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Landis et al.

[11] **3,887,254**

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[54] **ELECTRIC GROUNDING APPARATUS**

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[52] **U.S. Cl.** ..... **339/5 R**; 339/10; 339/14 L; 339/222

[51] **Int. Cl.** **H01r 39/00**

[58] **Field of Search** ..... 339/5 R, 5 RL, 5 S, 8 R, 339/8 P, 8 PB, 8 RL, 10, 14 L, 222

[56] **References Cited**

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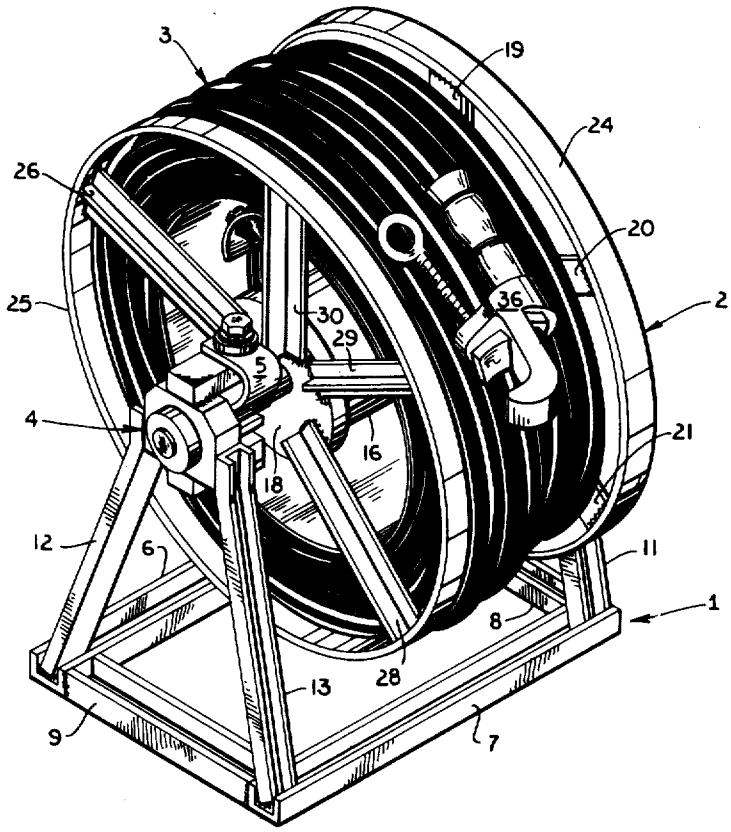
Assistant Examiner—DeWalden W. Jones
Attorney, Agent, or Firm—Walter M. Rodgers

[57] **ABSTRACT**

For electrically grounding a device such as a lineman's truck, a conductive frame is arranged to be mounted on and electrically connected with the device to be grounded and a conductive reel is rotatably mounted in bearings supported by the frame so that a flexible conductive grounding cable element electrically connected at one end to the reel and adapted to be wound thereon and having grounding means secured at its other end affords a direct ground connection through the frame, the reel and the flexible conductive means to ground. Shunt means of less impedance than the bearing means is interconnected between the reel and the frame so as to provide a shunt path around the bearings.

