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FLEXIBLE CASING FOR PUSH-PULL CABLE

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Fig. 1.

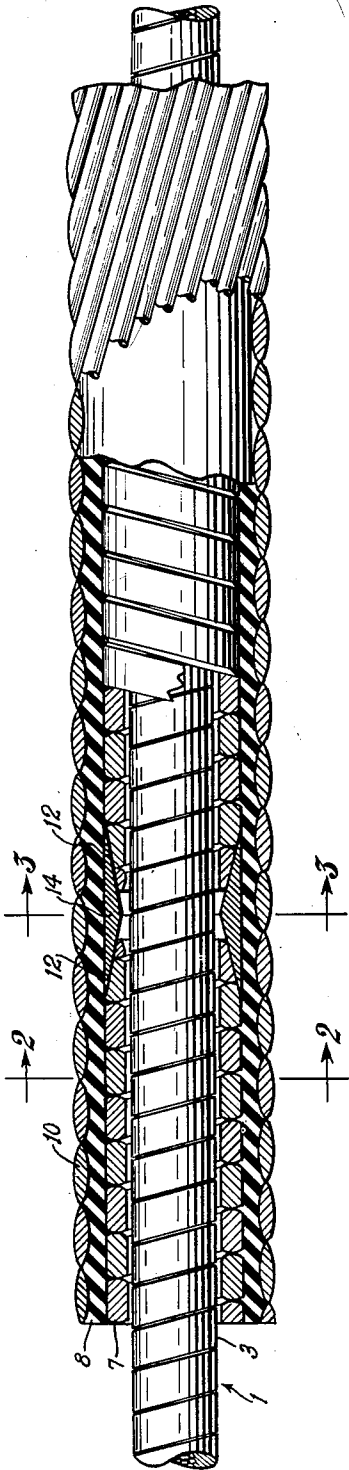


Fig. 3.

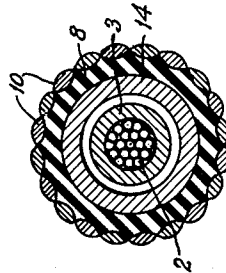
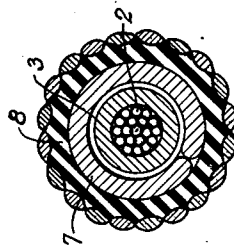


Fig. 2.



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1

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FLEXIBLE CASING FOR PUSH-PULL CABLE

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7 Claims. (Cl. 138—57)

The present invention relates to push-pull cable constructions which comprise the combination of an inner flexible core member slidably received in an outer casing, which is also flexible. The invention has as its particular object the construction of an outer casing which may be made in lengths so that the casing may be supplied to dealers in long coils, from which lengths are cut to meet the needs of the customers.

A casing of the type shown herein comprises an inner lining member formed from a wire of rectangular cross section wrapped in a tight helical coil, the inner surface of which is smooth so as to provide a surface over which the core member may slide easily and without danger of catching, kinking, or buckling. This inner member not only acts as a bearing for the slidable core, but it also takes the compression loads which are placed on the casing.

Around this inner member is a sleeve or casing of yielding, water-proof material, such as rubber or a rubber-like composition, which protects the inner lining and the core and absorbs any compression loads which may be placed on the casing. Surrounding this sleeve is an outer jacket, which is abrasion and wear resistant and also serves as the means for bearing the tensile loads and stresses which are placed on the casing. This outer jacket may be braided over the casing, but it is preferred to employ an outer wrapping composed of a number of steel wires spirally wrapped over the intermediate sleeve under sufficient tension so that the rubber or other yielding, plastic material constituting the intermediate sleeve will be caused to flow into the crevices between the turns of wire constituting the inner lining and into the crevices between the turns of wire constituting the outer wrapping. This construction serves to hold the several constituents of the outer casing together and prevents them from shifting one upon the other.

It is preferred to use for the outer wire wrapping wires which are preformed in the general spiral or convolute form in which they lie, so that they will tend to hold their places in the wrapping and will not fly apart or tend to unwind when the casing is severed into lengths for use.

The inner core may be of any preferred design.

The new form of casing which is shown and described herein is the subject of applicant's copending application, Serial No. 188,809, filed October 6, 1950.

