March 1, 1960 B. D. BROWN 2,927,170

CABLE LIMIT SWITCH

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Fig-1

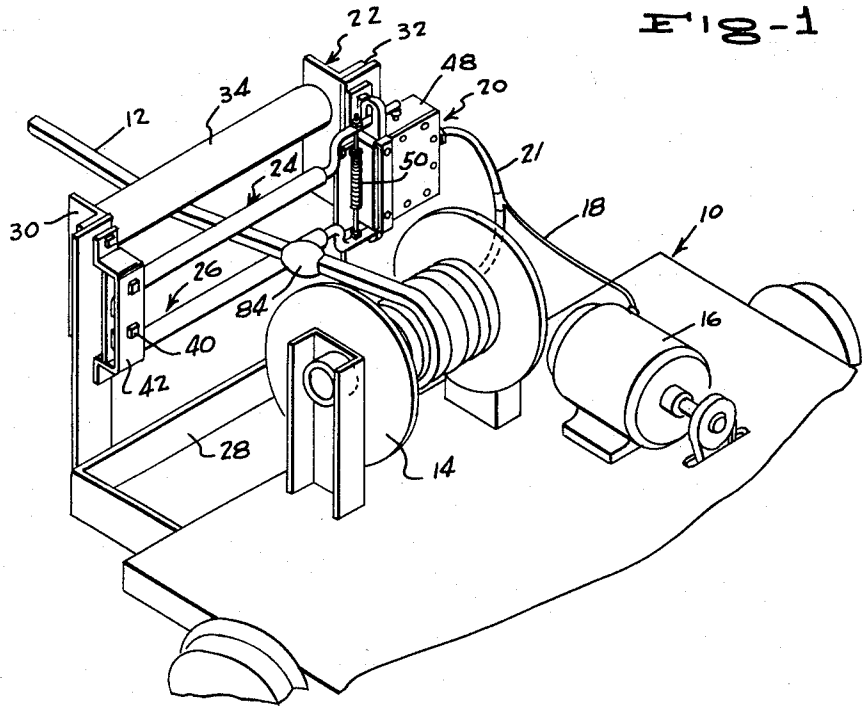
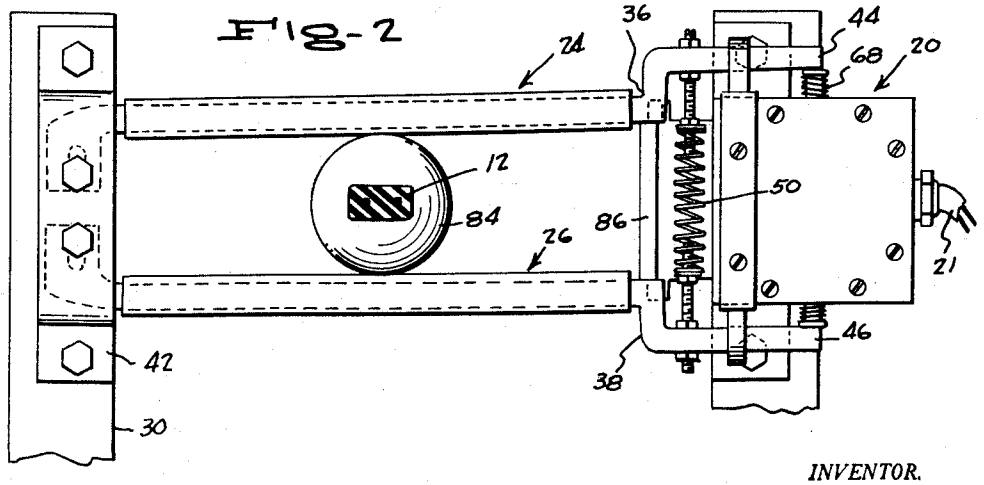


