Jan. 24, 1967 R. L. PAYER ETAL 3,299,626

CABLE ATTACHMENT DEVICE AND METHOD

Filed Aug. 22, 1963 4 Sheets-Sheet 1

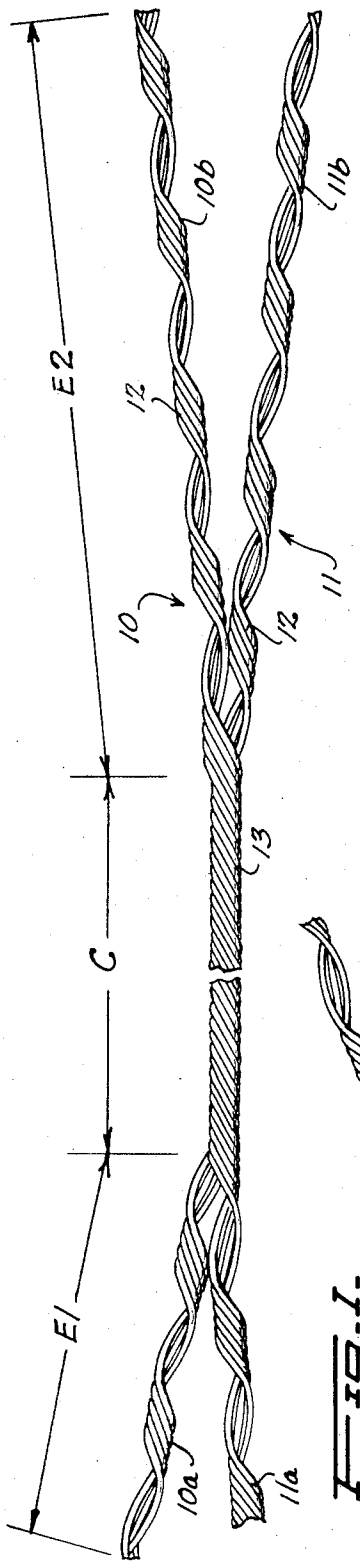


FIG. 1.

