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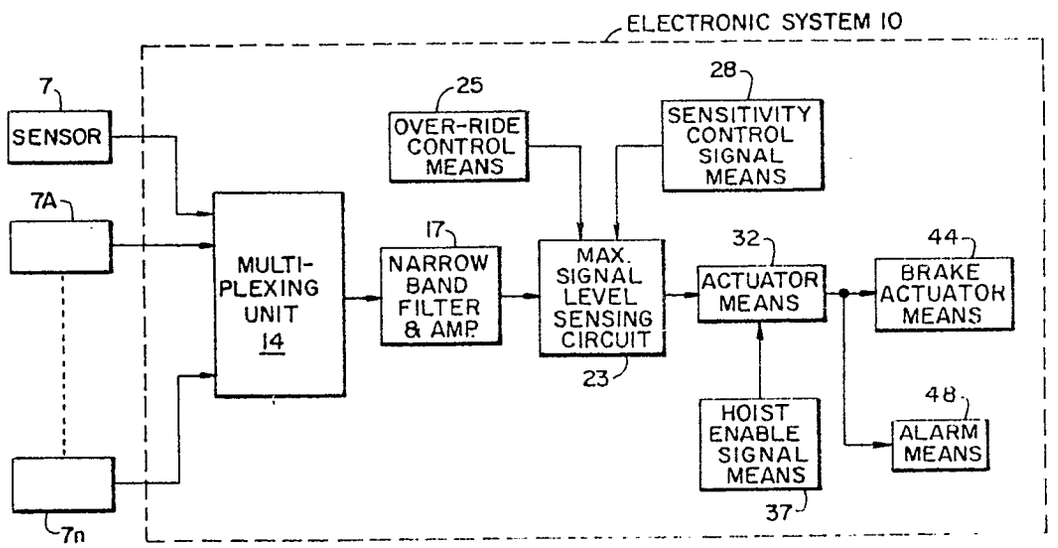
(54) Safety system and method.

(57) The safety system is for use with apparatus having a movable conductive member (3) such as a derrick which might be elevated near overhead electric power lines. The derrick carries at least one electric field sensor (7) providing a signal representative of the strength of the electric field. An electronic system (23,32,44,48) is responsive to the signal to disable further actuation of the derrick, to brake its movement and to provide an alarm to the operator.

FIG. 2.



EP 0 324 217 A1

SAFETY SYSTEM AND METHOD

The present invention relates to safety systems and methods and, more particularly, to a safety system and method for use with electrically conductive members when used in the presence of power lines.

According to the invention there is provided a safety system and method for use with apparatus having a conductive member, where said apparatus changes the attitude and/or altitude of the conductive member during the operation of the apparatus, and includes at least one sensor mounted on the conductive member. The sensor is adapted to sense an electric field and provide a signal representative of the strength of the sensed electric field. Further changing of the attitude and/or altitude of the conductive member is prevented in response to the signal from the sensor when the electric field strength is greater than a predetermined safe value.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic representation of a truck-mounted derrick having a safety system constructed in accordance with the present invention.

Figure 2 is a block diagram of the safety system shown in Figure 1.

Figures 3A to 3D illustrate schematically different types of sensors which may be used with the present invention.

There have been fatal accidents in oil fields where drilling and well service personnel have raised derricks and masts of drilling and workover rigs into electrical power lines. This safety problem is not unique to the oil industry but is also applicable to other industries where devices such as cherry pickers are used by power companies and tree surgeons, or construction cranes and other conductive masts or devices, accidentally come into contact with power lines. Nor is the present invention restricted to devices mounted on trucks but is also applicable to a situation where a conductive member may be raised in the presence of a power line. A conductive member for purposes of the present invention is any member whose structure is conductive or whose structure is non-conductive but has other means of conduction such as wires and cables. The present invention provides a method of preventing this type of accident and at the same time warning the operator that the rig is in a hazardous situation.