Fig-2



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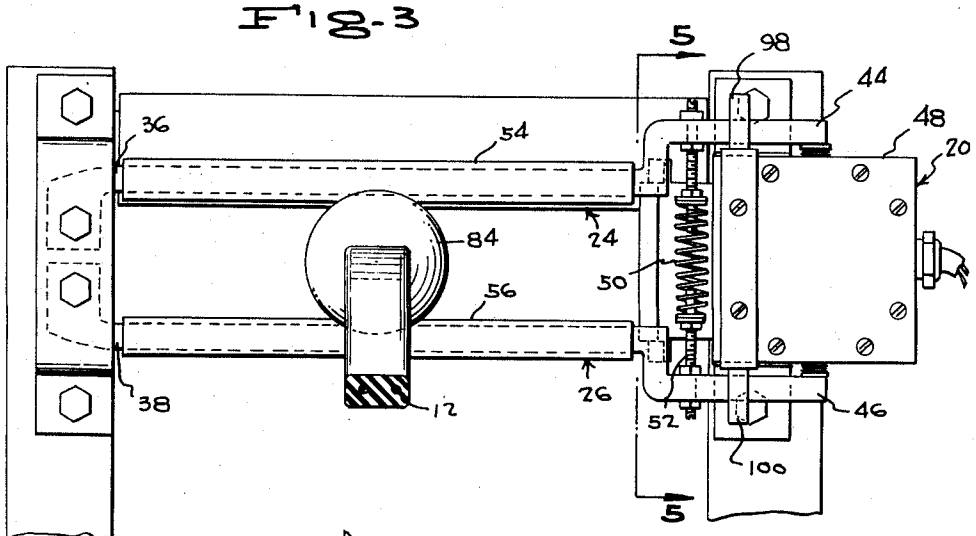
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CABLE LIMIT SWITCH

