Aug. 22, 1944. C. F. PROOS 2,356,614

JOINTS FOR OIL-INSULATED HIGH TENSION CABLES

Filed June 20, 1941 2 Sheets-Sheet 1

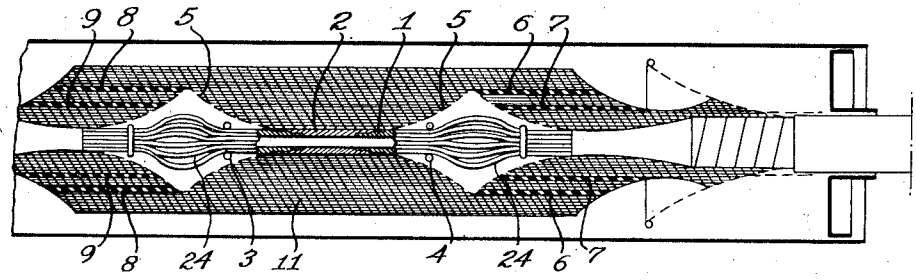


Fig. 1

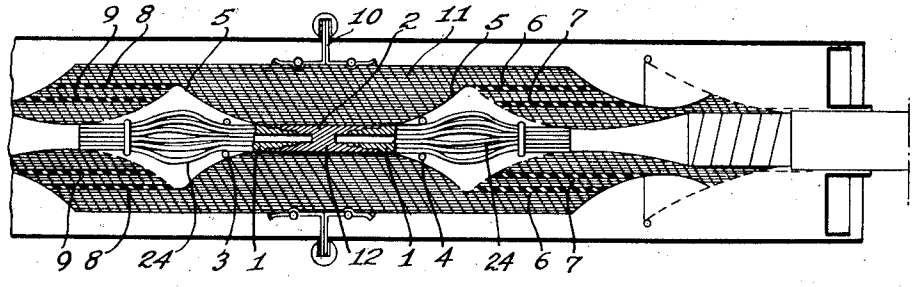


Fig. 2

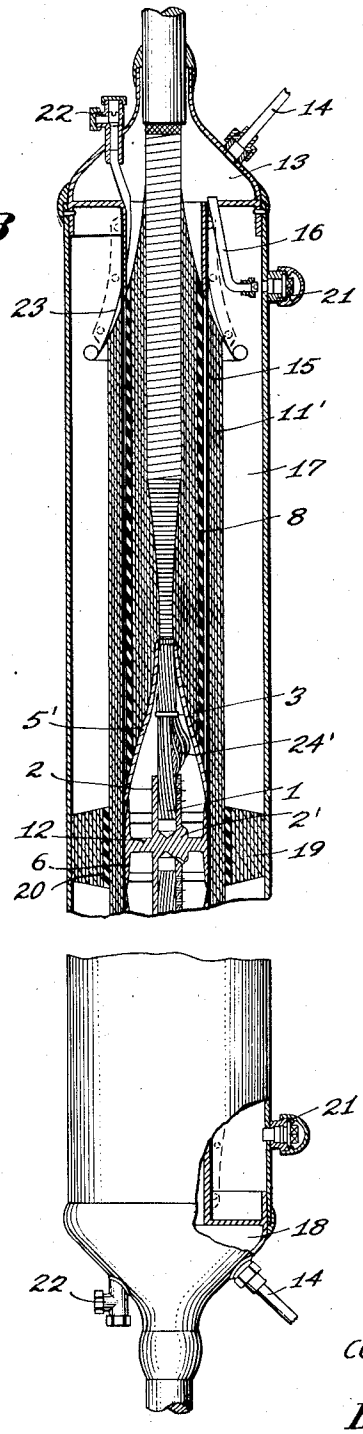
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Filed June 20, 1941 2 Sheets-Sheet 2

Fig. 3



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Patented Aug. 22, 1944

2,356,614

UNITED STATES PATENT OFFICE

2,356,614

JOINT FOR OIL-INSULATED HIGH-TENSION CABLES

Cornelis Frederik Proos, The Hague, Netherlands; vested in the Alien Property Custodian

Application June 20, 1941, Serial No. 398,968
In the Netherlands July 5, 1940

10 Claims. (Cl. 174—21)

This invention relates to joints for oil-insulated high tension cables.

In the manufacture of oil-insulated high tension cables suitable provision should be made for the circulation of oil between the place of maximum intensity of the field within the cable and an oil container connected with the cable. Oil from such containers is supplied to the cable under pressure and passes between the two in response to variations in the temperature of the cable.

Little or no difficulty is encountered in supplying oil to cables in which a single canal or passage for the oil is located immediately underneath the lead sheath thereof. However, in high tension cables in which an oil canal is provided in the center of the conductor, special provision must be made for handling the oil supply in the cable joints. In cables of the latter type, means must be provided in the joints for passing oil into or through the conductor.