Referring now to Figure 1, there is shown a typical service conductive member such as a derrick 3 mounted on a truck 1 and which is raised to an operating position by conventional means. Located at strategic points on the derrick 3 are one or more sensors represented by sensors 7, 7A, and 7n, which are electrically connected to an electronic system 10. As the derrick 3 is raised during normal operation and it approaches an electric power line, sensors 7 to 7n will have voltages induced by the electric field created by the power lines and provides signals to the electronic system 10. When the electric field exceeds a predetermined strength the electronic system 10 will stop the raising of derrick 3 and sound an alarm audibly and visibly as hereinafter explained.

With reference to Figure 2, sensors 7 to 7n in the presence of an electric field each provide a signal to a multiplexing unit 14 of electronic system 10 which multiplexes the signals at approximately 1 second samples. The multiplexed signal is then provided to a narrow band filter and amplifier 17 which filters the multiplexed signal so that only a signal having a frequency substantially corresponding to a frequency of the power on the power line is provided to a maximum signal level circuit 23. Circuit 23 is of a conventional type and its detail is not necessary to an understanding of the present invention. Maximum signal level circuit 23 may be overridden by an override signal from an override signal means 25 which may be a simple on/off switch receiving a direct current voltage for application to the maximum signal sensing circuit 23.

A sensitivity control signal means 28 provides a signal to maximum signal level circuit 23 for adjusting the sensitivity of maximum signal level circuit 23. Maximum signal level sensing circuit 23 provides a brake signal to actuator means 32, which is part of the conventional raising means, and which also receives a hoist enable signal from hoist enable signal means 37 when derrick 3 is being raised. The brake signal from actuator means 32 is provided to brake actuator means 44 and to alarm means 48. Alarm means 48 may provide either an audio alarm, a visual alarm or both.

In operation, an operator wishing to raise the derrick 3 causes the hoist enable signal means 37 to provide a hoist enable signal to actuator means 32 which raises derrick 3. When derrick 3 approaches a power line, the electric field around that power line causes sensors 7 to 7n to provide signals to multiplexing unit 14 having amplitudes corresponding to the intensity of the electric field. Multiplexing unit 14 provides a multiplexed signal to narrow band filter and amplifier 17 which in turn provides the filtered signal to maximum signal level circuit 23. Any one of the sensors 7 to 7n providing a signal that is greater than a predetermined safety

level causes maximum signal level circuit 23 to provide a signal to actuator means 32 disabling actuator means 32 and causing actuator means 32 to provide the brake signal to brake actuator means 44 and alarm means 48. Brake actuator means 44 stops the movement of derrick 3, while alarm means 48 sounds an alarm that derrick 3 has approached a power line. Should any one of the sensors 7 to 7n provide such a signal and the operator in his judgment can see that he can safely raise derrick 3 in the presence of the power line, he may then utilize override control means 25 to provide an override signal to maximum signal level sensing circuit 23 which then is deactivated to allow actuator means 32 to continue to raise derrick 3. The operator would also use the override signal when lowering derrick 3 after the derrick has entered a strong electric field.

Although the system of the present invention has been shown as having multiple sensors, a single sensor appropriately placed on derrick 3 may also be utilized in which case multiplexing unit 14 would not be necessary and the signal from the single sensor may be applied directly to narrow band filter and amplifier 17.

Figure 3A, 3B, 3C and 3D show different types of configurations for sensors 7, although the specific configuration of sensor 7 is not restricted to any one of four types shown, but must be a sensor which will produce a signal in the presence of an electric field that is representative of the strength of the electric field.

The present invention, as hereinbefore described is a safety system for use with a truck which utilizes a derrick or a conductive structure which is raised from one position to another position during the course of operation and which may come into contact with electric power lines and cause injury or death to the operators of such apparatus.