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FIG-3



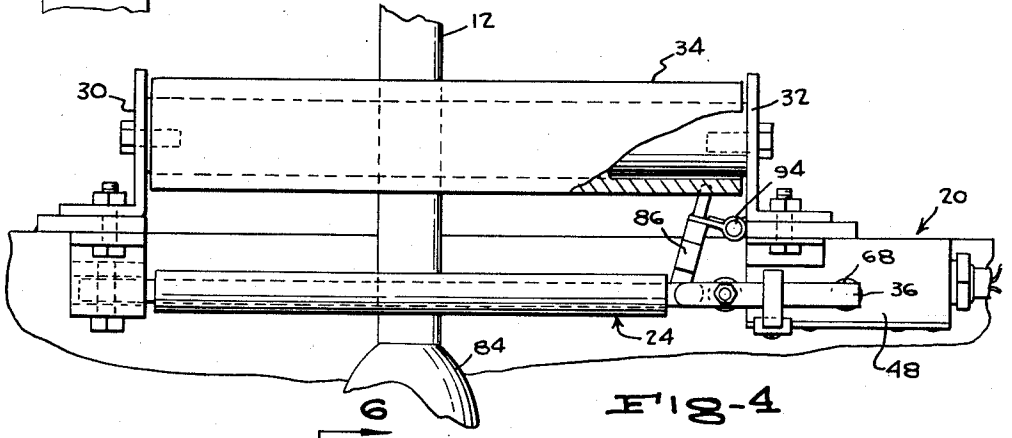


FIG-4

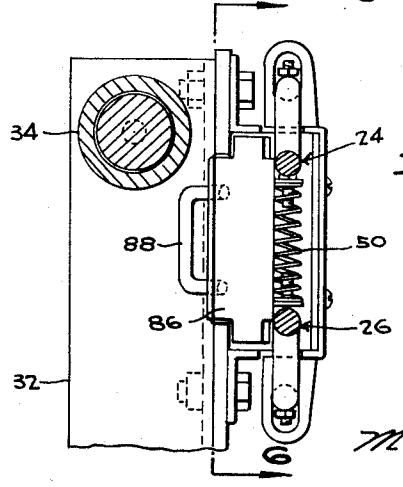


FIG-5

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CABLE LIMIT SWITCH

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FIG-6

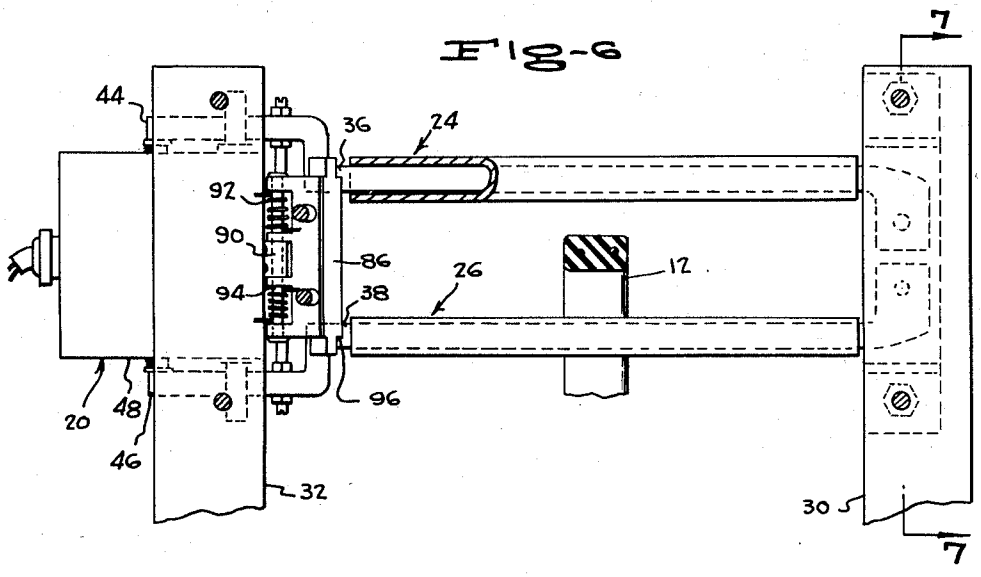


FIG-7

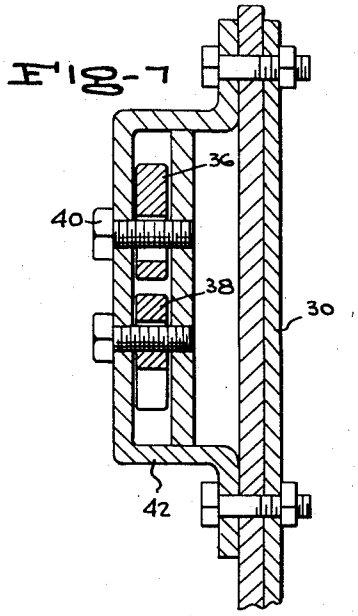
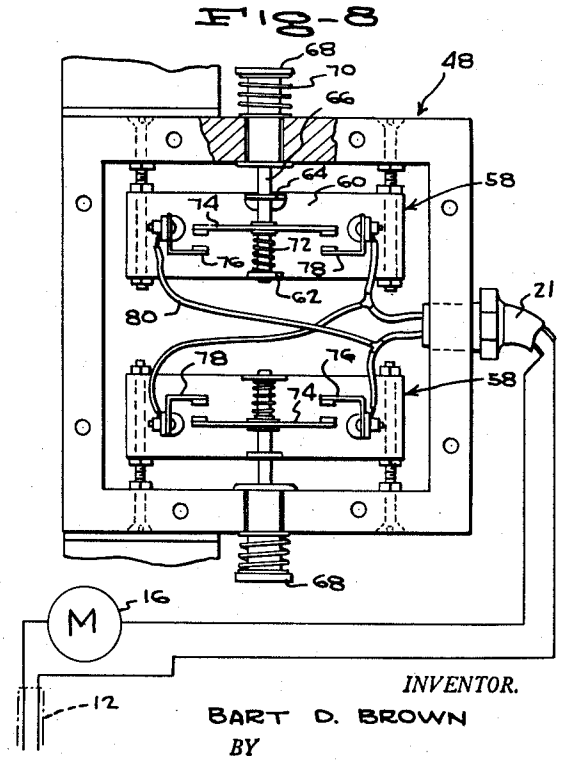