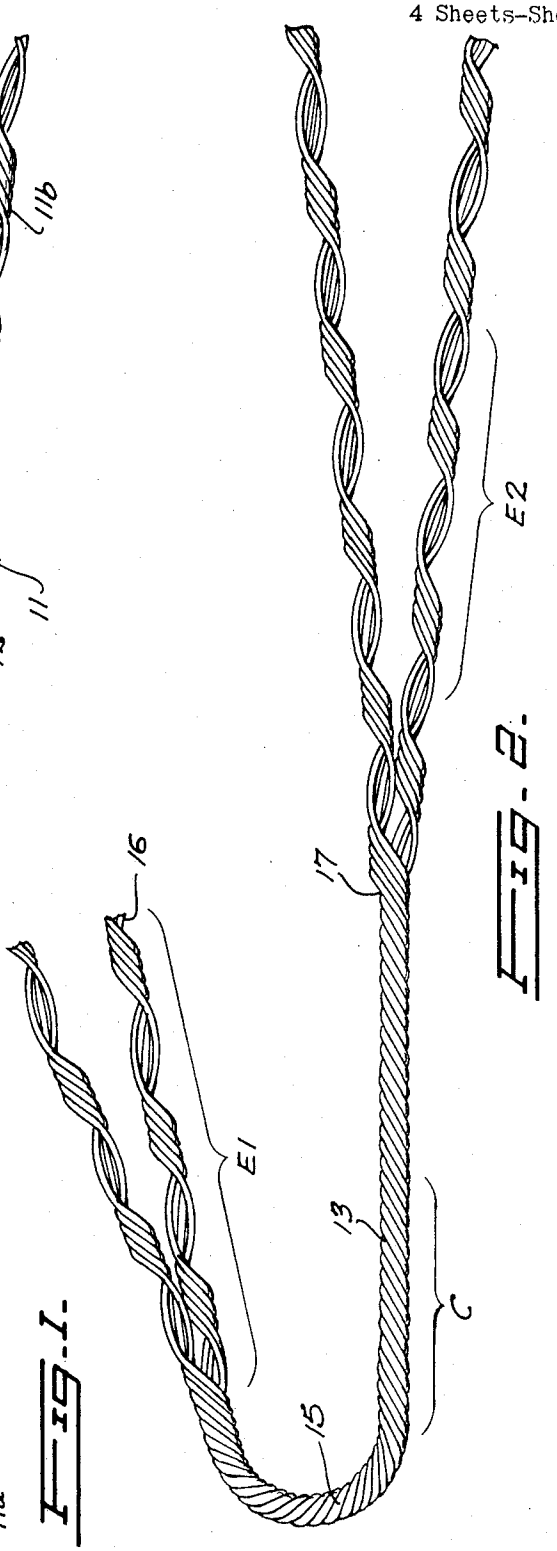


FIG. 2.

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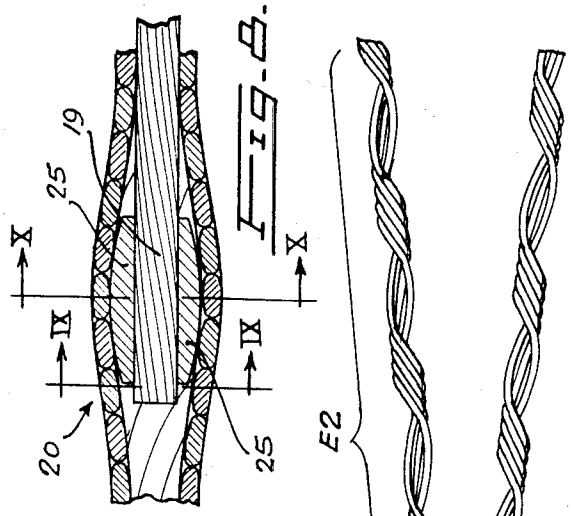


FIG. 8.

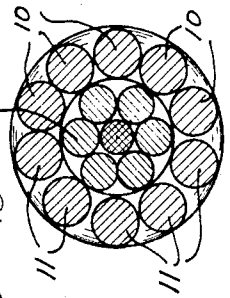


FIG. 7.

FIG. 3.