Claims

1. A safety system for use with apparatus having a conductive member (3), said apparatus changing the attitude and/or altitude of the conductive member during operation of the apparatus, characterized by:
a sensor (7) mounted on the conductive member (3) for sensing an electric field and providing a signal representative of the strength of the electric field, and
means (23,32,44) connected to said sensor (7) to prevent any further said changing of the attitude and/or altitude of the conductive member, in response to the signal from the sensor (7) when the sensed electric field strength is greater than a predetermined value.

2. A safety system according to Claim 1 characterized in that the sensor (7) includes at least one sensor wherein an electric field induces in the sensor a voltage whose amplitude corresponds to the strength of the electric field, and said sensor (7) provides the induced voltage as said signal.

3. A safety system according to Claim 1 or Claim 2 characterized in that the conductive member (3) has one end at a fixed position and the other end may be raised to a higher level and lowered from a higher level, and said sensor (7) is mounted on the conductive member (3) at or near the movable end of the conductive member.

4. A safety system according to Claim 3 for use with apparatus including actuator means (32) for moving the conductive member (3) to change the attitude of the conductive member in response to a hoist signal, and hoist enable means (37) connected to the actuator means (32) to provide the hoist signal to the actuator means in response to activation by an operator;
characterized in that said preventing means (23,32,44) comprises:
maximum signal level means (23) connected to the sensor (7) to provide a control signal to the actuator means (32) when the signal from the sensor exceeds a predetermined level so as to prevent the actuator means from moving the conductive member (3) and to cause the actuator means (32) to provide a brake signal, and
brake actuator means (44) responsive to the brake signal from the actuator means (32) to brake the movement of the conductive member (3) so as to prevent a further change in said attitude.

5. A safety system according to Claim 4 characterized in that said preventing means (23,32,44) further includes a filter (17) connected between the sensor (7) and the maximum signal level means (23) to filter the signal from the sensor so as to provide a signal having a frequency substantially corresponding to a frequency of the electric field.

6. A safety system according to Claim 5 further comprising alarm means (48) connected to the actuator means (32) and responsive to the brake signal for providing an alarm to the operator of the apparatus to warn him that the conductive member (3) has entered an electric field whose strength is greater than the predetermined safe value.

7. A method for safely changing the attitude and/or altitude of a conductive member in the vicinity of an electric power line characterized by the steps of:
mounting at least one sensor at or near the movable end of the conductive member, said sensor providing a signal when in the presence of an

electric field representative of the strength of the electric field, and

moving the conductive member until either it arrives at a desired attitude and/or altitude for the conductive member or the sensor provides a signal that the conductive member has entered an electric field whose strength is greater than a predetermined safe value.

8. A safety system for use with apparatus having a conductive member (3), said apparatus changing the attitude and/or altitude of the conductive member during operation of the apparatus, characterized by:

a sensor (7) mounted on the conductive member (3) for sensing an electric field and providing a signal representative of the strength of the electric field, and

alarm means (23,32,48) connected to the sensor (7) and responsive to the signal from the sensor to provide an alarm when the conductive member has entered an electric field whose strength is greater than a predetermined safe value.

FIG.1.