FIG-8



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United States Patent Office

2,927,170

Patented Mar. 1, 1960

2,927,170

CABLE LIMIT SWITCH

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Application October 17, 1958, Serial No. 767,838

6 Claims. (Cl. 200—61.14)

The present invention relates to mining equipment generally and in particular to a cable limit switch for use with a mine work vehicle.

In the mining industry, an electrically driven vehicle is frequently employed to haul loads of ore, coal, or rock from the mine working face to a location of transfer of the load to another conveying means. The vehicle carries a reel on which is wound a power cable having one end anchored and electrically connected to a fixed source of electric current and having the other end of the cable electrically connected to the drive motor of the vehicle. The cable unwinds from the reel as the vehicle moves away from the power source and is rewound on the reel as the vehicle moves back toward the power source.

Occasionally, the vehicle is caused to travel beyond or overrun the length of the cable either resulting in the severing of the one end of the cable from the anchoring means and power source or detachment of the other end of the cable from the reel. This not only disrupts mining operations for the period of time required to repair the cable connection but also creates a serious hazard in mines having gas in the atmosphere. The severing of the cable connection creates a flash or a spark which may ignite the gas and cause an explosion.

The principal object, therefore, of the present invention is to provide a means which effectively prevents the severing of the cable connections by overrun of the vehicle.

Another object of the present invention is to provide a cable limit switch for use with a mine vehicle which is easily attached to and detached from the mine vehicle, one which is positive in operation, and one which has positive means for locking the switch in open position after overrun of the vehicle.

A further object of the present invention is to provide a cable limit switch for use with a mine vehicle which is simple in structure, one sturdily constructed, one economically feasible, and one which is adaptable for any type of electrically operated mine vehicles.

These and other objects and advantages of the present invention will be fully apparent from the following description when taken in conjunction with the annexed drawings, in which:

Figure 1 is an isometric view, showing a portion of one end of a vehicle bed with portions of the vehicle wheels broken away, with the cable limit switch of the present invention installed thereon.

Figure 2 is an elevational view of the cable limit switch according to the present invention, the switch being shown in open position with the spreader element on the cable engaging the switch rollers;

Figure 3 is an elevational view similar to Figure 2 but showing the switch in closed or vehicle operating condition;

Figure 4 is a top plan view of the assembly shown in Figures 2 and 3;

Figure 5 is a view taken on the line 5—5 of Figure 3;

Figure 6 is a view taken on the line 6—6 of Figure 5;

Figure 7 is a view on an enlarged scale, taken on the line 7—7 of Figure 6; and

Figure 8 is a view of the switch with the cover removed, the connections of the switch to the vehicle motor being shown schematically.

Referring in greater detail to the drawings in which like numerals indicate like parts throughout the several views, the reference numeral 10 designates a vehicle including a bed, the vehicle 10 being of the type used in a mine for hauling coal, ore, or the like, from the mine working face to a place of disposal of the ore, rock or transfer of such to another conveyance. Only a portion of the vehicle 10 is shown as the invention may be used with any type of vehicle that is electrically driven and connected by a cable to a source of power. The cable is designated by the numeral 12 and is seen to have an intermediate portion wound upon a reel 14, it being understood that the free end portion of the cable 12 is attached to and electrically in circuit with a source of electric current. Conventional means is provided for effecting the winding movement of the reel 14 when it is desired to wind the cable 12 thereon, such means not being shown as not being a part of the present invention. A drive motor 16 is secured to the vehicle 10 and its electrical connection to the cable 12 includes a wire 18 and a switch designated generally by the reference numeral 20. An electrical conduit 21 connects the inner end of the cable 12 within the reel 14 to the switch 20 and to the free end of the wire 18 so that electric current may be furnished the motor 16 with the switch 20 serving as a control for the motor 16.