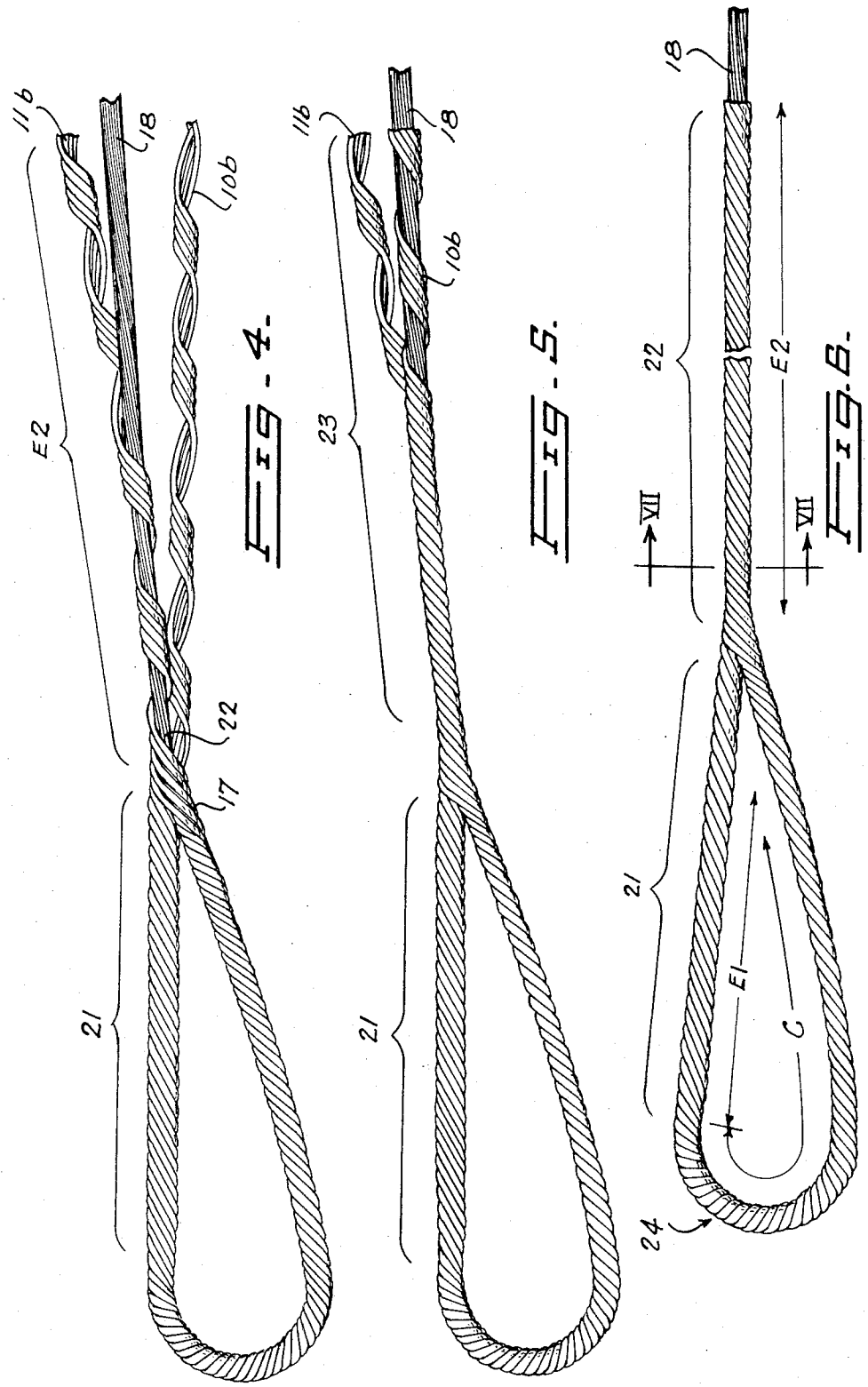


FIG. 13.

