

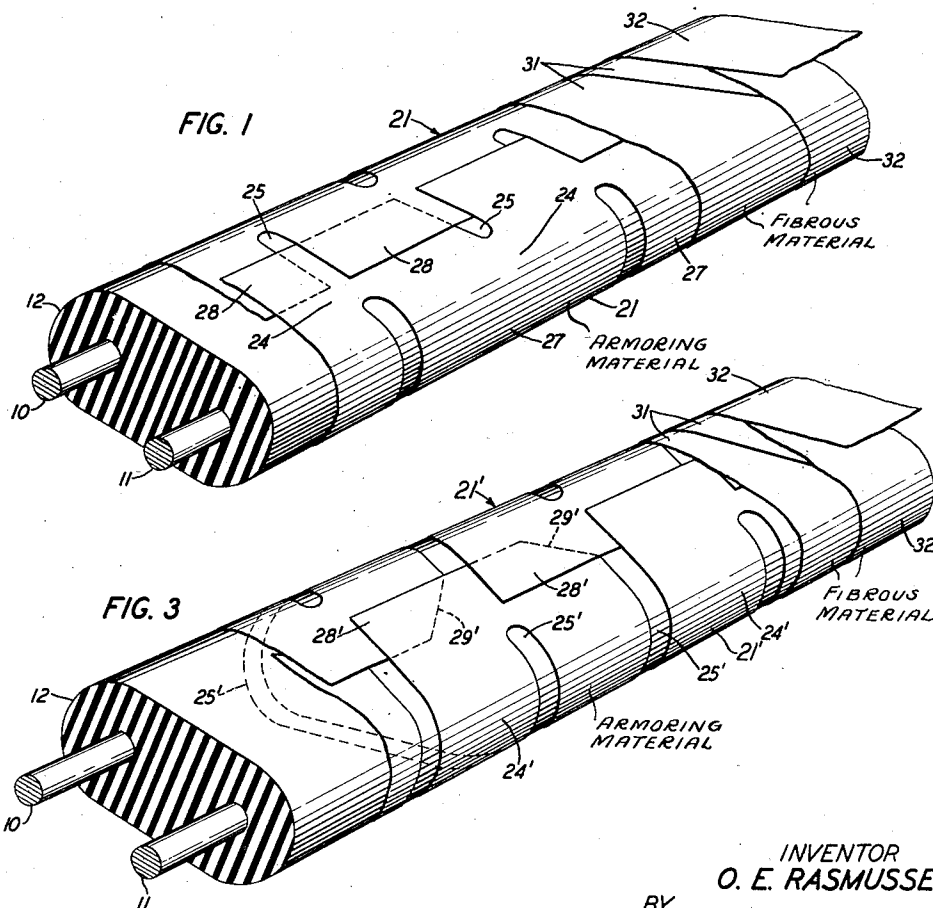
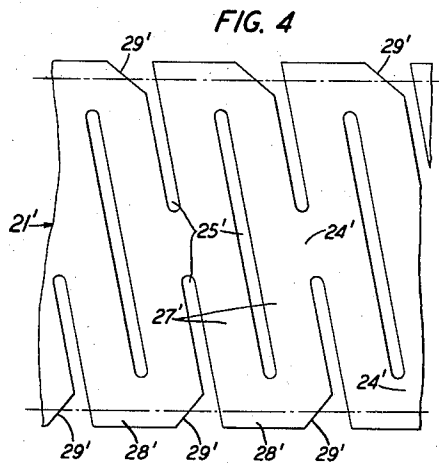
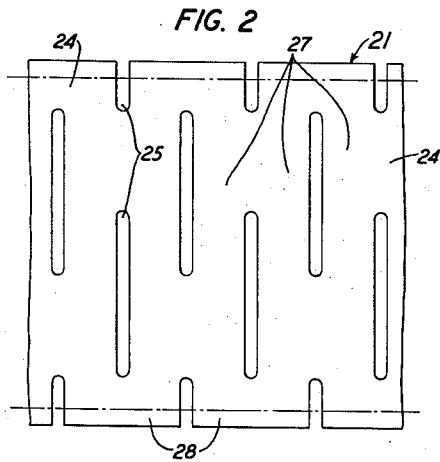
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ARMORED CONDUCTOR STRUCTURE

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ARMORED CONDUCTOR STRUCTURE

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This invention relates to armored conductor structures and more particularly to structures of this kind intended for burial directly in the ground.