8 Claims, 5 Drawing Figures



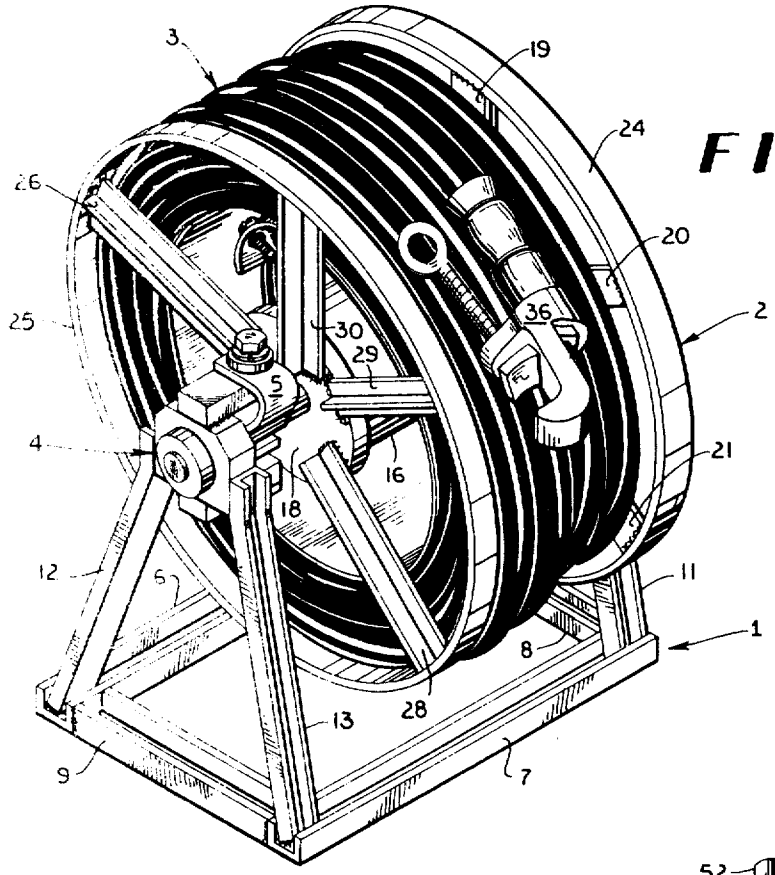


FIG 1

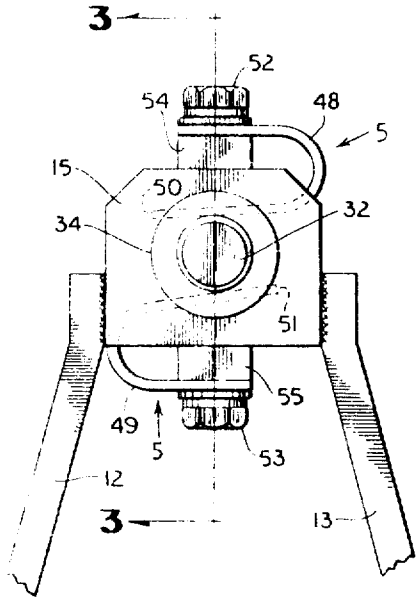


FIG 2

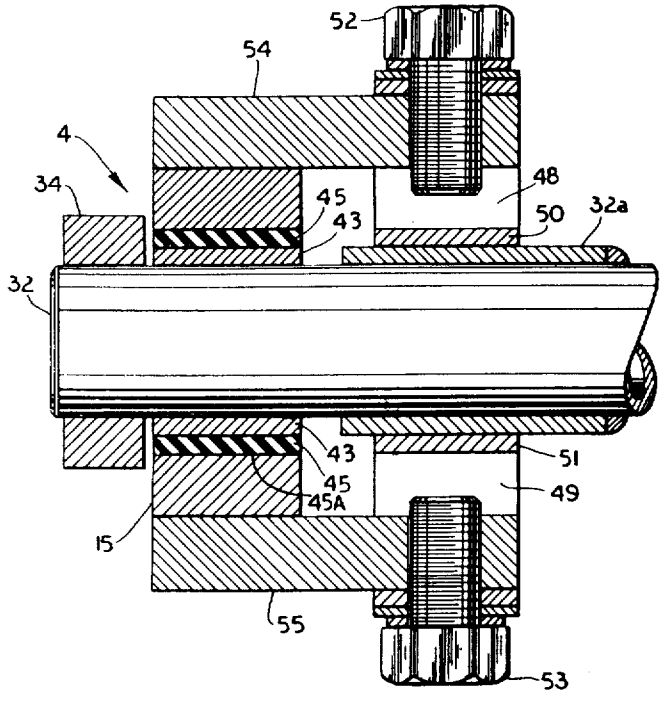


FIG 3

