

[54] OPEN MESH CABLE GRIP

[72] Inventor: Alfred W. Fidrych, Stonington, Conn.

[73] Assignee: Harvey Hubbell Incorporated, Bridgeport, Conn.

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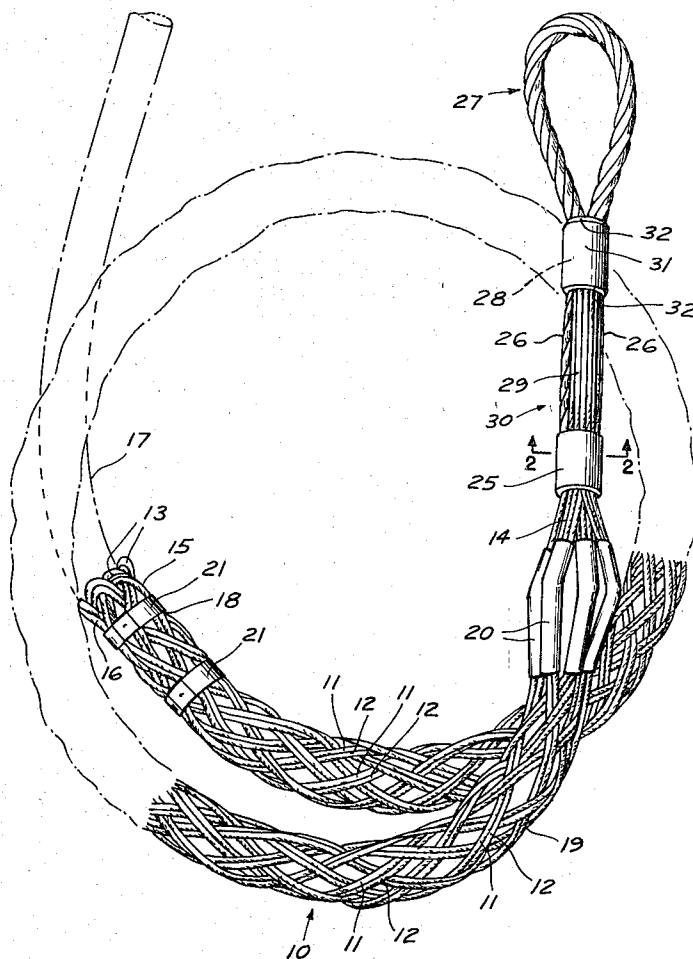
Primary Examiner—John Petrakes