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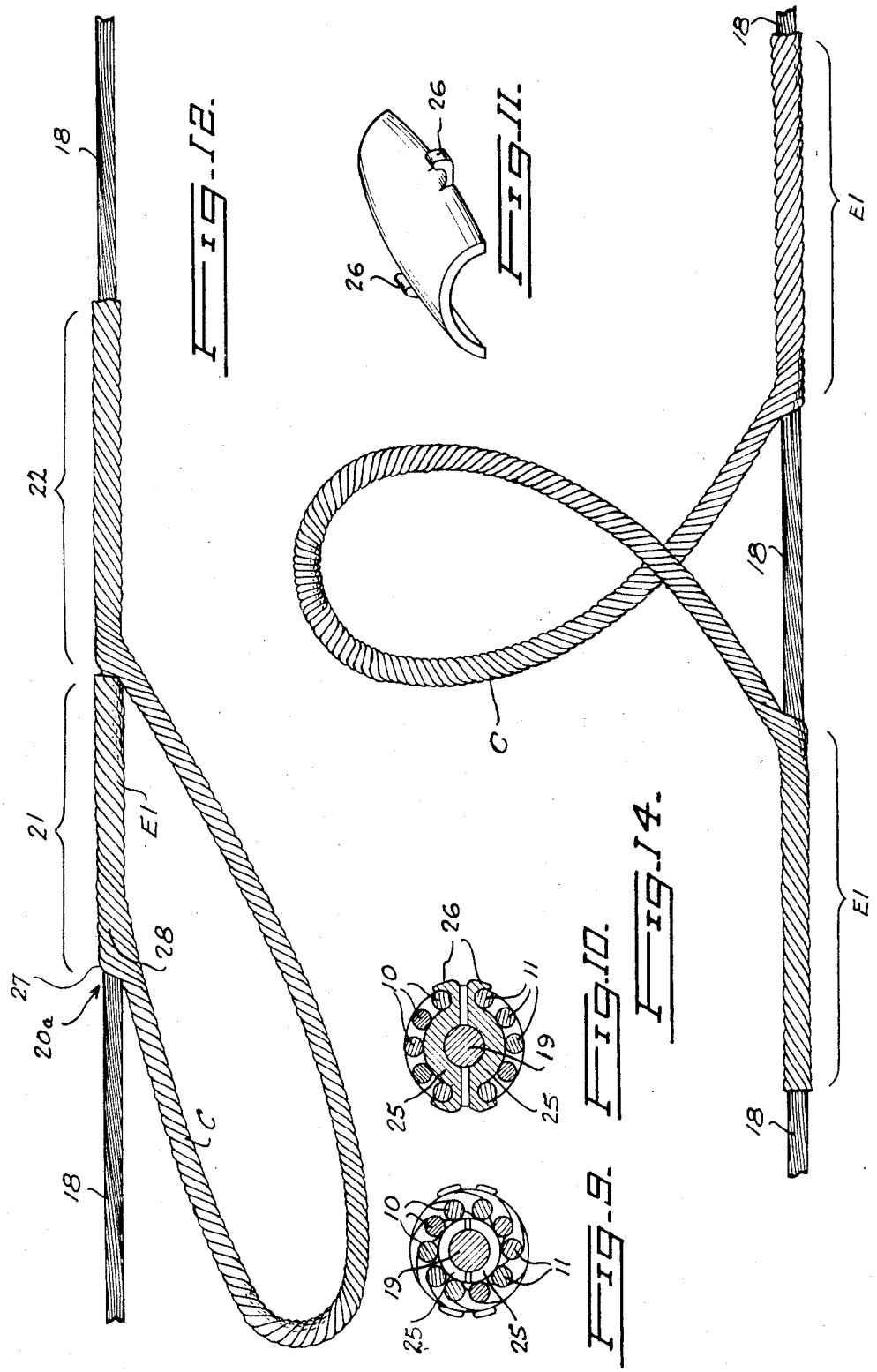


Fig. 12.

Fig. 11.

Fig. 10.

Fig. 14.

Fig. 9.

United States Patent Office

3,299,626

Patented Jan. 24, 1967

3,299,626

CABLE ATTACHMENT DEVICE AND METHOD

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Filed Aug. 22, 1963, Ser. No. 303,778

8 Claims. (Cl. 57—145)

This invention relates to a cable attachment device and method for constructing cable attachament loops of the type used for connecting a cable to another structure, usually a fixed structure. When the cable terminates at the attachment loop, the latter is ofen called a dead-end.

The art of forming dead-ends in transmission lines and guy wires using helically-preformed rods has been developed to the extent that so-called half-lays of such rods are now available as standard hardware items. A half-lay consists of a plurality of wire rods each pre-formed into a helical configuration with the same pitch length, internal diameter and direction of lay. These rods are bunched together and lightly secured to one another by glue to enable them to be handled as a single member, a so-called half-lay. When such a preformed half-lay is wound around a cable it will exert a grip thereon enabling it to transmit a tensional force to the cable. The internal diameter of the half-lay is preferably made slightly less than the external diameter of the cable so that the gripping action will be firm. It is also preferable that the pitch length of the half-lay be shorter than the pitch length of the outer strands of the cable, as this facilitates a firm binding action between the cable and the half-lay wrapped around it.