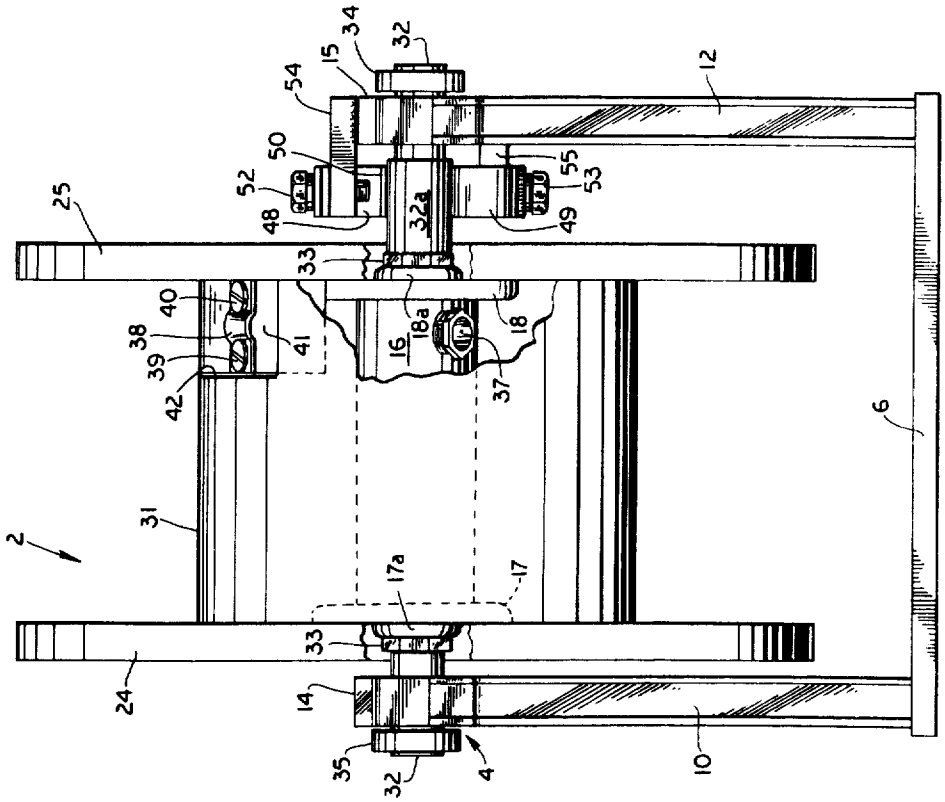

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FIG 4

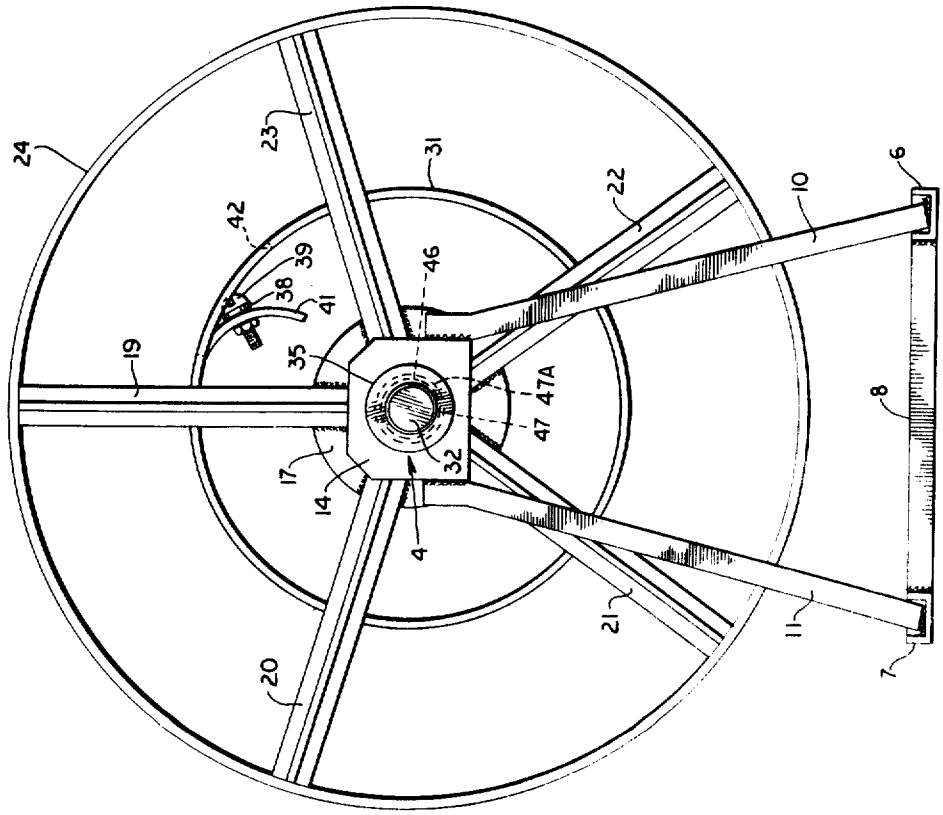
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FIG 5

