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2007234483 12 Nov 2007

Abstract

An extra low voltage lighting system including an engine, and a power generation means mounted on a mobile chassis, and a plurality of independently operable lighting arrays each including multiple lighting fittings associated with the power generation means with the power generation means providing current to the lighting arrays at extra low voltage.

2007234483 04 Dec 2008

A LIGHTING SYSTEM

Field of the Invention.

The present invention relates to lighting systems and particularly mobile lighting systems.

Background Art.

Lighting systems in general are known, and mobile lighting units are also known.

The uses and applications of high-intensity mobile lighting units are numerous and diverse. Mobile lighting systems are often used in confined or temporary working environments, such as in the mining field. Other examples include night lighting of athletic fields, primary and background lighting for motion pictures, lighting for shows and concerts, and lighting in times of emergencies.

A good and functionally useful mobile lighting system must be designed to be strong in the following areas: compactness; efficacy (maximum usable light per watt of power consumed); daylight quality; photometric versatility: high efficiency; lightweight; ruggedness; ease of operation; compatibility (no noise or static or too much heat on the subject or equipment); and economical cost of operation and maintenance balanced against other systems.

Prior portable, mobile lighting systems have utilized traditional lamps, such as incandescent, mercury vapour and any number of gas-arcing lamps, to achieve this purpose. Problems with traditional lamps is that their low intensity level requires a large number of lamps be used, their efficacy and efficiency is not optimal, and problems exist in maintaining daylight-type illumination, as well as dark, uneven spots on the playing field.

Recently, high-wattage metal halide lamps have been developed which significantly improve upon some of the deficiencies of standard lamps. However, these metal halide lamps, commonly referred to as HMI lamps (which stands for hydrargyrum (mercury), medium, and iodides) have problems which have prevented their prior use in mobile lighting systems.

A primary problem with the use of HMI lamps, in any system, whether stationary or mobile, is that when used with reflectors, such an intense heat is generated by the focused light that it may cause the lamp itself to break from heat fatigue.

2007234483 04 Dec 2008

Additionally, problems may be encountered with the mounting of the HMI bulbs. They are comparatively fragile. This problem is amplified considerably when using HMI lamps in portable mobile units where they are subjected to much more jostling and shock.

Still further, and problems are typically encountered with the conventional mobile lighting systems in relation to power consumption. For example conventional mobile lighting systems operate at either 240 V or 415 V and as such fall within the category of "low-voltage apparatus". This can create problems for the maintenance or repair of the lighting systems particularly when the lighting system use in a remote area.

Further problems may be created if "high-voltage" lights are used such as gas discharge lamps. High-voltage refers to voltage levels exceeding 1000 V AC or 1500 V DC. These lamps generally require a short impulse or high-voltage current to ignite or strike the lamp. The igniter apparatus can be internal or external to the lamp and when provided externally. This can subject the lamp wiring that would normally be rated at between 600 to 1000 V, to extremely high stresses, and even though the current is applied for only a short time, this can introduce another point of failure.

It will be clearly understood that, if a prior art publication is referred to herein, this reference does not constitute an admission that the publication forms part of the common general knowledge in the art in Australia or in any other country.

Summary of the Invention.

The present invention is directed to a lighting system, which may at least partially overcome at least one of the abovementioned disadvantages or provide the consumer with a useful or commercial choice.

With the foregoing in view, the present invention in one form, resides broadly in an extra low voltage lighting system including an engine, and a power generation means mounted on a mobile chassis, and a plurality of independently operable lighting arrays each including multiple lighting fittings associated with the power generation means with the power generation means providing current to the lighting arrays at extra low voltage.

2007234483 12 Nov 2007

The use of extra-low voltage (ELV) in an electrical circuit is one of several means to provide protection against electrical shock. The International Electrotechnical Commission and its member organizations define an ELV circuit as one in which the electrical potential of any conductor against earth (ground) is not more than either 50 volts RMS (70 volts peak) for alternating current, or 120 volts for direct current.

The main advantages of extra low voltage are safety, reliability and practicality. In contrast to the more common 240 V or 415 V conventional mobile lighting systems, extra low voltage, such as 24 V direct current is not considered a dangerous voltage and direct contact is not likely to result in injury from electric shock.

Extra low voltage supply does not attract the stringent rules and regulations associated with equipment operating and 240 V and 415 V. Although some training is required, it is generally not necessary to have a licensed electrician maintain the equipment operating at extra low voltage. Replacement, general maintenance and repairs can be carried out by machinery operators and mechanical tradespeople who are often the only skilled or semi-skilled personnel available on some construction and mining sites.

The lighting system of the present invention includes an engine, and a power generation means, the power generation means typically being a generator/alternator. Providing the engine and power generation means mounted on a chassis results in the entire system being portable.