The switch 20 includes an upstanding frame 22 carried by the bed of the vehicle 10 and a pair of switch actuating members 24 and 26, each member being a roller, arranged in vertical spaced relation and supported in the frame 22 for movement toward and away from each other. The frame 22 has a U-shaped base 28 having the free ends of its legs fixedly secured to the end of the bed of the vehicle 10, as shown in Figure 1. Rising from the ends of the bight of the base 28 are uprights 30 and 32 carrying between their upper ends a guide roller 34. The roller 34 is of conventional construction and is not employed in the limit switch of the present invention, the structure of the latter having been added to the uprights 30 and 32 as an attachment.

Each of the members 24 and 26 includes a bar 36, 38, respectively, flattened and bent at one end and provided with a slot through which extends a bolt 40 loosely securing the end of the bar 36, 38, in an opening provided in a vertically disposed bracket 42 secured to one face of the upright 30. The portions of the bars 36 and 38 adjacent their other ends are offset as at 44 and 46, respectively, with the free ends of the bar portions 44 and 46 extending loosely over the casing 48 of the switch 20. A spring 50 extends between the offset portions 44 and 46 and is secured thereto by bolt and nut assemblies 52. The spring 50 biases the actuating members 24 and 26 toward each other.

The members 24 and 26 have rotatable sleeves 54 and 56, respectively, mounted on the portions between their ends, the sleeves 54 and 56 constituting rollers.

Referring to Figure 8, the switch casing 48 is shown with its cover removed and exposing a pair of switch assemblies of identical construction. Each switch assembly, designated by the numeral 58, includes a base 60 having perpendicular brackets 62 and 64 slidably supporting a plunger 66. One end of the plunger 66 projects beyond the edge of the base 60 and is engaged by another plunger 68 which projects through a hole in the wall of the casing 48. Springs 70 bias the plungers 68 outwardly and other springs 72, circumposed about

the portions of the plungers 66 adjacent the brackets 62 bias the plungers 66 to the position in which a bridging contact carried thereby is out of contacting engagement with fixed contacts mounted on the bases 60. The bridging contact in each assembly 58 is designated by the numeral 74 and the fixed contacts by the numerals 76 and 78.

One conductor 80 of the conduit 21 connects both of the fixed contacts 76 together and to one side of the motor 16 while another wire or conductor 82 connects the other fixed contacts 78 together into one side of the power source by way of one of the conductors within the cable 12. The other conductor of the cable 12 is connected to the other side of the motor 16 in the conventional manner shown schematically in Figure 8.

A spreading element 84 is carried on the cable 12 at a point inwardly of the end of the cable 12 which is secured to the reel 14. This spreading element, upon traveling movement of the vehicle 10 away from the power source, with the cable 12 paying out, passes between the actuating members 24 and 26 and moves the members 24 and 26 away from each other a distance sufficient to let each of the plungers 68 move outwardly of the casing 48 under the action of the spring 70, and open the normally closed switches 58 by permitting the moving of the bridging contacts 74 out of their bridging and contacting engagement with respect to the fixed contacts 76 and 78 under the action of the spring 72. This breaks the circuit to the motor 16 and stops the traveling movement of the vehicle 10.

The spreading element 84 is of a size larger than the normal space between the actuating members 24 and 26 when in the position in which they are toward each other.