The present invention relates to means for forming casings of the design and type specified in very long lengths, which may be sold in large coils or bundles. The outer wire wrapping and the intermediate rubber sleeve may be formed on a production machine or machines in practically unlimited lengths but the manufacture of the inner lining of the casing presents a wholly different problem for the reason that up to the present it is practical to manufacture the inner spiral wire lining in limited lengths only, of from 100 to 200 feet at the maximum. It is, therefore, necessary to devise a practical means for splicing lengths of the inner lining end to end within the casing in such a manner that the joint shall not affect or hinder in any way the free sliding of the inner core within the casing. For this reason, any splicing means at the adjoining ends of sections of the inner lining must assure absolute alignment of the internal bores of two adjoining sections of the lining. The splicing means should not create a bulge at the point where the sections are spliced. It should also be

2

simple, practical, and inexpensive and should be of a type and form which may be fed continuously through the machine which applies the plastic intermediate layer and the outer wire covering, so that the finished product may be made in practically unlimited lengths without interrupting the operation of the mechanism for applying the intermediate sleeve and the outer wrapping.

It will be noted that in the finished casing the inner lining takes the compression loads while the outer wrapping takes all of the tension loads, so that after the casing is completed no tension loads whatever are exerted on the inner lining.

The problems and requirements which have been outlined above are all met in a satisfactory manner by the device shown herein, which illustrates the invention in its best known and preferred form, without, however, limiting the invention to the details of the construction as shown and described herein.

In the drawings:

Fig. 1 is a view of a length of the cable assembly showing a point at which sections of the inner casing or lining are spliced. This view is broken away at various points to illustrate the construction.

Fig. 2 is a section on the line 2—2 of Fig. 1.

Fig. 3 is a section on the line 3—3 of Fig. 1.

In the form of the invention shown herein, the inner sliding core member is indicated as a whole by the numeral 1. As indicated above, the inner core member may be of any design, but it is preferred to employ what is known in the trade as the "high efficiency" type of core in which a bundle of small wires 2, usually 19 in number, are cabled or bundled together and held in a firm but flexible column by an outer wrapping 3. This wrapping is a spirally coiled wire substantially rectangular in cross section but with rounded edges to permit the core to flex. The wrapping is applied about the inner cable 1 and is then pressed or swaged onto the inner cable, so that it interlocks therewith. The outer surface of the core is smooth so that it will slide readily within the casing, it being customary to coat the core with a lubricant. It will be seen that while the outer surface of the core is generally smooth, there are crevices along the core and it is therefore necessary that the interior of the casing be perfectly smooth so as not to present any points on which the core may catch; otherwise, the smooth and efficient operation of the cable will be interfered with.

The outer casing consists of the inner lining 7 which is composed of a wire substantially rectangular in cross section and coiled so that the flat inner surface of the wire forms a smooth bearing surface over which the core will slide. The edges of the wire which constitutes the coil are rounded as shown so as to permit the necessary flexibility of the casing when it is bent around obstructions or corners of the structure in which the cable is installed.

As indicated in Fig. 1, these lining members 7 are made in coils in individual lengths, usually not to exceed 200 feet, and are assembled end to end in the finished casing so that the bores of adjacent coils are in absolute register. Any irregularities of alignment would present obstructions in the path of the core which would interfere with the free movement of the core in the casing.

Surrounding the lining is the intermediate sleeve 8 of rubber or similar yielding plastic and water-proof material. There are a number of recently developed artificial resins and artificial rubber-like materials which may be used in place of rubber. Any of these materials which are suitable for the purpose should be capable of extrusion in any standard form of tubing machine, and then should be vulcanizable or thermo-setting so that the sleeve 8 may be cured in place.

Around the outside of the sleeve 8 is applied the outer wire wrapping 10. As noted above, this wrapping is applied about the sleeve under sufficient tension so that it will embed itself in the soft uncured sleeve 8, the tension placed upon the wires also causing the material of the sleeve 8 to penetrate into the interstices between the spiral turns on the outside of the lining 7. Also, as noted above, the wires constituting the wrapping 10 are preferably preformed in the shape or approximately

3

the shape which they occupy in the finished casing. The wires are applied with a relatively long spiral so that they will carry all tensile stresses to which the casing may be subjected. It will also be noted that the spiral of the outer wrapping and the spiral of the inner lining are on different hands so that one spiral offsets the other, thus reducing any tendency of the casing to coil upon itself.

In making up a casing of the type specified, sections of the inner lining member are fed end to end into the machine which applies the intermediate sleeve 8 and then the outer wrapping 10. This feeding is done by pushing one section of the inner lining against the next preceding section, so that the casing is propelled through the machine by the force exerted on the incoming section of the lining.

