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3,036,149

GRADING AND SHIELDING MEANS FOR TRANSMISSION LINES

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2 Sheets-Sheet 1

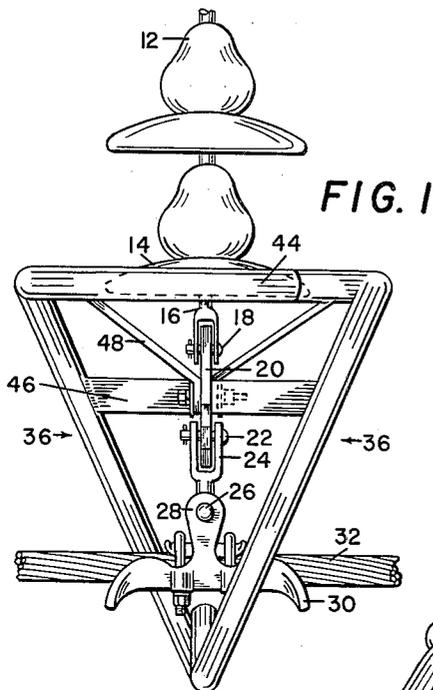


FIG. 1

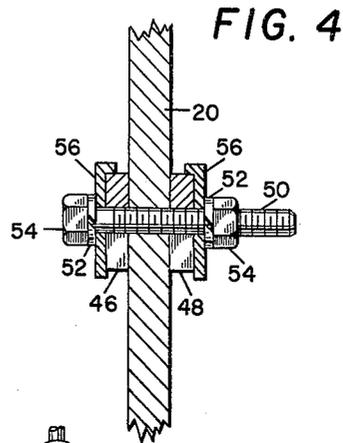


FIG. 4

FIG. 2

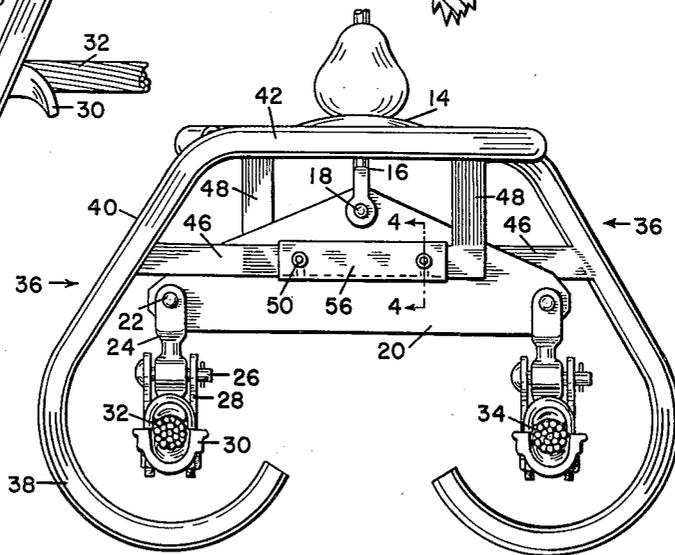
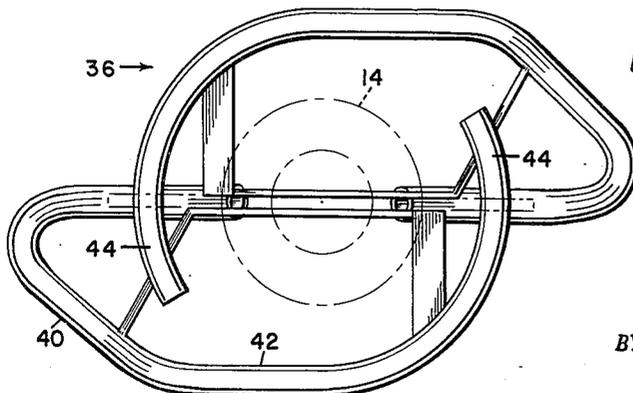


