator arranged to output a warning signal to said display means after a predetermined period of time has elapsed since initial use of the tag line insulator.

19. A tag line insulator as claimed in any preceding claim, further comprising a voltage detection means, a microprocessor means, and a memory means, said tag line insulator adapted to record electrical strikes detected by the voltage detection means.

20. A tag line insulator as claimed in claim 18, further comprising a clock, said tag line insulator arranged to record the date and time of incidences of electrical strikes.

21. A tag line insulator substantially as hereinbefore described with reference to the accompanying drawings.

22. The use of a tag line insulator in a tag line, wherein said tag line is attached to a load and said tag line insulator is electrically insulating.
Application No: GB0404856.7
Claims searched: 1-22
Examiner: Joe Mitchell
Date of search: 29 June 2005

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

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Field of Search:

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

B8H; H2C; H2H

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

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