Both ends of each section of a coil of wire constituting the inner lining are formed on long smooth tapers 12, which are ground thereon on a centerless grinder or similar machine tool and located in the long V-shaped recess or groove between sections is a continuous ring or collar 14, the inner surfaces of which are accurately ground to fit the tapers on two adjoining sections. The outer diameter of this ring or collar 14 is the same, or substantially the same, as the outer diameter of the coil so that the thickness of the layer of plastic material around this ring will be the same as at all other points on the casing. This also permits the joint or splice to pass through the center of the tubing machine with the sections. It will be noted that the inner crown or ridge of the ring 14 is set back slightly beyond the inner periphery of the sections 7 so that it will not catch on the core.

This tapered ring will hold two sections of the inner lining in alignment so that the bores of the sections are in perfect register by the endwise pressure exerted on the sections as they are fed into the tubing machine which applies the intermediate sleeve 8. When the outer wrapping 10 is applied the entire casing assembly will be held together and there is no tendency of the sections to separate because all tensile loads are taken up by the outer wrapping.

The casing assembly may be cured by passing the assembled casing through a long heating and curing oven, or the casing may now be coiled up and cured in any type of autoclave or heater without possibility of the sections 7 separating.

If in use, the casing assembly happens to be cut at or near a splicing ring 10, any small residue of a coil 7 exposed at this point may be removed and the resulting clearance at this point will in no manner affect the efficient performance of the assembly. Or, any residue of a coil may be left in place without harm. In installing the casing, should a bend occur which includes one of the splicing rings, the tapered surfaces of the ring will permit the coils of wire to adapt themselves to the curvature.

What is claimed is:

1. A flexible outer casing for push-pull cable assemblies comprising an inner lining having a smooth inner surface over which the core of the push-pull cable assembly is adapted to slide, said inner lining being adapted to withstand compression loads, and being formed of a plurality of aligned sections, each of said sections being formed of a single wire substantially rectangular in cross-section and wound in a tight spiral of relatively low pitch, the ends of adjacent sections being tapered, an endless collar having oppositely tapered inner surfaces fitted over the tapered ends of adjacent aligned sections and with its outer surface flush with the outer surfaces of the adjacent coils, a continuous sleeve of yielding material surrounding the outer surfaces of the aligned sections and the collar, and an outer wrapping surrounding the sleeve and a plurality of sections of the inner

4

lining, said outer wrapping consisting of wires wrapped in a relatively steep spiral and adapted to withstand tension loads.

2. A flexible outer casing for push-pull cable assemblies comprising an inner lining having a smooth inner surface over which the core of the push-pull cable assembly is adapted to slide, said inner lining being composed of a plurality of aligned sections, each of said sections being formed of a coil of wire, the ends of adjacent sections being tapered, a collar having oppositely tapered inner surfaces fitted over the tapered ends of adjacent aligned sections, a continuous sleeve of yielding material surrounding the outer surfaces of aligned sections and the collar, and an outer casing composed of wires spirally wrapped about the outer surface of the sleeve and extending over a plurality of sections of the inner lining.

3. A flexible casing of the type described in claim 2 in which the wire comprising each section of the inner lining is substantially rectangular in cross-section and wound in a spiral of relatively low pitch with the coils of wire in contact.

4. A flexible casing of the type described in claim 2 in which the wires comprising the outer casing are wrapped in a relatively high pitch and adapted to withstand tension loads.

5. A flexible tubular casing comprising an outer jacket composed of wire strands spirally laid at a relatively high pitch, an inner lining within a single length of the outer jacket, said inner lining being composed of a plurality of short sections in end to end relation, said sections being composed of wire spirally laid at a relatively low pitch, the ends of each section of the inner lining being tapered, a collar located between two adjacent sections, said collar having tapered inner surfaces having a sliding fit with the tapered surfaces on the inner lining sections, and an intermediate layer of yielding material between the outer jacket and the inner lining.

6. A flexible tubular casing comprising an outer jacket composed of wire strands spirally laid at a relatively high pitch, an inner lining within a single length of the outer jacket, said inner lining being composed of a plurality of short sections in end to end relation, said sections being composed of wire spirally laid at a relatively low pitch, the ends of each section of the inner lining being tapered, a collar located between two adjacent sections, said collar having tapered inner surfaces having a sliding fit with the tapered surfaces on the inner lining sections, and an intermediate layer of vulcanized rubber-like material between the jacket and the inner lining.

7. A flexible tubular casing comprising an outer jacket composed of wire strands spirally laid at a relatively high pitch, an inner lining composed of a plurality of sections in a single length of the outer jacket, said sections being composed of wire spirally laid at a relatively low pitch, a splicing member surrounding the gap between two adjacent sections, said splicing member having a sliding fit with the ends of the sections, and an intermediate layer of yielding material between the outer jacket and the inner lining.

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