ELECTRIC GROUNDING APPARATUS

Vehicles such as electric lineman's trucks frequently are parked in areas adjacent to high tension power lines and thus constitute a hazard particularly when such trucks are equipped with extensible booms mounted at one end to the truck frame and provided with a "bucket" at the other end for supporting a lineman engaged in conducting repair or maintenance operations since a bucket or its boom may accidentally contact a high tension line and thus afford a direct connection to the vehicle which is not ordinarily grounded because of its insulating tires unless special grounding means are utilized.

Conventional grounding means ordinarily constitute an elongated conductor with a clamp at each end arranged for clamping to the vehicle body at one end and to a grounded pin or other suitable grounding means at the other end. Such conventional grounding apparatus is cumbersome to maintain and to transport to the job site and of course requires special grounding procedures whereby one end is fastened to the vehicle and the other end to ground. It sometimes happens that grounding by this means is inadvertently overlooked particularly in situations wherein time is limited.

According to the present invention an elongated flexible grounding means such as a cable is wound about a conductive reel and one end of the grounding cable is secured to the reel and the reel is rotatably mounted via suitable bearing means on a conductive frame which in turn is secured to and thus in electric contact with the frame of the vehicle to be grounded. Suitable shunt means is arranged to provide a low impedance shunt path around the reel bearings. Thus by the invention convenient means are provided for transporting the flexible grounding means which inherently eliminates the necessity of affixing a grounding clamp to the vehicle to be grounded and which also eliminates the use of an excess portion of the grounding cable than that which is necessary under particular grounding conditions since only so much of the cable as is needed is reeled out prior to connecting the paid-out end of the grounding cable to a suitable grounding pin or the like.

For a better understanding of the invention reference may be had to the following detailed description taken in conjunction with the accompanying drawings in which

FIG. **1** is a perspective view of grounding apparatus constructed according to the invention;

FIG. **2** is an enlarged view of the center portion of the near side of FIG. **1**;

FIG. **3** is an enlarged cross-sectional view taken along the line designated 3—3 in FIG. **2**;

FIG. **4** is an enlarged side view of the apparatus shown in FIG. **1** with the flexible grounding cable means removed and in which

FIG. **5** is an end view of the apparatus shown in FIG. **4** as observed from the lefthand end thereof.

In the drawings the numeral **1** generally designates a conductive frame while the numeral **2** generally designates a conductive reel rotatably mounted on the frame. The numeral **3** generally designates a flexible conductive grounding cable means which is wound about the frame **2**. The numeral **4** generally designates bearing means by which the reel **2** is rotatably mounted on the frame **1**, the bearing means being provided at one end of the reel with shunt means generally designated by the numeral **5** and which constitutes a shunt path around the bearings by which the conductive reel **2** is supported on the conductive frame **1**. The frame is adapted for mounting directly to a conductive part of the vehicle to be grounded and the flexible conductive cable means **3** is then paid out by rotating the reel. The outer end of the cable is secured to ground in any suitable manner such as by a grounding clamp secured to a grounding pin driven into the ground. Of course all conductive parts of the vehicle must be bonded together or otherwise electrically interconnected.