Heretofore conventional practice included a provision, in such joints, of radial canals leading to the central canal in the conductor. Connecting clamps for the conductor are specially designed for the purpose and are of a special shape, and the insulation surrounding such a clamp is specially formed. Inasmuch as the insulation surrounding such a clamp is exposed to a high dielectric load it is desirable that the insulation be of as simple a shape as possible in order to obtain the highest possible insulating effect from the said insulation. In any event complicated conformations in the shape of such insulation should be avoided.

According to the present invention the clamp itself is of a construction which is quite common, and in view of the high tension which it is intended to carry, the clamp should preferably be entirely enclosed within a suitable sheath of cylindrical shape. Other shapes may, of course, be employed where required by some special construction of the conductor, but in any event the use of radial canals to carry the oil to the central canal in the conductor is avoided.

The advantages of the invention are obtained by increasing the diameter of the conductor at one or more points within the joint by the use of a jacket of perforated conducting material providing a space surrounding the conductor. Within said space a portion of the conductor is spread open to some extent to establish communication between the central canal in said conductor and the space within said jacket. The insulating material is wound upon the jacket and canals are provided in the said insulating material, coaxial with the conductor, affording communication between the space outside the insulating material and the space within the said jacket. The space outside the insulating material is enclosed by a suitable casing and oil hence may flow between the latter space and the said central canal through the said coaxial canal and the space within the said jacket.

The invention, furthermore, may be used in a joint utilizing a connecting clamp which is adapted to break off oil communication between the central canals of the conductors in connected cable lengths, by providing an annular partition separating the outer oil space in the joint into separate parts located at opposite ends of said clamp, and by providing at each cable end, adjacent said clamp, one of the mentioned jackets, wound insulation, and a coaxial oil passage in such insulation so that each length of cable will have the present invention applied thereto. Under this arrangement, the lengths of cable are substantially independent in service and each length may have its own separate oil supply. In case of damage or other disturbance this independence of the cable lengths is highly advantageous.

The drawings show several different forms of the invention.

Figure 1 is a longitudinal section of a preferred form of the invention comprising a joint in which the central canals of the conductors of two connected cable lengths are connected and in which the conductor has a part of increased diameter at each side of the connecting clamp.

Fig. 2 is a longitudinal section of a modified form of the invention by means of which the connected lengths of the cable are completely separated in so far as their oil supplies are concerned.

Fig. 3 is a view, broken away to show, partly in section, a joint according to a further modification of the invention in which there is a single part of the conductor with increasing and decreasing diameter, located symmetrically with respect to the middle of the joint.

The conductor 1 of the cable is preferably stranded and is provided with a central oil duct or canal. In Fig. 1 the diameter of the connecting clamp 2 corresponds to that of the conductors connected with the clamp. The conductors, near the ends of each cable, are bent outwardly as at 24 in order to obtain a spaced entrance for the oil into the central canal of the conductor. At points near the ends of each connected con-

ductor a gradual increase of diameter of the outer surface of the conductor is obtained by means of perforated metal jackets 5, surrounding the mentioned outwardly bent portion of the conductor. These jackets 5 take part in the conduction of the current, their principal function being to provide equipotential surfaces of suitable shape. Insulation 11, preferably in the form of layers of paper tape or the like, is wound tightly over the conductors and over said jackets. In said insulation, canals 6, 7, 8 and 9 are provided, leading from the two said jackets to the outside of said insulation, thus providing oil ducts leading from outside said insulation, through the latter and the jacket 5 and the bent out portions 24 of the conductors into the central canals of the latter.

The canals 6, 7, 8 and 9 may be formed conveniently by helically winding strips of thick paper or linen or other suitable material between adjacent layers of the insulation 11, as shown on the drawings. Thus the said canals are helical and extend coaxially of the conductor in each connected length of cable.

Rings or sleeves 3 are provided in order to assure that the shape of the conductor in the insulation is maintained when forming the joint.

The form of the invention illustrated in Fig. 2 differs from the form illustrated in Fig. 1, principally in that the clamp 2 has a solid central portion in the form of a partition 12 barring communication between the central canals of the connected cables and in having an annular partition 10, which extends between the casing of the joint and the insulating tape. Thus the joint is bipartite and permits the use of independent oil supplies to each cable length with resultant advantages in servicing a line of cable.

Fig. 3 shows another modification of a joint according to the invention. The space surrounding the connecting clamp 2' may be closed by means of a jacket 5' of copper wire cloth of such shape as to give a graduated, enlarged conductor surface around said clamp. A broken line indicates, in the paper insulation 11', a helical canal 8 by means of which oil communication is obtained between the space surrounding the connecting clamp 2' and the spaces 13 and 13 at both ends of the joint. The spaces 13 and 18 are in communication with oil containers, located outside the joints, by means of the pipes 14.

In the paper insulation outside the helical canal 8, oil tight insulation layers 15 are provided, to prevent passage of oil in a radial direction through the insulation and also longitudinally along the outer surface of the connecting clamp 2 in the middle of the joint. Owing to the provision of these oil tight layers 15 the joint is divided into three separate oil spaces each of which may be filled and evacuated separately. A pipe 16 connects space 13 at one end of the joint with the space 17 in the middle of the joint. The space 18 at the other end of the joint is substantially separated from the remainder of the joint as at this end of the joint there is no pipe corresponding to mentioned pipe 16.