The engine provided will typically be a combustion engine, and a diesel powered combustion engine is preferred as diesel engines are more efficient and more economical than particularly when at low-power and at engine idle. Diesel engines produce very little carbon monoxide as they burn the fuel in excess air even at full load and are typically considered to be far more reliable and long lasting than a petrol engine. Due to their lower heat losses, diesel engines have a lower risk of gradually overheating if left idling for long periods of time.

With regard to the generator/alternator, provided that the generator/alternator used is suitable for the purpose, any type or configuration may be used.

2007234483 12 Nov 2007

The generator/alternator will typically be associated with an electrical system for the generation and conveyance of an electrical current from the generator/alternator to the lighting arrays. The system will typically include a number of generators/alternators, normally with a generator/alternator provided for each lighting array.

The current produced will typically be provided as direct as opposed to alternating current. There may be a suitable control system or current levelling system provided in order to produce a consistent level of current.

One or more electrical storage means may be provided as a part of the system. The electrical storage means may be used when the engine is taken offline for maintenance, or in instances where the fuel for the engine is refilled. Alternatively, the electrical storage means may be the main power supply for the lights with the power generation means recharging the electrical storage means. The provision of the preferred electrical storage means, namely batteries, may also double in function as a counterbalance or ballast to offset the weight of an extendable boom if provided.

The system also includes a plurality of independently operable lighting arrays each including multiple lighting fittings.

According to a particularly preferred embodiment, four independently operable lighting arrays, each including 9, 100 to 150 W, 24 V light fittings are provided.

Each array can include halogen, xenon or LED lamps to suit the particular application. Each array may include a combination of different types of lamps or a single type of lamp depending upon the application. As can be seen, the particular types of lamps are operable at low voltage without loss of illumination.

It is preferred at the lighting system of the present invention is a portable lighting system. Portability will increase the functional uses to which the lighting system can be put. Preferably, the chassis to which the engine and power generation means is mounted will be provided with one or more wheels or the like. The chassis may be provided with the steering means and a separate drive engine in order to render the chassis movable without a vehicle, or alternatively, a tow hitch or similar may be provided.

The chassis may preferably have at least one, and typically a number of stabiliser assemblies. The stabiliser assemblies will normally be provided in the form

of deployable stabiliser legs with ground bearing members. Following the location of the apparatus in the desired location, the stabiliser legs may be deployed in order to embrace the system against movement, particularly in instances where the apparatus is to remain for an extended period of time.

In addition, the lighting arrays will typically be mounted to the chassis as well. Normally, the lighting arrays will be mounted to the chassis using a deployable mounting arm attached to the chassis and the lighting arrays. The mounting arm may be a substantially unitary arm member or maybe a multipart arm to allow increased functionality. The arm may be mounted to the chassis on a rotating base to allow the arm and the lighting arrays to be directed in different directions once the apparatus has been properly located.

Preferably, an upper section of the boom that supports the lighting arrays is rotationable relative to the boom or to the chassis. This allows the base of the boom to be fixed allowing the boom to remain oriented in a single direction relative to the chassis. This means that the counterweight can remain in a single position and not require movement of the counterweight which may be difficult if the counterweight include any one or more of the drive engine, batteries, or draw bar assembly.

The arm will typically be a segmented arm formed of a number of arm members, each member pivotably attached to an adjacent member, with one arm member attached relative to the chassis and another arm attached relative to the lighting arrays. In combination with the preferred rotating base, the pivoting arm will typically provide superior flexibility in the orientation of the lighting arrays.

Each of the lighting arrays is typically independently movable relative to the mounting arm. The lighting arrays may be manually adjustable or adjustable in any manner.

The arm will typically be extendable and retractable and between a use condition and a storage condition respectively. When in the stored condition, the arm will typically move the lighting arrays to a position closer to be chassis and when in the use condition, the chassis and lighting arrays will typically be separated by a distance. The arm can be of any suitable length, with larger chassis having longer arms. When the arm is deployed, particularly in angles other than vertical, a counterweight may be provided on the chassis.

Brief Description of the Drawings.

Various embodiments of the invention will be described with reference to the following drawings, in which:

Figure 1 is a schematic side elevation view of a lighting system according to a preferred embodiment of the present invention.

Detailed Description of the Preferred Embodiment.

According to a particularly preferred embodiment of the present invention, a lighting system is provided.

The preferred embodiment illustrated is a mobile extra low voltage lighting apparatus including an engine, and a power generation means mounted on a mobile chassis, with a plurality of independently operable lighting arrays each including multiple lighting means associated with the power generation means with the power generation means providing current to the lighting arrays at extra low voltage.

The preferred embodiment system of the present invention has the following design specifications:

Engine

16 hp, water cooled, three cylinder diesel engine.