It is an object of the invention to provide an armored cable structure which is simple to produce, easy to lay and which will provide safe protection against attacks by burrowing rodents.

The requirements of a cable of this type capable of answering these objects are as follows: The construction should be as light as possible to reduce cost of material and to simplify transportation and handling; the armoring should cover the insulated wires as completely as possible to give adequate protection against attacks and, on the other hand, should permit bending of the cable on a comparatively small radius without undue deformation of the armoring, thus permitting the use of comparatively small reels; the structure should be non-tangling and should present a smooth surface to facilitate general handling.

In accordance with the invention, a cable structure of this kind is provided which includes a single layer of armoring tape. The layer of armoring is formed of an armoring tape of suitable material and applied longitudinally of the conductor structure. The armoring forms a continuous layer entirely enclosing the insulated conductor or conductors, except for narrow transverse openings cut in the material at frequent intervals to permit bending of the armored structure without appreciable buckling of the tape material.

The armoring tape may be more or less definitely sectionalized, the sections being separated by the said narrow openings, which are bridged by small connecting portions to form a continuous tape structure. The edge portions of the sections along the seam are made to overlap those of the opposite edge in a manner to interlock and thus prevent buckling of the tape material along the seam.

The openings in the body portion of the tape are wide enough to prevent crowding of the tape material on the inside of the bend without buckling when the conductor is bent, on a fairly small radius, and are narrow enough to not unduly expose the insulated conductor when widened on the outside of the bend. Other features of the invention will appear from the following detailed description.

The invention will now be described as applied in a practical embodiment of its various fea-

tures and reference will be made to the accompanying drawing, in which:

Fig. 1 is a perspective view of an armored cable structure with parts broken away to more clearly show the construction;

Fig. 2 is a plan view of the armoring tape used in the structure of Fig. 1;

Fig. 3 is a perspective view of an armored cable structure similar to that shown in Fig. 1 but using a modified construction of armoring tape; and

Fig. 4 is a plan view of the armoring tape used in the structure of Fig. 3.

Referring now to Figs. 1 and 2, the cable structure comprises two conductors 10 and 11 placed in parallel relation throughout the structure and enclosed in insulating material 12, which may form a single continuous body or may comprise two separate bodies of insulation, one about each conductor. The tape armoring surrounding the insulation 12 comprises an armoring tape 21 of suitable material for protection against gopher attacks. The structure may further include outer wrappings, such as 31 and 32 applied about the armoring tape.

This structure, containing two parallel conductors, thus is substantially oval-shaped having two comparatively flat sides and two rounded sides or edges. Whereas the armoring tape shown in Fig. 1 is particularly adapted for the oval structure, it may readily be adapted for structures of circular or other cross section. The armoring tape is shown more in detail in Fig. 2 in the form in which it is manufactured before application to the cable structure.

The tape 21 presents a flat surface. In effect, it is subdivided into strip portions 27 by narrow transverse openings 25, the strips being interconnected by means of short connecting portions 24 disposed in rows longitudinal of the tape.

It will be noted in Fig. 2 that by the distribution of connecting portions 24 the tape has a series of edge sections 28 along each edge, separated by short narrow cuts and mutually displaced along the two edges.

The tape 21 is applied longitudinally to one flat side of the conductor structure and is returned-bent about the two rounded edges to form a seam along the other flat side. As the tape is applied about the cable, the edge sections from opposite sides of the seam are caused to overlap and to become interleaved with those from the opposite edge of the seam. Due to the mutual displacement between the edge sections along the opposite sides of the tape, each section is adapted to be passed into an opposing cut and thus

to partly underlie one edge section and partly overlie the adjacent edge section along the opposite edge. In this manner an interlocked seam is provided which will permit the overlapping portions along this seam to shift longitudinally when the armored cable is bent without deformation of the tape materially and thus without unduly exposing the insulated conductors to gopher attacks.