Additional taping 19 is provided to form a support in the middle of the joint and it is provided with a helical canal 20, which affords an oil connection between the opposite ends of the space 17.

A plug 21 is provided for filling and evacuating the space 17 and also to give access to the end of the pipe 16. There is also provided a pipe 22 for drawing off oil for examination of samples. At 23, a funnel-shaped part is indicated, for controlling the electrical field.

I claim:

1. A joint for oil-insulated high tension cables having conductors with central oil canals, said joint comprising a portion of a conductor, insulating material surrounding said conductor portion and a casing defining an outer oil space substantially surrounding the said insulating material; the said conductor portion having a perforated jacket of conducting material extending substantially thereabout in contact near its ends with the said conductor portion whereby to constitute said jacket a conducting portion of the conductor, and the said jacket having a graduated diameter which at its greatest point is substantially greater than the normal diameter of the said conductor thereby defining an inner oil space between said jacket and said conductor portion; means in said conductor affording oil communication between the central canal thereof and said inner oil space; a canal in said insulating material, extending from said perforated jacket to said outer oil space and disposed coaxially with but spaced from the said portion of the conductor, and affording oil communication between the said outer oil space and said inner oil space, through the said perforated jacket, a second conductor and a conducting clamp connecting said conductors.

2. A joint for oil-insulated high tension cables having conductors with central oil canals, said joint comprising a stranded conductor having a stranded body portion and an expanded jacket substantially surrounding said body portion in partial spaced relationship thereto, tape insulation extending substantially around the outside of said conductor, and a casing defining an outer oil space substantially surrounding the said insulating material; the said body portion having one or more similar internal axially extending oil canals, the said jacket being of conducting material in contact near its ends with the said body portion whereby to constitute said jacket a conducting portion of the conductor, and the said jacket having a graduated diameter greater at its greatest point than that of the said body portion thereby defining an inner oil space between said jacket and said body portion; means in said conductor affording oil communication between said canal or canals and said inner oil space; one or more substantially similar canals in said tape insulation extending from said jacket to said outer oil space and disposed coaxially with but spaced from the body portion of the conductor, and affording oil communication between the said outer oil space and said inner oil space, through the said perforated jacket, a second conductor and a conducting clamp connecting said conductors.

3. A joint according to claim 2, further characterized in that the canal or canals in the tape insulation are disposed concentrically with respect to the conductor.

4. A joint according to claim 2, further characterized in that the means affording oil communication between the said canal or canals in the body portion of the conductor and the said inner oil space comprise outwardly bent portions of strands of the said body portion, providing spaces between said bent strands through which oil may pass, and a ring or rings, substantially encircling the body portion at one or both ends of said bent portions, adapted to maintain the

shape of said body portion of the conductor while the joint is being adjusted.

5. A joint according to claim 2, further characterized in including two of said cables arranged coaxially, each provided with the means defined in said claim for providing fluid communication between the said outer oil space and the said internal canal or canals, and said connecting clamp connecting the ends of said two cables.

6. A joint according to claim 2, further characterized in that said conductors are arranged coaxially, each provided with the means defined in said claim for providing fluid communication between the said outer oil space and the said internal canal or canals, and said clamp is tubular and connects the ends of said two conductors and is adapted to afford fluid communication between the internal canals of said conductors.

7. A joint according to claim 2, further characterized in including two of said cables arranged coaxially, each provided with the means defined in said claim for providing fluid communication between the said outer oil space and the said internal canal or canals, and an annular partition extending between the tape insulation and the casing, subdividing the said outer oil space into two parts each of which is in fluid communication with the canal or canals in one of said cables.

8. A joint according to claim 2, further characterized in including two of said cables arranged coaxially, each provided with the means defined in said claim for providing fluid communication between the said outer oil space and the said internal canal or canals, and said clamp having a partition barring oil communication between the canals in said two cables, and an annular partition disposed between the tape insulation and the casing, subdividing the said outer oil space into two parts, whereby to render separate and distinct the various oil carrying areas of the two cables in the joint.

9. A joint according to claim 2, further characterized in that the stranded body portion comprises two substantially similar connected parts, and that the said jacket is in contact near one of its ends with one of said similar connected parts of the stranded cable body and is in contact near its other end with the other of said similar connected parts of the stranded cable body.

10. A joint according to claim 2, further characterized in that the stranded body portion comprises two substantially similar connected parts, that the said jacket is in contact near one of its ends with one of said similar connected parts of the stranded cable body and is in contact near its other end with the other of said similar connected parts of the stranded cable body, and further, in having an annular partition extending between the tape insulation and the casing, subdividing the outer oil space into two parts, and in that the said canals in the tape insulation extend in opposite directions from the said jacket into both of the said two parts of the outer oil space.

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