Means embodying a holding implement is provided for releasably locking the members 24 and 26 in their position in which the motor circuit is broken when they have been shifted to the circuit breaking position by the engagement of the element 84. Specifically, this means consists in a vertically disposed block 86 connected to the members 24 and 26 for movement about a vertical axis from a position out of engagement with the members 24 and 26 to a position engaging and separating the members 24 and 26 when the latter have been moved apart from each other. This block is shown in Figures 4 and 5 and is seen to have a handle 88 projecting from the face thereof remote from the members 24 and 26. A hinge member 90 is secured to the upright 32 and a block 86 has cut-out portions on its one edge receiving the hinge member 90 and also providing space for springs 92 which are circumposed about a short shaft 94 providing the hinge connection between the block 86 and the hinge member 90. The springs 92 bias the block 86 to the position in which the shoulders on its confronting face, as at 96 in Figure 6, engage the lower and upper edges of the bars 36 and 38, respectively, when the members 24 and 26 are shifted away from each other by the action of the element 84.

The handle 88 provides a means by which the block 86 may be manually shifted to the out of engagement position with respect to the members 24 and 26 when it is desired to reenergize the motor 16 for further traveling movement of the vehicle 10. Eye formations 98 and 100 carried by the switch casing 48 support the bar portions 44 and 46, respectively, for upward and downward movement.

In operation, the actuating members 24 and 26 are normally in their position toward each other with the plungers 68 on the upper and lower ends of the casing 48 depressed inwardly of the casing 48 and with the switch contacts within the switch 20 in closed position. Upon traveling movement of the vehicle 10, the cable 12 pays out to a predetermined distance at which the abutment or element 84 is pulled between the members 24 and 26 and effects their separation, breaking the circuit of the contacts in the switch 20 and stopping the motor 16. The

members 24 and 26 will be automatically held in their circuit breaking position by the movement of the block 86 to the interposed engagement position shown in Figure 2 until the block 86 is manually moved to the out of engagement position which permits the contacts of the switch 20 to once more be closed and the motor 16 to be energized, effecting the rotation of the drive shaft of the motor 16 and traveling movement of the vehicle 10.

What is claimed is:

1. The combination with a vehicle having a bed, a reel rotatably mounted on said bed, a drive shaft carried by said bed, a source of electric current located at a point remote from said vehicle, a flexible power cable having one end electrically connected to said source and having the portion adjacent the other end electrically connected to said drive shaft, said cable having an intermediate portion wound upon said reel so that it unwinds responsive to traveling movement of said vehicle in a direction away from said source, of a pair of spaced switch actuating members supported on said bed for movement toward and away from each other, the part of said cable adjacent said wound intermediate portion extending between and spaced from said members, a spreading element of a size larger than the spacing between said members carried by said cable part, a normally closed switch operatively connected to each member, and a conductor electrically connecting said other end of said cable to said switches, said spreading element upon unwinding of said intermediate cable portion responsive to traveling movement of the vehicle in the direction away from said source being movable between and engageable with said members to shift each of said switches to open position.

2. The combination with a vehicle having a bed, a reel rotatably mounted on said bed, a drive shaft carried by said bed, a source of electric current located at a point remote from said vehicle, a flexible power cable having one end electrically connected to said source and having the portion adjacent the other end electrically connected to said drive shaft, said cable having an intermediate portion wound upon said reel so that it unwinds responsive to traveling movement of said vehicle in a direction away from said source, of a pair of spaced switch actuating members supported on said bed for movement toward and away from each other, the part of said cable adjacent said wound intermediate portion extending between and spaced from said members, a spreading element of a size larger than the spacing between said members carried by said cable part, a normally closed switch operatively connected to each member, a conductor electrically connecting said other end of said cable to said switches, said spreading element upon unwinding of said intermediate cable portion responsive to traveling movement of the vehicle in the direction away from said source being movable between and engageable with said members to shift each of said switches to open position, and spring means operatively connected to said actuating members urging said members toward each other.