The frame structure **1** includes longitudinal base channels **6** and **7** interconnected at their ends by transverse base channels **8** and **9**. Secured at the corners of the rectangular frame **6–9** are corner posts designated by the numerals **10, 11, 12** and **13**. An end plate **14** is secured as by welding or otherwise to the upper ends of corner posts **10** and **11** and a similar bearing plate **15** is secured as by welding or otherwise to the upper ends of corner posts **12** and **13**.

The conductive reel generally designated by the numeral **2** is rotatably supported on the frame structure generally designated by the numeral **1** and comprises inner cylindrical means **16** secured at its ends to circular plates **17** and **18**. Cylindrical means **16** is preferably welded at its ends to the circular plates **17** and **18**. As is best shown in FIG. **5**, a plurality of radially extending spoke-like elements **19, 20, 21, 22** and **23** are secured as by welding to the circular disc **17** and a circular peripheral band **24** is secured as by welding or otherwise to the outer ends of the spokes **19–23** inclusive. At the other end of the reel, a circular continuous band **25** is secured about a plurality of spokes similar to the spokes **19–23** and which are designated by the numerals **26–30**.

A cylinder designated by the numeral **31** is of larger diameter than cylindrical means **16** and is secured at its ends to the inner surfaces of the spokes **19–23** at one end and to the spokes **26–30** at the other end. Coaxially disposed with respect to the cylindrical means **16** and the outer cylinder **31** is a shaft **32** positioned axially of the reel as determined by lock nuts **33** which are threaded onto the shaft **32** and which engage bosses **17A** and **18A** on the discs **17** and **18** respectively. Shaft **32** is provided with a conductive sleeve **32A** which is secured thereabout in any suitable manner such as by a pressed fit.

For the purpose of fixing the reel in proper position with respect to the frame, end collars are secured about the extremities of the shaft **32** and these collars are designated by the numerals **34** and **35**. These collars **34** and **35** may be secured to the shaft **32** by suitable means such as by set screws not shown.

The flexible conductive cable means generally designated by the numeral **3** is provided at its outer end with a grounding clamp designated by the numeral **36**. This grounding cable means is wound about the reel generally designated by the numeral **2**. The inner end of the grounding cable **3** is secured to cylindrical means **16** by connector bolt **37** which is threadedly related in known manner with the cylindrical means **16** and constitutes a means for securing mechanically the inner end of the grounding cable **3** to cylindrical means **16** and for electrically connecting the flexible grounding cable means **3** to the cylindrical means **16** and in turn to the reel generally.

For the purpose of aiding in securing the flexible grounding cable **3** to the reel **2**, a clamping element **38**

is mounted by means of mounting screws **39** and **40** which are threadedly related with arcuate inwardly extending segment **41** struck from the cylinder **31** and forced inwardly with respect to cylinder **31** so as to provide an aperture in cylinder **31** designated by the numeral **42** for receiving the inner end portion of grounding cable means **3**.

It is apparent from the description thus far that the grounding means **3** in the form of a flexible cable is electrically connected by the connector **37** with the reel and is arranged to extend through aperture **42** and underneath the clamp **38** and thence about cylinder **31** so that rotation of the reel **2** causes the flexible grounding cable means **3** to be wound on cylinder **31** or to be paid out therefrom as is desired.

The bearing means generally designated by the numeral **4** at the near end of the grounding apparatus as viewed in FIG. 1 comprises a sleeve designated by the numeral **43** which is disposed within insulating sleeve **45** and formed in plate **15**. Insulating sleeve **45** is mounted within aperture **45A**. At the other end of the machine bearing sleeve **46** is surrounded by insulating sleeve **47** which is mounted within aperture **47A**. Bearing sleeves **43** and **46** constitute low friction means for rotatably supporting the shaft **32**. If desired the insulating sleeves **45** and **47** may be omitted if the bearings **43** and **46** are formed of plastic, fiber, or from metallic particles which are sintered into a cylindrical porous mass impregnated with lubricating fluid having desired lubricating and insulating properties. Since it is undesirable to allow large fault currents such as may be accommodated by the apparatus of this invention to flow through the bearings, these bearing elements are constructed so as to be characterized by substantial impedance so as to inhibit the flow of electric current therethrough either by the use of insulating sleeves such as **45** and **47** or by the use of bearings formed at least in part of insulating material.