The tape material may be iron or steel or any other suitable composition and may or may not have its surface treated, as by tinning or galvanization. The material may be non-oxidizing and acid resistant to have a long life in contact with earth and other substances present in the ground.

The openings in the completed armoring should be not more than $\frac{1}{8}$ inch and should preferably average about $\frac{1}{16}$ inch in width. This is to permit laying the cable in the ground with fairly sharp curves or bends without unduly exposing the insulation to gopher attacks when the openings are widened on the outside of the bend. On the other hand, openings of this width will also prevent crowding of the tape material on the inside of the bend, when the cable is laid or when it is reeled, so that the armoring tape will not be unduly deformed and forced out of position, thereby exposing the insulation to gopher attacks.

It has been found that by means of these narrow transverse openings the tape portions forming the main surface of the armoring are free to shift slightly along the cable surface either to widen the openings or to close them up when the cable is bent and therefore the tendency to buckle and expose the underlying cable insulation is absent when small cables are wound on their flat sides on reels as small as 12 inches in diameter.

It has also been found that the introduction of narrow transverse openings in the tape material and particularly of the helical distribution of the openings with a comparatively small pitch is greatly effective in reducing the usual stiffness of armored cables of this general type and in easing the handling thereof, both in factory and field.

The modified cable structure shown in Fig. 3 is similar to that shown in Fig. 1 but differs from that in Fig. 1 by having an armoring tape 21', as shown in Fig. 4. The armoring tape of structure 21' has its transverse strip portions 27' disposed at an oblique angle with respect to the center line due to the cutting at an oblique angle of the transverse openings 25'. As appears from Fig. 3, each strip portion 24' is applied about the cable along a helix with a pitch such that one end of each strip becomes aligned with an opposing end of the adjacent strip along the seam to, in effect, form a substantially continuous helical tape about the cable and thus insure a high degree of flexibility. The arrangement at the same time provides for the halfway displacement of the edge sections 28' along one edge relative to those along the opposing edge and thus permits an interleaving of the edge sections similar to that secured by the tape shown in Fig. 1.

The tape construction shown in Fig. 4 serves as an example in showing that the underlying corner 28' of each edge section may be blunted so that it will not tend to cut into the insulation when the cable is bent over the flat side. The

same effect may be secured by rounding the inside corner.

The outer wrappings 31 and 32 may be of fibrous material, such as paper, and are helically applied in tape form. The wrappings may be impregnated or coated with any suitable substance to retard their deterioration.

Cables of the type described above may be used for supplying electric light and power or for communication purposes. Since they are particularly adapted for use in rural areas the distances over which such cables will be used are usually quite considerable. It is therefore of great importance that the cost of manufacture and the cost of transportation and laying be as low as possible.

The self-contained cable structure described above is therefore preferable over cables made in conduits, since the cable may be plowed down in a fast continuous process from reels of reasonable size. The described structure is readily unbent from the reel and laid in sharp curves without danger of the tape buckling and unduly opening along the seam. With one or two wrappings outside the armoring there is no danger of tangling or catching as the cable leaves the reel and the cable may also readily be manipulated by hand without danger of injury.

The described structure lends itself particularly to fast manufacturing as compared with cables having helically armored tapes, since the longitudinal tape may be applied and locked in position as fast as the insulated conductor structure can be produced.

Due to the fact that the finished armoring is in effect broken up into a large number of small shields or strips separated by narrow openings a degree of flexibility may be secured which is at least as high as with helically applied armoring tape.

The absence of buckling of the armoring is especially important in assuring definite protection against gopher attacks and is attained by the introduction of the transverse openings in the material which will permit a slight shifting of the armoring material relatively to the insulation, particularly on the inside of the bend, when the cable is bent. The armored cable may therefore be wound on reasonably small reels without danger of opening up along the seam. Thus storage, transportation and laying is greatly facilitated.

It should be understood that the cable may include more than two conductors arranged in a single layer and may contain more than one such layer of a plurality of conductors. A single conductor cable, circular or flat, is also contemplated within the scope of the invention. The two or more conductors may be twisted together or otherwise intertwined and a concentric arrangement is also contemplated within the scope of the invention.