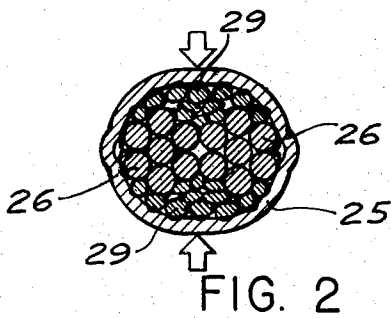
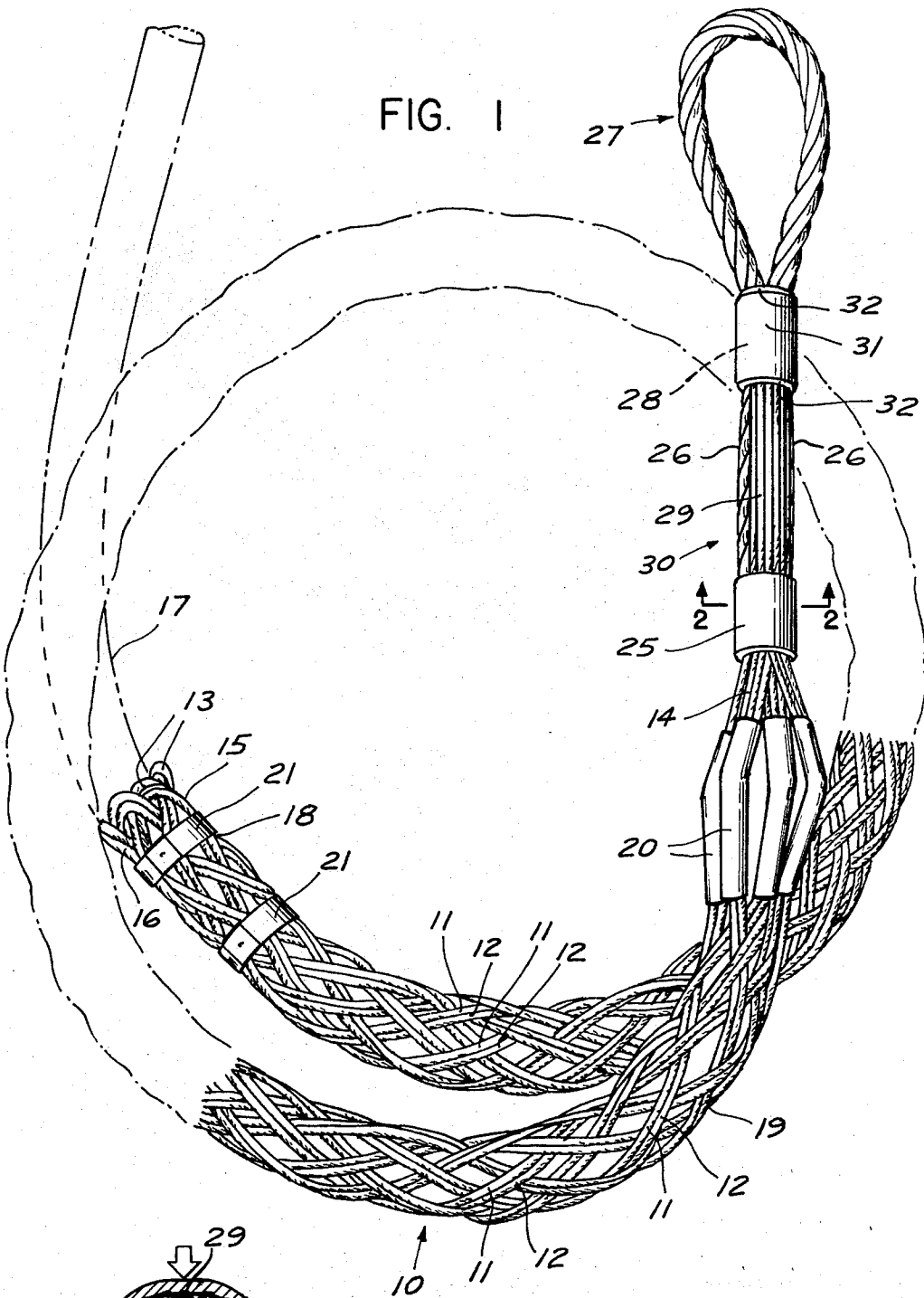
Attorney—Sylvester J. Liddy, John J. Hart, Joe E. Daniels and Charles E. Baxley

[57] ABSTRACT

An open mesh wire cable grip having a grip body composed of paired strands woven over one and under one at the cable receiving end thereof and in certain cases at also the draft end thereof, and woven over two and under two between the ends thereof. The strands at the draft end of the grip body are gathered into a plurality of branches which form the shoulder of the grip, and these branches are further divided into two groups which are bound together with the ends of the draft loop by two steel bands to form a stiffened draft shank. The outermost band forming such shank is enclosed by a tube of heat shrinkable plastic to cover any protruding strand ends. The plastic tube may be provided with a distinctive color, or an additional distinctively colored sleeve may be secured to the grip's draft end to designate the size of the grip.