Generators/Alternators

Four by 24 V, 100 Amp, continuous rated generators. Each generator is driven by twin V-belts from a common drive pulley. The alternators will normally be radially mounted at approximately 90° separation about an axis of the drive engine to minimise or more evenly distribute the lateral load on the drive engine main/flywheel bearings.

Light Fittings

Four independently operable lighting arrays, each including 9, 100 to 150 W, 24 V light fittings. Each array can be a combination of halogen, xenon or LED lamps to suit the particular application.

Chassis

The illustrated preferred embodiment is trailer 10 mounted using standard 16 inch or 15 inch four-wheel-drive wheels 13. The trailer 10 includes a hydraulically powered, cantilever type construction, extendable arm 11, extendable to a length (height) of approximately 7 m. The trailer also includes a number of a

hydraulically actuated, deployable stabiliser legs 12 at approximately 90° separation about the trailer.

The extendable arm 11 can be tilted at various angles between the vertical to horizontal, in order for example to extend the lighting arrays 15 over a highwall 16, but when oriented horizontally, the weight of the extendable arm 11 is counterbalanced by a trailer mounted counterweight 14. The extendable arm will also normally have a mechanical interlocking system in order to temporarily lock the position of the arm. The mechanical interlock is preferably provided to ensure that the boom cannot be moved from a substantially vertical position without the engagement of the counterweight, and similarly the counterweight cannot be removed without the boom being returned to either the substantially vertical condition or a collapsed condition.

Operation Features

The extra low voltage provided by the 24 V operation of the present system includes all of the operational features/advantages of the more conventional 240 V or 415 V lighting systems. The 24 V operation also has additional benefits in terms of safety, reliability and practicality. Further, extra low voltage supply does not attract the stringent rules, regulations, or the protection devices associated with equipment operating and 240 V and 415 V. Although some training is required, it is generally not necessary to have a licensed electrician maintain the equipment operating at extra low voltage. Replacement, general maintenance and repairs can be carried out by machinery operators and mechanical tradespeople who are often the only skilled or semi-skilled personnel available on some construction and mining sites.

Mining and civil construction sites are often located in remote areas and skilled technicians required to install and maintain 240 V or 415 V equipment are not always immediately available. Further, these people may have to drive in or fly in to the site resulting in increased expenses, more down time and lost production.

The design of the preferred embodiment of the present invention also has redundancy features not found on the 240 V or 415 V equipment. The provision of four independently operable lighting arrays, each including 9, 100 to 150 W, 24 V light fittings means that the loss of one light fitting results in the loss of approximately 2.8% of the lighting output of the system. The conventional configurations presently

in use, include 4, 1000 W or 1500 W fittings and the loss of one of those fittings results in the loss of 25% of the lighting output.

Alternative configurations utilize 4 X 1000 W, 6 X 1000 W, 4 X 2000 W, or 2 X 1000 W light fittings, and failure of a single light fitting will lead to a different percentage loss of illumination.

The provision of multiple alternators, independently driven and independently supplying each of the four arrays of nine light fittings, allows the loss of a single alternator to result in only a loss of 25% of the lighting output. In contrast, the conventional designs have one 240 V or 415 V alternator and obviously the loss of this alternator would result in a 100% loss of output.

Lamps and replacement light fittings and V-belts are often available from a variety of outlets such as auto accessory shops and petrol stations. Although the fittings and lamps may not necessarily be of the same output parameters and style, a variety of replacement fittings and lamps can be utilised to suit the purpose until original equipment manufacturer (OEM) fittings are available.

Environmental Benefits

The design of the preferred embodiment incorporates a diesel engine which will meet the most recent emission and noise standards. The preferred embodiment also incorporates integral bunding configured to contain 125% of the on board fluids (diesel and hydraulic oil) in the event of tank rupture. The engine and the generator compartment will be manufactured with acoustic insulation to keep noise levels to a minimum. Indeed one of the main benefits would be that this equipment can then be used in areas where there is an interface with pedestrians or other vehicles/machinery as well as closed areas where noise tends to reverberate.

Safety

Extra low voltage such as 24 V direct current is not considered a dangerous voltage and direct contact is not likely to result in injury from electric shock. Contact with 240 V or 415 V power supplies can result in serious injury or death. Electrical Superintendents and Engineering managers are required to have stringent regulations and procedures in place to control and protect fixed and mobile equipment that can generate what is classed as low-voltage, namely 240 V or 415 V. Extra low voltage, particularly direct current, is a safe and attractive alternative to the person responsible for electrical equipment on most sites.

Maintenance

Apart from the routine maintenance of the diesel engine and chassis, the most common failure will be in the lamps. Lamps for 24 V driving lights or work lights are commonly available and are relatively inexpensive. They are also physically small and therefore a number of spare lamps can be stored on board the chassis to be changed by personnel with minimal training. In contrast, 240 V or 415 V floodlight lamps are not as commonly available and depending on the type of light fitting, are usually expensive and impractical to store on board the chassis. Most types of gas discharge lamps also require ballast which adds considerable weight and offers another point of failure.