FIG. 3



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FIG. 5

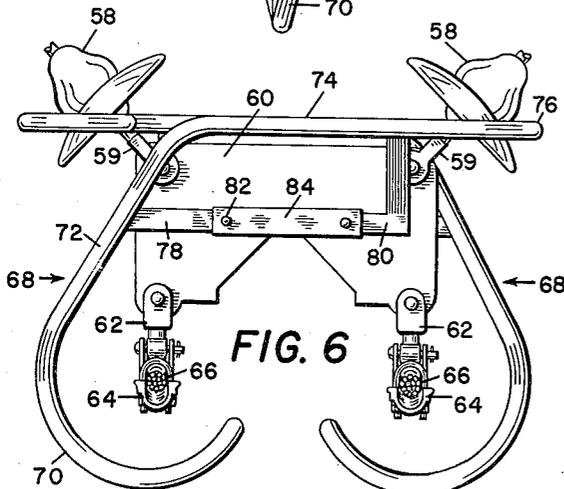
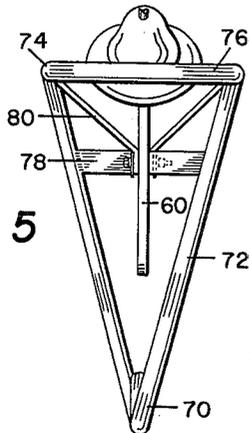


FIG. 6

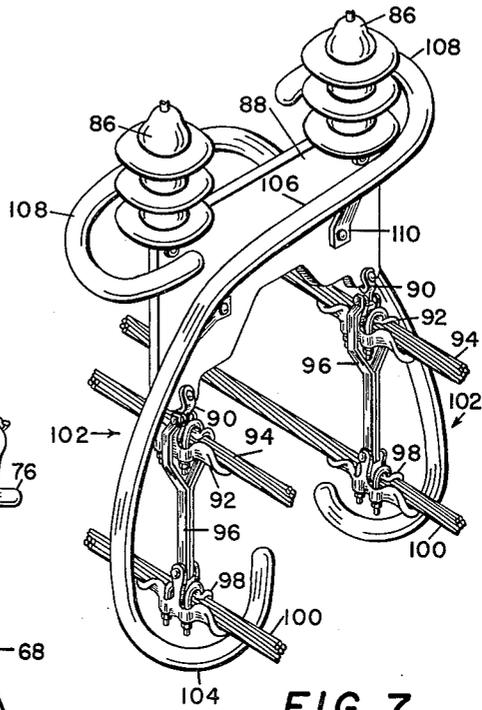


FIG. 7

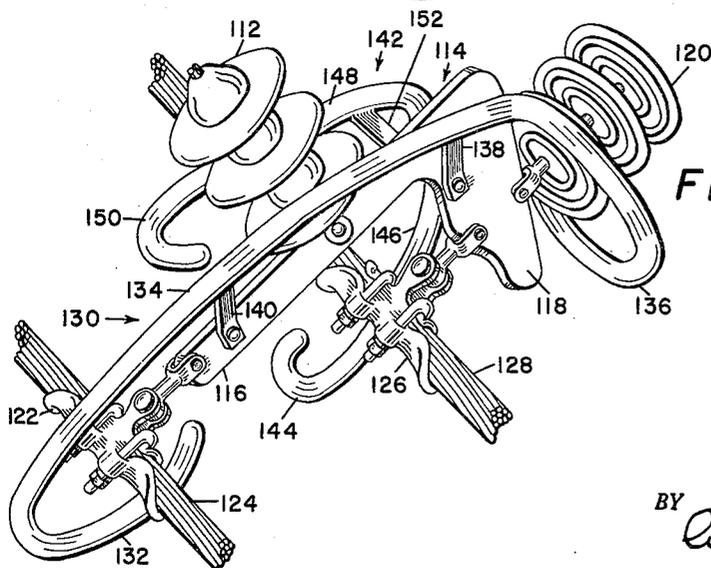


FIG. 8

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GRADING AND SHIELDING MEANS FOR TRANSMISSION LINES

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9 Claims. (Cl. 174-141)