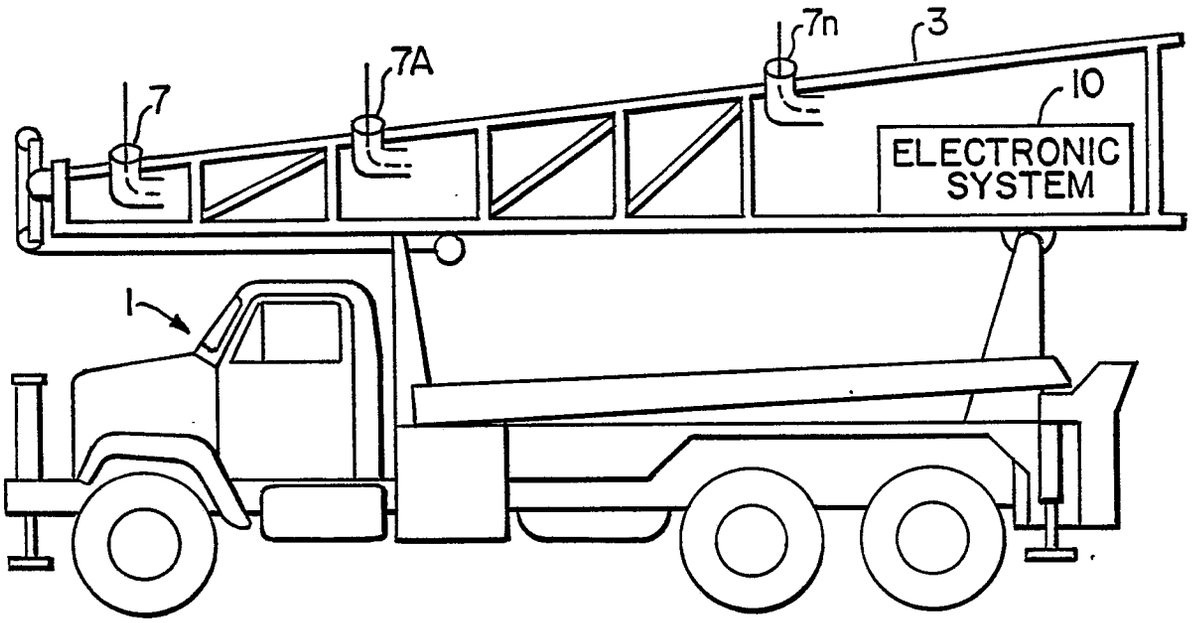


FIG.3A.

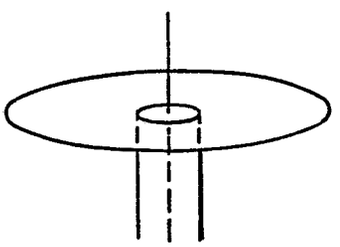


FIG.3C.

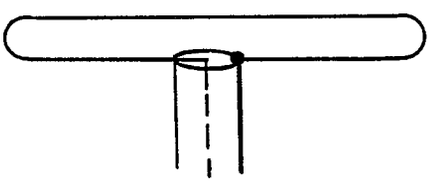


FIG.3B.