Other Applications

A variation to the combination generator/lighting tower design of the illustrated embodiment, is to split the system into a trailer mounted central generator accompanied by a number of trailer mounted light towers fitted with between one and three light fittings. A typical application would be for the temporary lighting of road intersections and roadwork sites where a minimal amount of light is required in a number of locations for the safety of traffic. The low voltage connection cables can be safely run on temporary supports or buried in shallow depressions.

In the present specification and claims (if any), the word "comprising" and its derivatives including "comprises" and "comprise" include each of the stated integers but does not exclude the inclusion of one or more further integers.

Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, the appearance of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more combinations.

In compliance with the statute, the invention has been described in language more or less specific to structural or methodical features. It is to be understood that the invention is not limited to specific features shown or described since the means herein described comprises preferred forms of putting the invention into effect. The invention is, therefore, claimed in any of its forms or modifications

2007234483 12 Nov 2007

within the proper scope of the appended claims (if any) appropriately interpreted by those skilled in the art.

2007234483 12 Nov 2007

Claims

1. An extra low voltage lighting system including an engine, and a power generation means mounted on a mobile chassis, and a plurality of independently operable lighting arrays each including multiple lighting fittings associated with the power generation means with the power generation means providing current to the lighting arrays at extra low voltage.
2. An extra low voltage lighting system according to claim 1 including at least one extra low voltage in which the electrical potential of any conductor against earth (ground) is not more than either 50 volts RMS for alternating current, or 120 volts for direct current.
3. An extra low voltage lighting system according to claim 1 or claim 2 wherein the power generation means included at least one generator/alternator.
4. An extra low voltage lighting system according to any one of the preceding claims wherein the engine provided is a diesel combustion engine.
5. An extra low voltage lighting system according to claim 3 wherein the at least one generator/alternator is associated with an electrical system for the generation and conveyance of an electrical current from the at least one generator/alternator to the plurality of lighting arrays.
6. An extra low voltage lighting system according to any one of the preceding claims wherein including a plurality of generators/alternators, with a generator/alternator provided for each lighting array.
7. An extra low voltage lighting system according to any one of the preceding claims wherein direct current is used.
8. An extra low voltage lighting system according to any one of the preceding claims wherein a control system is provided in order to provide a consistent level of current to the lighting arrays.
9. An extra low voltage lighting system according to any one of the preceding claims including one or more electrical storage means provided to at least temporarily store power generated by the power generation means.
10. An extra low voltage lighting system according to any one of the preceding claims including a plurality of independently operable lighting arrays, each including a plurality of 100 to 150 W, 24 V light fittings.

2007234483 12 Nov 2007

11. An extra low voltage lighting system according to any one of the preceding claims wherein each array includes lighting fittings chosen from the group including halogen, xenon or LED lamps.

12. An extra low voltage lighting system according to any one of the preceding claims wherein the chassis is provided with a number of stabiliser assemblies.

13. An extra low voltage lighting system according to claim 12 wherein the stabiliser assemblies are deployable stabiliser legs with ground bearing members.

14. An extra low voltage lighting system according to any one of the preceding claims wherein, the lighting arrays are mounted relative to the chassis using a deployable mounting arm attached to the chassis and the lighting arrays.

15. An extra low voltage lighting system according to claim 14 wherein the mounting arm is a multipart arm to allow increased functionality.

16. An extra low voltage lighting system according to claim 15 wherein the mounting arm is mounted to the chassis on a rotating base to allow the arm and the lighting arrays to be directed in different directions once properly located.

17. An extra low voltage lighting system according to claim 14 wherein the deployable arm includes a plurality of arm members, each member pivotably attached to an adjacent member, with one arm member attached relative to the chassis and another arm attached relative to the lighting arrays.

18. An extra low voltage lighting system according to any one of claims 14 to 17 wherein each of the lighting arrays is independently movable relative to the mounting arm.

19. An extra low voltage lighting system according to any one of claims 14 to 18 wherein the arm will typically be extendable and retractable and between a use condition and a storage condition respectively.

20. An extra low voltage lighting system according to claim 14 wherein when the arm is deployed at angles other than vertical, a counterweight is provided on the chassis.

21. An extra low voltage lighting system according to claim 20 wherein an interlock is provided to ensure that the deployable arm cannot be moved from a substantially vertical position without the engagement of the counterweight,

and similarly the counterweight cannot be disengaged without the deployable arm being returned to either the substantially vertical condition or a collapsed condition.

22. An extra low voltage lighting system substantially as described herein with reference to the accompanying drawings.

2007234483 12 Nov 2007