As the name implies a half-lay is designed to occupy a half of a full cylindrilcal surface, and it is known to wrap a pair of half-lays around the same length of cable, with the second half-lay occupying the spaces between convolutions of the first half-lay so as completely, or nearly completely, to encircle the cable and form a so-called whole-lay. It may, however, be convenient to leave small gaps between the two half-lays for ease of application and removal, for which purpose each half-lay may in fact be rather less than a true half-lay. The number of rods required to make up a whole-lay will vary with dimensions. Assume that, for a given typical set of dimensions, ten rods constitute a whole-lay. A half-lay will then comprise five rods, although there may at times be convenience in using only four. The grip on the cable will not be quite as good for a given length when only four rods are used, but the ease of application may be improved. In the description and claims wihch follow, when reference is made to substantially a half-lay, it is intended to include pre-formed helical members that are not full half-lays.

Another consideration, when a pair of half-lays (or substantially half-lays) are to be intertwisted with each other, either alone or around a cable, is that they should be complementary. Thus, although it will normally be convenient to use half-lays that are the same (for example both of five rods or both of four rods) it is within the scope of the invention to use dissimilar numbers of rods. For example one half-lay may have five rods, while the other has four or even three (still assuming that ten rods constitute a whole-lay). One half-lay may even have six rods, provided of course the other half-lay does not have more than four. It is this relationship that is referred to in the claims as "a pair of complementary members each constituting substantially a half-lay".

It is further within the scope of the present invention that the number of rods in a particular half-lay member may vary along the length of the member. It could, for example, have five rods over its central portion, where (as will appear below) a pair of such members are intertwisted

in the absence of a cable to form a whole-lay portion, while having four rods at each of its end portions that are wrapped around a cable.

As a practical commerical matter these modfications and variations provide little advantage in the normal case. Indeed they introduce undesirable complexity, and such possibilities are mentioned not to suggest that they represent normally desirable variations but in order to make it clear that they are within the scope of the invention, as there may be special instances where such modifications would be economically justified. In the specific description which follows the preferred form of half-lay member built up from five rods is the form illustrated, it being still assumed that the dimensions are such that ten rods make a whole-lay.

An object of the invention is to provide an improved method of assembling a closed attachment loop on a cable using a pair of half-lay members. This loop may be formed as a terminal or dead-end at an end of the cable, or may be attached to the side of a portion of the cable removed from an end thereof.

Specifically, it is an object of the invention to provide an improved attachment method which furnishes an increased area of contact with a cable (and hence improved gripping properties) for a given length of pre-formed helical members, in comparison with methods previously proposed. A further object is to furnish a pre-formed attachement device consisting of two half-lay members that will be especially convenient to assemble with a cable in the field to form an attachment loop. The invention also relates to the attachment loop when formed.

Various embodiments of the invention are illustrated by way of example in the accompanying drawings. It is to be understood that the scope of the invention is not restricted to the specific details of these embodiments, being determined by the appended claims only.

In the drawings:

FIGURE 1 is a view of a cable attachment device according to the invention;

FIGURE 2 shows the device of FIGURE 1 after a bend has been inserted on it, preliminary to its assembly with a cable;

FIGURE 3 shows the first step in the assembly of the device of FIGURES 1 and 2 with a cable;

FIGURE 4 shows a later stage in this assembly process;

FIGURE 5 shows a yet a later stage; and

FIGURE 6 shows the final assembly.

FIGURE 7 is a section on VII—VII in FIGURE 6;

FIGURE 8 is a central section showing a modification;

FIGURE 9 is a section on IX—IX of FIGURE 8;

FIGURE 10 is a section on X—X of FIGURE 8;

modification of FIGURE 8;

FIGURE 12 is a view of yet another modification;

FIGURE 13 is a fragmentary enlarged view of a portion of the device of FIGURE 12 prior to assembly; and

FIGURE 14 is a further modification.