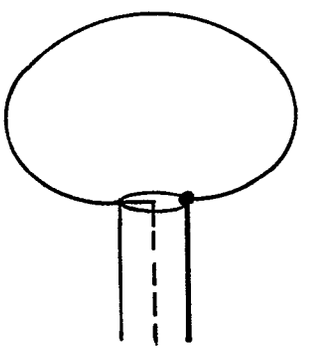
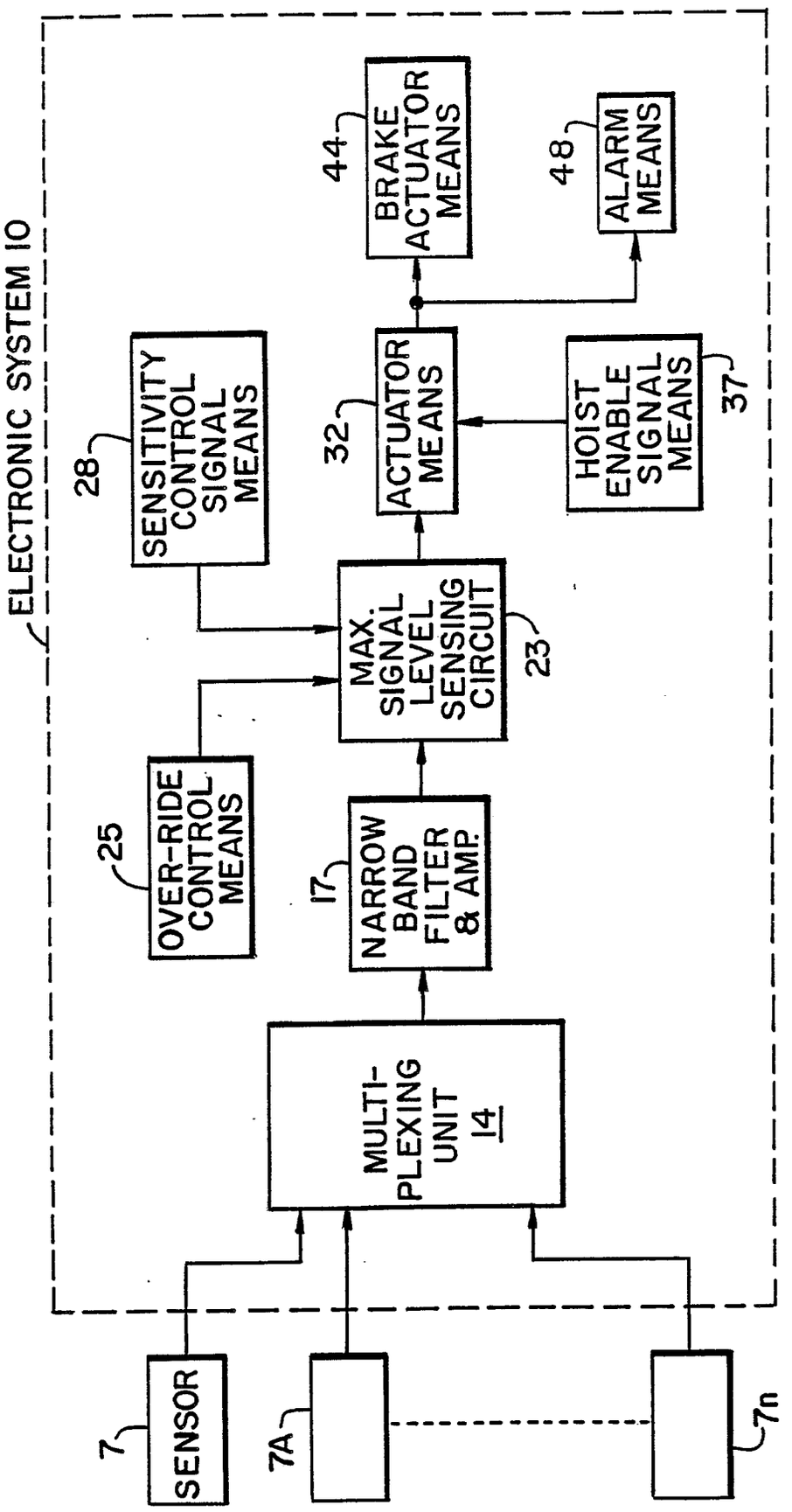


FIG.3D.

FIG. 2.


ELECTRONIC SYSTEM 10
SENSOR
7
7A
7n
MULTI-PLEXING UNIT 14
NARROW BAND FILTER & AMP.
17
OVER-RIDE CONTROL MEANS
25
SENSITIVITY CONTROL SIGNAL MEANS
28
MAX. SIGNAL LEVEL SENSING CIRCUIT
23
ACTUATOR MEANS
32
HOIST ENABLE SIGNAL MEANS
37
BRAKE ACTUATOR MEANS
44
ALARM MEANS
48

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 30 0275

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.4)
X	US-A-4 064 997 (E.R. HOLLAND) * Column 9, line 42 - column 10, line 8 *	1-8	H 02 H 5/12 B 66 C 15/06 G 01 R 19/145
X	EP-A-0 134 943 (HYDRO-QUEBEC) * Page 10, line 4 - page 12, line 9 *	1-8	
X	US-A-4 649 375 (FMC CORP.) * Column 1, line 65 - column 3, line 36 *	1-8	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

H 02 H 5/00
B 66 C 15/00
G 01 R 19/145

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12-09-1988	LIBBERECHT L.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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