14 Claims, 5 Drawing Figures





INVENTOR.
ALFRED W. FIDRYCH
BY

John J. Hart

ATTORNEY

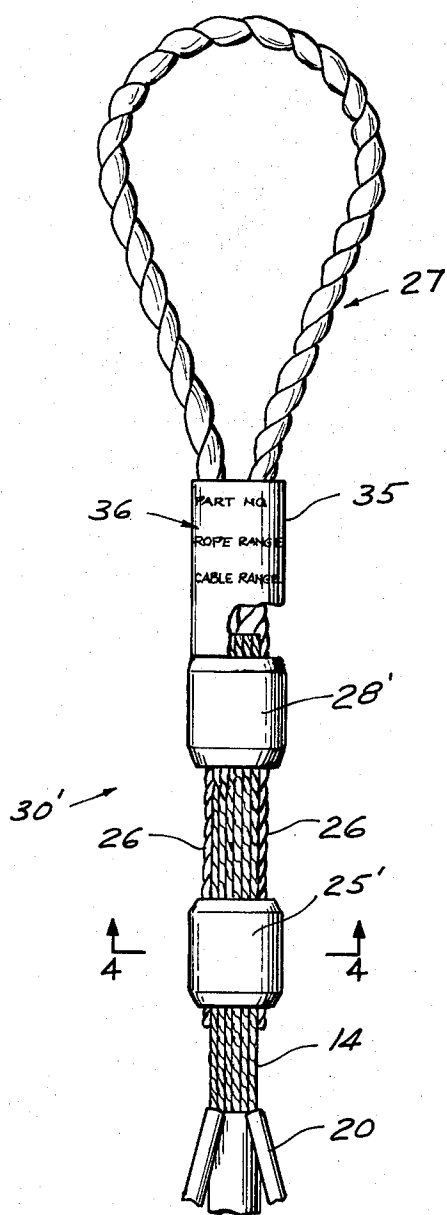


FIG. 3

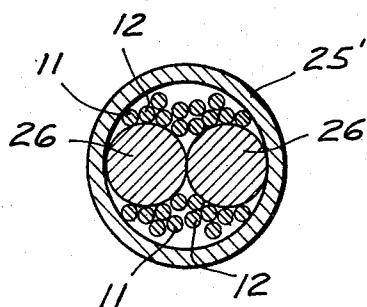


FIG. 4

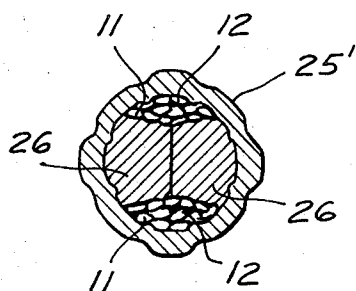


FIG. 5

INVENTOR.

ALFRED W. FIDRYCH

BY

Alfred W. Fidrych
ATTORNEY

OPEN MESH CABLE GRIP

This invention relates to open-mesh woven wire grips of the type used for drawing bare or insulated electric conductors or cables and wire or synthetic ropes through underground conduits or along overhead supports, and for holding and supporting such cables and ropes.

Gripping devices of the indicated type have a tubular body portion provided at one end with a draft device to enable the grip to support or draw the cable or rope and having its other end open to enable the cable or rope to be inserted therein. When inserting such an object thereinto the wire strands in the open-mesh tubular body portion are initially expanded radially by endwise compression. When the compression force is removed, the tubular body portion contracts to frictionally engage the periphery of the object and such grip on the object will become firmer the greater any forces are applied tending to separate the body portion from the object.