What is claimed is:

1. A long insulated conductor, an armoring tape forming a generally continuous layer enveloping said conductor, the edges of the armoring tape having transverse cuts at frequent intervals to form a series of edge sections, said edge sections on opposite edges being relatively displaced longitudinally and being long enough to overlap alternately with the displaced edge sections along the opposite sides of the seam.

2. A long insulated conductor, an armoring tape placed tightly about and longitudinally of said insulated conductor and forming a generally continuous layer enveloping said conductor, the edges

of the armoring tape forming a seam parallel with said conductor and having transverse cuts at frequent intervals to form a series of edge sections, said edge sections on opposite sides of said seam being relatively displaced longitudinally and being long enough to overlap with the displaced edge sections along the opposite side of said seam, each of said edge sections underlying one and overlying another of said edge sections on the opposite side of said seam.

3. A long insulated conductor, an armoring tape placed tightly about and longitudinally of said insulated conductor and forming a generally continuous layer enveloping said conductor, said tape armoring forming said generally continuous layer with a longitudinal seam and having a series of edge sections disposed along each side of said seam and alternately interleaved with the edge sections from the opposite sides of said seam.

4. A long insulated conductor, an armoring tape placed tightly about and longitudinally of said insulated conductor and forming a single generally continuous layer enveloping said conductor, said armoring tape having a body portion running longitudinally of said conductor and having edge sections extending transversely of said conductor from the opposite sides of said body portion, said edge sections from each side of said body portion being spaced apart and disposed to form a locking seam together with edge sections along the opposite side of said seam, each of said edge sections partly overlying and partly underlying the opposite side of the seam.

5. A long, substantially oval-shaped, armored conductor structure having two opposed comparatively flat sides and two opposed rounded sides and being particularly adapted for bending over said flat sides on a small radius, including a plurality of insulated conductors and tape armoring closely surrounding said insulated conductors for protection against attacks by rodents, said tape armoring comprising an armoring tape forming a single continuous layer enveloping said plurality of conductors and having a seam disposed along one of said flat sides, said armoring tape having a continuous body portion and a series of edge projections along each edge of said tape, said projections on opposite sides of said seam being relatively displaced longitudinally and alternately interleaved.

6. A long, substantially oval-shaped, armored conductor structure having two opposite comparatively flat sides and two opposed rounded sides and being particularly adapted for bending

over said flat sides on a small radius, including a plurality of insulated conductors and tape armoring closely surrounding said insulated conductors for protection against attacks by rodents, said tape armoring comprising an armoring tape forming a single continuous layer enveloping said plurality of conductors and having a seam disposed along one of said flat sides, said armoring tape having a continuous body portion and the edges of said body portion having transverse cuts at frequent intervals, the cuts along one edge being displaced longitudinally relatively to those along the other edge and being astride the opposed edge between cuts.

7. A long, substantially oval-shaped armored conductor structure having two opposed comparatively flat sides and two opposed rounded sides and being particularly adapted for bending over said flat sides on a small radius, including a plurality of insulated conductors and tape armoring closely surrounding said insulated conductors for protection against attacks by rodents, said tape armoring comprising an armoring tape forming a single continuous layer enveloping said plurality of conductors and having a seam disposed along one of said flat sides, said armoring tape having a continuous body portion with a series of edge projections on each side extending across said seam to interlock the tape edges, each of said edge projections overlying one and underlying another of the projections on the opposite side of said seam.

8. A long, substantially oval-shaped, armored conductor structure having two opposed comparatively flat sides and two opposed rounded sides and being particularly adapted for bending over said flat sides on a small radius, including a plurality of insulated conductors and tape armoring closely surrounding said insulated conductors for protection against attacks by rodents, said tape armoring comprising an armoring tape forming a single continuous layer enveloping said plurality of conductors and having a seam disposed along one of said flat sides, said armoring tape comprising a series of transverse strip portions and short connecting portions between said strip portions for forming a continuous tape structure, each of said strip portions being long enough to overlap across said seam and being disposed along a helix about said conductor structure to have one of its ends partly overlie its other end and partly underlie the end of an adjacent strip portion along said seam.

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