July 15, 1930. W. C. HAYMAN 1,770,851

FLUID FILLED ELECTRIC CABLE

Filed Nov. 29, 1929

Fig. 1.

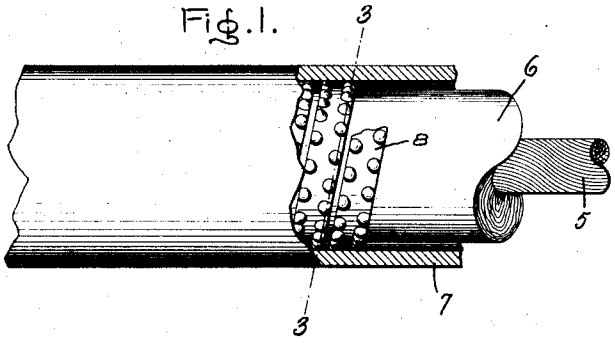


Fig. 2.

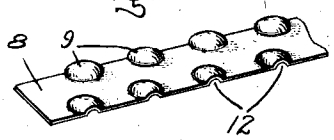


Fig. 4.

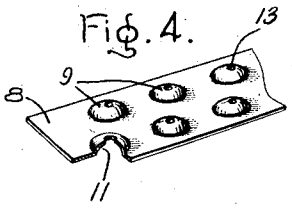
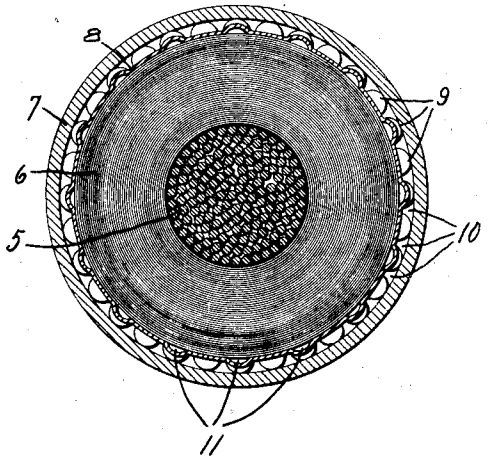


Fig. 3.



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UNITED STATES PATENT OFFICE

WILLIAM C. HAYMAN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

FLUID-FILLED ELECTRIC CABLE

Application filed November 29, 1929. Serial No. 410,306.

The present invention relates to electric cables of the type having a channel for the reception of fluid insulation such as oil, with which the insulation about the conductor is impregnated, and an enclosing sheath. Cables of this type may be divided into classes, those having the channel in the center of the conductor and those having the channel between the peripheral surface of the insulation and the inner wall of the enclosing lead sheath.

My invention is directed to the last-mentioned class and has for its object the provision of an improved means for forming the exterior or peripheral channel, and one that will be free of air or gas voids when the cable is in service, which voids are so highly objectionable in electric cables, especially those intended for transmitting current of very high voltages.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the drawing which is illustrative of my invention, Fig. 1 is a view in side elevation of a piece of cable with certain of the parts broken away; Fig. 2 is a perspective view of a metal ribbon or tape employed in forming the fluid channel; Fig. 3 is a cross-section of the cable shown in Fig. 1 taken on line 3—3 but on a somewhat larger scale, and Fig. 4 is a perspective view of a slight modification.

5 indicates the conductor, such as copper, 6 the insulation thereon, such as paper, and 7 the outer enclosing sheath, such as lead. All of these parts may be of any suitable construction and arranged in any suitable way.

In order to form a channel for the impregnating fluid, such as thin degasified oil for example, the insulation is wound with a thin metal tape or ribbon 8 located between the periphery of the insulation and the inner wall of the sheath. The ribbon or tape may be made of copper and is as thin as possible, consistent with the feature of maintaining an oil channel of suitable radial depth between the insulation and the sheath. In order that ample radial depth of channel may be provided for the fluid so that it can flow lengthwise of the cable without undue resistance, the ribbon is provided with a great many small projections or buttons 9 along its length. The outer surfaces of some or all of these projections engage the inner wall of the sheath and thus define a longitudinally extending channel 10 which is of annular form in cross-section and contains fluid insulation for impregnating the paper insulation. The sheath rather loosely surrounds the projections as distinguished from tightly fitting over the same. The projections may be made by suitable dies, as of roller formation for example, so that by passing the ribbon between them the projections will be formed one after the other. The projections may be of any desired shape and size, it will be found advantageous, however, to provide them with a well rounded outer surface of which a portion of a sphere is a good example, so as not to interfere with the sheathing operation and to make them relatively small so as not to affect the bending of the ribbon as in winding the same over the insulation. Such rounded forms are well adapted to resist crushing pressures, as in bending the cable. The under side of the ribbon is flat and lies smoothly on the paper or other insulation around the conductor.