The cable attachment device illustrated in FIGURE 1 consists of two half-lay members **10** and **11** each consisting of a plurality of helically pre-formed rods **12** glued together in the manner already described, although, as indicated below, gluing may be dispensed with. The rods **12** have a common pitch length which is chosen to be less than the pitch length of the cable with which the device is to be employed. Along a central portion C the two half-lays **10**, **11** are intertwisted to form a hollow whole-lay **13**. At end portions E1 and E2, the half-lay end portions **10***a*, **11***a*, **10***b* and **11***b* remain independent of each other.

The first step in the preferred method of use of this device is to bend it at **15** in the manner shown in FIGURE 2, such bend being made in the central, whole-lay portion C. The position of this bend **15** is so chosen

that the end portion E1 terminates at 16 approximately in alignment with the junction 17 of end portion E2 and central portion C.

As FIGURE 3 demonstrates, a cable 18 is now introduced into the device with its end 19 located at the junction 20 of portions C and E1. The half-lays 10*a* and 11*a* of this end portion E1 are then wrapped around the cable 18 to form the wrapped portion 21 shown in FIGURE 4. The point of commencement 17 of the other end portion E2 is then brought into contact with the cable 18 at 22 and the half-lays 10*b*, 11*b* of end portion E2 are wrapped around the cable along portion 23 as shown in FIGURES 4 and 5, to produce the final attachment loop 24 shown in FIGURE 6. Alternatively, if desired, the end portion E2 could commence further along the cable than the end of end portion E1. There could then be a length of unwrapped cable between the two wrapped end portions E1 and E2.

The relative and actual lengths of the central and end portions C, E1 and E2 will be chosen to suit individual circumstances. The total gripping strength of the device will be approximately proportional to E1+E2, the total length of the end portions engaging the cable. The size of the loop 24 will be dependent on the length C+E1. It has been found in practice that for a typically required gripping strength and a typical loop size, the total length of the device E1+E2+C tends to be less than with prior devices for a similar purpose.

It should be mentioned that grit will be applied to the inside surface of each half-lay before it is wrapped around the cable, in accordance with prior practice, to enhance the gripping effect.

If it is desired to produce an increased gripping force on the end 19 of the cable, in comparison with that applied elsewhere, and in particular to apply additional pressure to the core strand of a wire rope (manila core and steel outer strands) or a bimetallic cable (steel core and aluminum outer strands), a shim may be secured to an inside surface of at least one of the half-lays. For example, the shims 25 may be glued to the inside surfaces of the half-lay members, or secured thereto by other means, or both. An example of another method of securing the shims 25 in position is a pair of ears 26 that clip over the rods of the half-lay members, as shown in FIGURE 10. Additionally a pair of shims 25 may be applied in a like manner to the cable at the point 22 where the end portion E2 begins to be wrapped around the cable.

FIGURE 12 shows another modification in which the loop is attached to a length of the cable 18 removed from an end. Wrapped portions 21 and 22 are employed, as before, the assembly having been put together in the same manner as already described, except that the junction 20*a* between the central and end portions C and E1 of the device has been modified before wrapping around the cable commenced. As best seen from FIGURE 13, the two half-lay members are upset at 27 and 28 in the initial manufacture of the device to provide additional space for the cable 18 to pass through.

Although the preceding description has setout a particular sequence for carrying out the assembly steps, and this is the preferred sequence, it will be apparent that other sequences are possible. For example, one of the end portions, say the end portion E1 could be wrapped around the cable to form wrapped portion 21 before the central whole-lay portion C is formed. It is not essential that the central whole-lay portion C be formed before the loop is formed, although it is convenient to do so. Obviously the loop must be formed before the second of the end portions to be wrapped around the cable is so wrapped.

FIGURE 14 shows a modification in which the central portion C is crossed over itself and the two ends E1 and E2 are wrapped around the cable extending in opposite directions away from each other.