This invention relates to combined grading and shielding means for high voltage transmission lines suspended in tension from tower or other supports, to improve voltage distribution at the ends of suspension string insulators adjacent the conductors, draw away flash-over and suppress corona discharge and radio and television interference. Such transmission lines are commonly supported by strings of insulators of a length designed to insulate at the transmitted voltage, but at very high voltages, as 300 kv. and higher, it has been found necessary to apply such shields about the lower end of the insulator string and its hardware and clamp connection to the conductor, to grade and improve the distribution of voltage on the insulator, prevent flash-over and reduce the stress at pointed portions of the hardware tending to produce corona discharge and radio and television interference.

One object of the invention is to provide improved grading and shield means which is more simple in construction, light in weight and economical to manufacture.

Another object is the supply of such means in the form of a cage with smooth exterior surfaces enclosing all of the hardware parts.

Another object is the provision of means having the above advantages in a construction comprising few parts and capable of convenient and safe application to the suspension hardware from outside positions and without disturbing the suspension.

To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

FIG. 1 is a side elevation of a grading and shielding means embodying the present invention, as viewed transversely of the conductors;

FIG. 2 is a side elevation of the same as viewed longitudinally of the conductors;

FIG. 3 is a top plan view of the same;

FIG. 4 is a detailed sectional view on the line 4-4 in FIG. 2;

FIG. 5 is a view similar to FIG. 1 of a modified embodiment;

FIG. 6 is a view at right angles to FIG. 5;

FIG. 7 is a perspective view of a further modification, and

FIG. 8 is a perspective view of a still further modified embodiment.

The embodiment of the invention shown in FIGS. 1 to 4, inclusive, is employed in connection with a single suspension string of insulators 12, of known construction, supported by cross arm means on a pole, tower or other support of known type. The lowermost insulator skirt 14 has depending therefrom a clevis bolt 16 pivotally connected by pin means 18 with the center of the upper edge of a metal yoke plate 20 of generally triangular shape, as shown in FIG. 2. Each of the opposite ends of yoke 20 has pivotally connected therewith at 22 a clevis link 24 with a pivotal pin connection 26 to the upwardly extending clevis arms 28 of a saddle-type clamp 30 secured to and supporting each of a pair of spaced horizontal conductors 32 and 34, to support the same in tension from the insulator string 12.

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The grading and shielding means for the insulators, conductors and hardware of such a two-bundle conductor system comprises a pair of separate lengths of rod material indicated generally at 36, which may be of iron, steel, aluminum or any known and suitable metal material for such purposes and of either tubular or solid construction. Tubular or pipe construction is preferred for its lightness and economy and the tube ends may be closed by rounded plugs, depending upon the position and exposure to moisture. Such rods 36 have generally circular shape in cross section, with smooth exterior surfaces and are symmetrical in shape, each having one free end 38 curved in a substantially vertical plane to extend in spaced relation about one of said conductors and its clamp and thence upwardly at 40 on the same side of both conductors 32 and 34, with its other free end curved above and inwardly over said conductors as at 42, and in spaced relation about the lower insulator as at 44, substantially in the plane thereof, as shown. Each length of rod 36 is supported by attachment to yoke plate 20, for which purpose metal bracket strips 46 and 48 are fixed at spaced points to each rod and to one side of the yoke plate. Strip 46 extends horizontally inwardly toward plate 20, while strip 48 is of L shape, having one leg extending downwardly and inwardly and its other extending parallel with and along the plate in line with the inner end of strip 46. Bolts 50 are passed through the strips 46 and 48 of the respective rods and through openings in yoke plate 20, as shown, with spring washers 52 under the head of the bolt and its nut 54. Keeper plates 56, with flanged upper edges are preferably placed on the bolts against the outer sides of the strips (FIG. 4), on both sides of the yoke, to firmly and securely lock the strips together and to the yoke. Strips 46 and 48 of each rod or tube may be made, in one piece or unitary if desired, and the openings for the bolts in the strips and keeper plates may be either circular or downwardly opening slots as shown.