In the manufacture and use of high tension cables it is of the greatest importance to extract from the parts within the sheath all of the air, other gases and moisture therein contained and to use only degasified fluid for impregnating the insulation.

With a structure such as described thus far it is apparent that a very large number of small pockets 11 would be formed, that is to say, the wall of each projection with the paper under it would define such a pocket or void, and that it would be a slow and difficult operation to extract all the air and gas therefrom. The path through the insulation or between the under surface of the tightly wrapped on ribbon and the insulation would be of high resistance and the cable would require long and expensive treatment to fully remove the air and other gases from the voids or pockets. To obviate the difficulty of evacuating the cable as above mentioned, the projections or buttons instead of being sealed

when the ribbon is applied have openings or passages in the walls thereof which communicate with the fluid channel and also with any vacuum apparatus which may be used in evacuating the cable. Such being the case, they will also permit oil to enter the pockets. In Fig. 2 the projections are located so near to the edge of the ribbon that lateral openings or passages 12 are provided through which the gases may escape and through which fluid may enter, the admission of fluid to the pockets is of assistance in shortening the time required initially to impregnate the insulation and is also advantageous when the cable is in service and the oil therein expands and contracts due to temperature changes.

In Fig. 4 is shown a modification of my invention in which well rounded projections or buttons 9 are provided as before but instead of being along the edge of the ribbon are located wholly between said edges. In this form of the invention the pockets defined by the walls of the projections are in communication with the annular channel between the insulation and the inner wall of the sheath through small openings or passages 13. These openings may be located at any suitable place, as shown they are in the center of the projection. Due to the fact that the lead sheath is loosely applied to the cable there will be sufficient clearance to permit the gases to be extracted from the pockets through the passages and for oil to enter said pockets.

It is desirable to make the projections or buttons of relatively large diameter and shallow as the oil channel does not require to be of large radial depth as the diameter of said channel is fairly large and hence will contain a relatively large amount of fluid when the cable is filled.

I have illustrated the invention in connection with a single conductor cable, but it is evident that it is not necessarily limited thereto.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. An electric cable comprising a conductor, a body of insulation surrounding the same and an enclosing sheath, in combination with a means located between the insulation and the sheath, projections on the means which define a longitudinally extending channel between the insulation and the sheath and contain pockets, and means for establishing communication between the pockets and the channel.

2. An electric cable comprising a conductor, a body of insulation thereon and an enclosing sheath, in combination with a ribbon which is wrapped around the insulation and is provided with projections which maintain the body of insulation in spaced relation to the inner wall of the sheath to define a channel, the projections and underlying body of insulation defining pockets which are in free communication with said channel.

3. An electric cable comprising a conductor, a body of insulation surrounding the same and an enclosing sheath in combination with a metal ribbon which is spirally wrapped around the insulation between its peripheral surface and the inner wall of the sheath, projections on the outer surface of the ribbon which define a longitudinal channel between the insulation and the sheath, said projections being formed along the side edges of the ribbon and having lateral passages leading therefrom into said channel.

4. An electric cable comprising a conductor, a body of insulation surrounding the same and an enclosing sheath in combination with a thin metal ribbon which is spirally wrapped around the insulation, said ribbon having a plurality of shallow spherical surfaced projections of relatively large diameter which with the sheath defines an annular fluid channel, each of said projections having a passage to establish communication between the interior thereof and the fluid channel.

5. As an article of manufacture a means for forming a fluid channel in an electric cable which comprises a strip of metal having projections thereon which form spacing means and contain pockets, the walls of said projections having openings to establish communication between the pockets and the surrounding atmosphere.

In witness whereof, I have hereto set my hand this 27th day of November, 1929.

WILLIAM C. HAYMAN.