A further advantage of the invention is that it will no longer be essential to employ glue to secure the individual wire rods together when complete half-lays are used. In the past such gluing has been necessary, because the product comprised only a half-lay. The cable attachment device that will constitute the main commercial product of the present invention will always include the central whole-lay portion, and a whole-lay forms a self-supported hollow body in which gluing of the individual rods can be dispensed with.

We claim:

1. A method of securing a closed attachment loop to a cable comprising
   (a) taking a pair of complementary pre-formed elongated helical members each constituting substantially a half-lay,
   (b) and assembling said members with the cable by the following steps,
      (i) intertwisting said members with each other intermediate their ends to form substantially a central whole-lay portion,
      (ii) bending said central portion to form a loop,
      (iii) wrapping first end portions of said members projecting beyond one end of said central whole-lay portion in tight intertwisted relationship around a first length of the cable,
      (iv) and wrapping second end portions of said members projecting beyond the other end of said central whole-lay portion in tight intertwisted relationship around a second length of the cable,
   (c) said assembly steps being carried out in any sequence provided step (ii) precedes the second performed of steps (iii) and (iv), wherein
   (d) said central portion is bent back on itself,
   (e) said first end portions are wrapped along the first cable length in a selected direction away from the central portion,
   (f) and the second end portions are wrapped along the second cable length in the same direction away from the central portion commencing substantially adjacent the ends of the first end portions.

2. A method of securing a closed attachment loop to a length of cable comprising:
   (a) taking a pair of complementary preformed elongated helical members each constituting substantially a half-lay,
   (b) intertwisting said members with each other intermediate their ends to form substantially a whole-lay central portion, end portions of said members extending from each end of said central portion unengaged by one another,
   (c) bending said central portion into a loop to position the free end of a first pair of said end portions generally in alignment with the junction between the central portion and the other pair of said end portions,
   (d) and carrying out steps (e) and (f) in either sequence, steps (e) and (f) comprising,
   (e) wrapping the first pair of end portions around the cable in tight intertwisted relationship,
   (f) and wrapping the second pair of end portions around the cable in tight intertwisted relationship beyond the wrapping location on the cable of the first pair of end portions, wherein
   (g) said first pair of end portions are wrapped along the cable in a selected direction away from the central portion,
   (h) and the second pair of end portions are wrapped along the cable in the same direction away from the central portion commencing adjacent the ends of the first pair of end portions.

3. A closed cable attachment loop comprising
   (a) a length of cable,
   (b) two preformed elongated helical members each comprising substantially a half-lay,
   (c) complementary first portions of said members be-

ing wrapped in intertwisted relationship around a first length of the cable,

(d) complementary second portions of said members comprising continuations of said first portions being intertwisted with each other displaced from the cable to form substantially a whole-lay portion,

(e) said whole-lay portion being bent into a loop,

(f) and complementary third portions of said members comprising continuations of said second portions being wrapped in tight intertwisting relationship around a second length of the cable to close the loop, wherein the ends of said third portions adjoining the second portions engage the cable in the vicinity of the ends of the first portions remote from their junctions with the second portions.

4. A method according to claim 2, wherein said first pair of end portions are wrapped along the cable commencing at an end of the cable.

5. A method according to claim 2, wherein said first pair of end portions are wrapped along the cable commencing at a position removed from an end of the cable.

6. A closed cable attachment loop according to claim 3, wherein said first portions engage the cable with their junctions with the second portions located at an end of the cable.

7. A closed cable attachment loop according to claim 6, including shim means disposed between said cable end and the portions of the helical members wrapped around said end to increase the gripping force of said members on said end in relation to the remainder of the cable.

8. A closed cable attachment loop according to claim 3, wherein said first portions engage the cable with their junctions with the second portions located at a position on the cable removed from an end thereof, said members being upset at this location to facilitate passage of the cable through a side of the intertwisted members.

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MERVIN STEIN, *Primary Examiner.*