It will be seen from the above described construction that the two lengths of rods or tubes 36 provide a cage with smooth exterior surfaces enclosing the lower ends of the insulator strings, conductors and hardware parts connecting them, to maintain the same at substantially the same potential with a very low voltage gradient, prevent flash-over, and suppress tendency to corona discharge and radio and television interference. Such construction comprises but few parts to be handled and maintained and is adapted to be applied from accessible positions at the sides and above the conductors, without disturbance of the parts for suspending the same.

A somewhat modified embodiment is disclosed in FIGS. 5 and 6 for a suspension comprising a two-bundle conductor system supported by two insulator strings 58 in a V shaped arrangement. The lower insulator elements and terminal clevis bolts 59 of the strings have pivotal pin connections with the opposite upper corners of the yoke plate 60 of generally rectangular shape. The opposite lower corners of the plate have pivotal pin connections with clevis links 62 pivotally connected with clamps 64 of conductors 66, respectively. Each of the identical grading and shielding rods 68 has a lower free end 70 curved in a substantially vertical plane to extend in spaced relation about one of the conductors and clamps and thence upwardly on the same side of both conductors, as at 72, with its other free end curved above and inwardly over said conductors, as at 74, and in spaced relation about the adjacent string insulator means substantially in the plane of the lower end thereof, as at 76, as shown. Each rod has welded or otherwise fixed thereto a pair of brackets 78 and 80, as described above in connection with the modification of FIGS. 1-4 and bolted by bolts 82 to a keeper plate 84 and yoke plate

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60 in the same manner, to securely support the shielding rods in position, with the advantages described above.

A further embodiment of the invention is disclosed in FIG. 7, for a four-bundle conductor system, comprising a pair of vertical insulator strings 86 pivotally connected as before to the opposite upper corners of a yoke plate 88, the opposite lower corners of which have pivotally connected thereto clevis links 90 pivotally connected in turn, as described above, to upwardly extending clevis parts of conductor clamps 92 for the upper pair of cables 94. Links 90 provide pivotal supports for the upper ends of straps 96 depending below conductors 94 and pivotally connected with the clamps 98 on the lower pair of parallel conductors 100. Here also the grading and shielding means comprises a pair of identical tubes or rods 102, such as described above, each having one free end 104 curved in a substantially vertical plane to extend in spaced relation about one of said lower conductors and clamps and thence upwardly on the same side of all of such conductors, with its other free end curved above and inwardly over said conductors, as at 106, and in spaced relation about the adjacent string insulator means substantially in the plane of the lower end thereof, as at 108. Each rod has a pair of bracket strips, one of which is shown at 110, constructed and bolted to yoke plate 88, as described above in connection with the embodiment of FIGS. 1-4. It will be seen that this embodiment likewise affords the advantages described in connection with the first embodiment.

Still a further embodiment is shown in FIG. 8, for a two-bundle conductor system supported by a vertical insulator string 112 having its lower end pivotally connected with a vertically positioned, angular yoke plate 114 having a horizontal arm 116 and a vertical arm 118, with a horizontal insulator string 120 pivotally connected to arm 118 to hold the conductors against side sway, as well understood in the art. A saddle clamp 122 supports one conductor 124 and a saddle 126 the other conductor 128. One shielding rod, indicated generally at 130, of the construction described above, has one end 132 curved in a vertical plane about conductor 124 and its saddle, from which it extends upwardly and inwardly as at 134 over both conductors, at one side of yoke 114, with its other end 136 curved downwardly and inwardly around the adjacent end insulator of string 120. This rod has bracket strips 138 and 140 welded thereto and bolted to yoke 114, as shown. The other shielding rod 142 has one end 144 extended downwardly, substantially in a vertical plane around conductor 128 and its saddle from which it extends upwardly at the other side of yoke 114 and over conductor 128 and around the lower insulator of string 112. Similar bracket strips, one of which is shown at 152, are welded to rod 150 and bolted to the yoke. This embodiment likewise supplies the advantageous functions and characteristics described above in connection with the first embodiment.