3. The combination with a vehicle having a bed, a reel rotatably mounted on said bed, a drive shaft carried by said bed, a source of electric current located at a point remote from said vehicle, a flexible power cable having one end electrically connected to said source and having the portion adjacent the other end electrically connected to said drive shaft, said cable having an intermediate portion wound upon said reel so that it unwinds responsive to traveling movement of said vehicle in a direction away from said source, of a pair of spaced switch actuating members supported on said bed for movement toward and away from each other, the part of said cable adjacent said wound intermediate portion extending between and spaced from said members, a spreading element of a size large than the spacing between said members carried by said cable part, a normally closed switch operatively connected to each member, each of said switches including a pair of spaced fixed contacts, a movable bridging

contact normally in contacting engagement with said fixed contacts, and spring means operatively connected to said bridging contact for biasing said bridging contact into contacting engagement with said fixed contacts, the movable bridging contact of each switch being connected to the adjacent member for movement with the latter, and a conductor electrically connecting said other end of said cable to said switches, said spreading element upon unwinding of said intermediate cable portion responsive to traveling movement of the vehicle in the direction away from said source being movable between and engageable with said members to shift each of said switches to open position.

4. The combination with a vehicle having a bed, a reel rotatably mounted on said bed, a drive shaft carried by said bed, a source of electric current located at a point remote from said vehicle, a flexible power cable having one end electrically connected to said source and having the portion adjacent the other end electrically connected to said drive shaft, said cable having an intermediate portion wound upon said reel so that it unwinds responsive to traveling movement of said vehicle in a direction away from said source, of an upstanding frame carried by said bed, a pair of switch actuating members each embodying a roller arranged in vertical spaced relation and supported in said frame for movement toward and away from each other, the part of said cable adjacent said wound intermediate portion extending between and spaced from said members, a spreading element of a size larger than the spacing between said members carried by said cable part, a pair of normally closed switches arranged in vertical spaced relation positioned adjacent one of the complemental ends of said rollers and each operatively connected to the adjacent roller, and a conductor electrically connecting said other end of said cable to said switches, said spreading element upon unwinding of said intermediate cable portion responsive to traveling movement of the vehicle in the direction away from said source being movable between and engageable with said members to shift each of said switches to open position.

5. The combination with a vehicle having a bed, a reel rotatably mounted on said bed, a drive shaft carried by said bed, a source of electric current located at a point remote from said vehicle, a flexible power cable having one end electrically connected to said source and having the portion adjacent the other end electrically connected to said drive shaft, said cable having an intermediate portion wound upon said reel so that it unwinds responsive to traveling movement of said vehicle in a direction away from said source, of an upstanding frame carried by said bed, a pair of switch actuating members each

embodying a roller arranged in vertical spaced relation and supported in said frame for movement toward and away from each other, the part of said cable adjacent said wound intermediate portion extending between and spaced from said members, a spreading element of a size larger than the spacing between said members carried by said cable part, a pair of normally closed switches arranged in vertical spaced relation positioned adjacent one of the complemental ends of said rollers and each operatively connected to the adjacent roller, a conductor electrically connecting said other end of said cable to said switches, said spreading element upon unwinding of said intermediate cable portion responsive to traveling movement of the vehicle in the direction away from said source being movable between and engageable with said members to shift each of said switches to open position, and spring means operatively connected to said rollers urging said rollers toward each other.

6. The combination with a vehicle having a bed, a reel rotatably mounted on said bed, a drive shaft carried by said bed, a source of electric current located at a point remote from said vehicle, a flexible power cable having one end electrically connected to said source and having the portion adjacent the other end electrically connected to said drive shaft, said cable having an intermediate portion wound upon said reel so that it unwinds responsive to traveling movement of said vehicle in a direction away from said source, of a pair of spaced switch actuating members supported on said bed for movement toward and away from each other, the part of said cable adjacent said wound intermediate portion extending between and spaced from said members, a spreading element of a size larger than the spacing between said members carried by said cable part, a normally closed switch operatively connected to each member, a conductor electrically connecting said other end of said cable to said switches, said spreading element upon unwinding of said intermediate cable portion responsive to traveling movement of the vehicle in the direction away from said source being movable between and engageable with said members to shift each of said switches to open position, and a holding implement connected to said members so that it moves between and engages said members when the members have been moved away from each other by said spreading element.

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