For the purpose of affording a shunt circuit around the bearings and between the conductive reel **2** and the conductive frame **1**, suitable magnetic shunt means are provided according to a feature of this invention and may comprise a pair of conductive loops designated by the numerals **48** and **49**. The ends **50** and **51** of the loops **48** and **49** slidably engage the conductive sleeve **32A** and the opposite ends of loops **48** and **49** are secured by bolts **52** and **53** respectively to support arms **54** and **55** which in turn are secured as by welding or otherwise to the support plate **15** which forms a part of the frame structure **1**. Thus as is apparent particularly from FIGS. **2** and **3** magnetic loops **48** amd **49** constitute a shunt circuit around the bearings and thus afford a low impedance connection between the frame **1** and the reel **2** which diverts current from the bearings. If the current is of large magnitude, the magnetic effect tending to urge the ends **50** and **51** of the loops **48** and **49** into high pressure engagement with the conductive sleeve **32A** tends to establish and maintain a low impedance circuit between these contacting elements. Preferably the magnetic loops **48** and **49** as well as the conductive sleeve **32A** are formed of hard drawn copper and if desired may be coated on their contacting surfaces with silver.

According to the invention, improved grounding apparatus is provided which eliminates the necessity for securing a grounding clamp to a vehicle frame. Furthermore it is apparent that by the invention, it is necessary to pay out only that portion of the flexible grounding cable **3** as may be required for a particular circumstance thereby eliminating the clutter and general disarray which sometimes is caused by a grounding cable of excessive length. Since the invention greatly facilitates grounding operations, it enhances the safety of maintenance and repair personnel because it virtually eliminates inadvertent failure to ground a vehicle before initiating hazardous maintenance and repair operations.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Electric grounding apparatus comprising a conductive frame arranged for connection to a device to be grounded, a conductive reel rotatably mounted on said frame, flexible conductive grounding means electrically connected with and adapted to be wound on said reel, bearing means rotatably mounting said reel on said frame, and shunt means of substantially less impedance than said bearing means and electrically interconnecting said reel and said frame, said shunt means comprising magnetic means secured to and electrically connected with said frame and forming a slidable contact with said reel.

2. Grounding apparatus according to claim **1** wherein the contact pressure between said reel and said shunt means varies in accordance with variations in the magnitude of current through said shunt means.

3. Grounding apparatus according to claim **1** wherein said bearing means comprises a bearing element interposed between said frame and said reel and formed of porous material impregnated with a fluid having insulating and lubricating properties.

4. Grounding apparatus according to claim **1** wherein said reel includes a shaft rotatably supported by said bearing means and slidably contacting said shunt means.

5. Grounding apparatus according to claim **4** wherein said reel includes conductive cylindrical means mounted on said shaft and to which one end of said flexible conductive means is electrically connected, and radially extending spider means at each end of said cylindrical means and forming therewith a spool on which said flexible conductor means is wound and from which said conductor means is paid out.

6. Grounding apparatus according to claim **5** wherein said spider includes a cylinder of larger diameter than said conductive cylindrical means and disposed thereabout and wherein an aperture is formed in said cylinder for receiving said flexible conductive grounding means.

7. Grounding apparatus according to claim **6** wherein clamping means is secured to said cylinder and arranged to grip said flexible conductive means.

8. Electric grounding apparatus comprising a conductive frame arranged for connection to a device to be grounded, a conductive reel rotatably mounted on said frame, flexible conductive grounding means electrically connected with and adapted to be wound on said reel, bearing means rotatably mounting said reel on said frame, and shunt means of substantially less impedance than said bearing means and electrically interconnecting said reel and said frame, said bearing means including low friction impedance means tending to inhibit the flow of electric current therethrough.

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