It will thus be seen that the invention accomplishes its objects and while it has been herein disclosed by reference to the details of preferred embodiments, it is to be understood that such disclosure is intended in an illustrative, rather than a limiting sense, as it is contemplated that various modifications in the construction and arrangement of the parts will readily occur to those skilled in the art, within the spirit of the invention and the scope of the appended claims.

I claim:

1. A high voltage electrical transmission system comprising supporting means provided with suspension string insulator means, a pair of electrical conductors, linkage means connected with said insulator means and having clamps thereon supporting said conductors under tension in spaced, parallel relation in substantially the same horizontal plane, combined grading and corona shields comprising a pair of separate lengths of generally cylindrical metal rods each having one free end curved in a substan-

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tially vertical plane to extend in spaced relation about one of said conductors and clamps, respectively, and thence upwardly on the same side of both of said conductors with its other free end curved above and inwardly over said conductors and in spaced relation about said string insulator means substantially in the plane of the lower end thereof, and brackets fixed to said shields and to said linkage means for movement with said linkage means, to maintain the positions of said shields relative to said conductors.

2. A transmission system as specified in claim 1 in which said linkage means is pivoted to the lower end of said insulator means for movement relative thereto about a horizontal axis.

3. A transmission system as specified in claim 1 in which said linkage means comprises a yoke plate pivoted to the lower end of said insulator means and having said brackets and shields fixed thereto.

4. A transmission system as specified in claim 1 in which said conductors are the lower pair of a bundle of four conductors including an upper pair of horizontally spaced conductors supported by said linkage means and said shields extend upwardly on opposite sides, respectively, of all of said conductors and thence about said string insulator means.

5. A transmission system as specified in claim 1 in which said linkage means comprises a yoke plate pivoted to the lower end of said insulator means with said brackets fixed thereto and link members connecting said clamps to the opposite ends of said plate for movements relative thereto about vertical and horizontal axes.

6. A transmission system as specified in claim 5 in which said insulator means comprises a pair of insulator strings connected to upper outer corners, respectively, of said yoke plate.

7. A transmission system as specified in claim 5 in which said insulator means comprises a pair of insulator strings and said yoke plate is L shaped with horizontal and vertical arms connected to said strings, respectively, and one of said shields has said other free end thereof curved about said insulator string connected to said vertical arm of said yoke plate substantially in the plane of the adjacent end of said insulator string.

8. In a high voltage electrical transmission system comprising a pair of spaced, substantially parallel conductors tensioned and supported in substantially the same horizontal plane by suspension string insulator means connected by linkage means with clamps on said conductors, combined grading and corona shields comprising a symmetrical pair of separate lengths of generally cylindrical metal rods each having one free end curved in a substantially vertical plane to extend in spaced relation about the bottom and opposite sides of one of said conductors and clamps, respectively, and thence upwardly on the same side of both of said conductors with its other free end curved above and inwardly over said conductors and in spaced relation about said string insulator means substantially in the horizontal plane of the lower end thereof, and brackets fixed to said shields and to said linkage means for movement with said linkage means to maintain the position of said shields relative to said conductors.

9. In a high voltage electrical transmission system comprising a pair of spaced, parallel conductors supported in tension in substantially the same horizontal plane by suspension string insulator means connected by a yoke plate with clamps on said conductors, combined grading and corona shields comprising a pair of separate lengths of generally cylindrical metal tubing each having one free end curved in a substantially vertical plane to extend in spaced relation about the bottom and opposite sides of one of said conductors and clamps, respectively, and thence upwardly on the same side of both of said conductors with its other free end curved above and inwardly over said conductors and in spaced relation about the lower end of said string insulator means, and metal strip

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brackets fixed to said tubing and bolted to said yoke plate, to support said tubing in position relative to said conductors and insulator means.

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