It has been found that grips currently used in overhead line stringing have too small a factor of safety in ultimate tensile strength under the higher work loads to which they are subjected in today's operations. Previously, in line stringing jobs, pulling lengths of 5,000 feet were typical. In line stringing, the real cost involved is in the set-up time which is measured in days, for the actual pull may be less than an hour. Thus, the fewer the set-ups that are required in a line stringing job, the less days it will take to complete it. For this reason high line contractors and utilities now have lengthened the usual pull to 10,000 feet and the trend is toward 20,000 feet. These longer pulls require larger cables and these two factors result in substantially higher work loads on the grips. This problem cannot be taken care of by merely increasing the strength of the grip for it has been found that when it is attempted to strengthen a normally woven grip by increasing the size of the wire in the mesh to take care of greater work loads, this increased strength is usually achieved at the sacrifice of flexibility of the grip, and of its ability to reduce in internal diameter and adequately grip the surface of the conductor or rope. This is especially noticeable when an attempt is made to use such a strengthened grip on synthetic rope of the type which is now being used in line stringing operations to an increasing extent, since rope of this type is readily compressed and will elongate while under tension, causing a substantial reduction in diameter. It has been found therefore, that in addition to possessing increased strength, the grip also must be capable of reducing in diameter along with the rope or it will lose contact with the rope, allowing it to slip out of the grip. This can be extremely hazardous when pulls are made over energized lines or over populated areas and busy highways. Also, draft loop pulling eyes, of the flexible type, in conventional grips are limited in strength so that in many cases, the ultimate strength of the wire mesh cannot be utilized. A further problem that is encountered in line stringing operations, is the ready selection of the proper grip for a particular job. The selection of the wrong grip at the job-site may result in a dropped cable with thousands of dollars of conductor loss and possible injury to valuable personnel. Under today's method of using on the job hard to distinguish grips of many sizes such a hazard is a distinct possibility.

One of the objects of this invention is to provide an efficient wire grip having such greater grip strength that it is enabled to pull greater loads over longer overhead spans with fewer set-up stations, thereby making it possible to materially reduce set-up costs.

Another object of the invention is to provide a wire grip of increased strength yet having the flexibility of known grips.

A further object of the invention is to provide a wire grip having improved gripping ability for all pulling operations involving bare or insulated conductors and cables, wire rope and the new synthetic ropes which have smooth surfaces and tend to stretch under tension with a consequent decrease in diameter.

Another object of the invention is to provide a wire grip capable of firmly holding bare or insulated conductors and ca-

bles, wire rope and synthetic rope of diameters smaller than a conventional grip of the same nominal size can safely hold.

A still further object of the invention is to provide an improved wire grip capable of effectively pulling conductors and ropes within a relatively wide diameter range so that a relatively few sizes of grips can cover all utility and high line stringing requirements.

A further object of the invention is to provide a grip which will greatly reduce the number of types of grips required to meet all line stringing requirements and which can be identified and selected fast and accurately.

Still another object of the invention is to provide a flexible pulling eye to be equal to or greater in tensile strength than the mesh of the grip.

Another object of the invention is to provide a high strength wire grip having an endless open receiving end free of protruding twisted or tubular ends.

Other objects of the invention, as well as the advantages and features of novelty of the improved grip thereof, will become apparent from the following description, when read in connection with the accompanying drawings, in which

FIG. 1 is a plan view of an improved, extra high strength wire grip embodying the invention;

FIG. 2 is a transverse sectional view taken along the line 2—2 of FIG. 1 to illustrate a step in the formation of the band shown;

FIG. 3 is a plan view partly in section of the draft shank and loop of a modified form of grip embodying the invention;

FIG. 4 is a sectional view looking along the line 4—4 in FIG. 3 and showing the condition of the parts before compression of the band; and

FIG. 5 is a view similar to FIG. 4 and showing the condition of the parts after compression of the band is completed.

As is shown in FIG. 1 of the drawings, the grip of this invention is composed of a tubular gripping body 10 made by taking a plurality of pairs of strands of wire and weaving the paired strands to form an open-mesh fabric wherein the strands are helically arranged and relatively movable at the crossings thereof to permit an expansion or contraction of such body in a manner well known to those skilled in the art. In constructing the grip body 10 each pair of strands constituted of two strands designated 11 and 12 is bent or folded double so as to provide at the object receiving end of such body a series of double loops 13 arranged in substantially uniformly spaced relation about a common axis. The free ends of the paired strands are then interlaced or interwoven together in the nature of a double strand weave so as to provide a tubular grip body of the desired length. At the opposite or draft end of the grip body 10, the converging end portions of one free end of two pairs of strands are gathered to form circumferentially arranged branches 14 each containing four strand end portions.

In weaving the tubular grip body 10, the two sides or free ends of the pairs of strands are wound spirally in opposite directions from the loops 13 to initially form adjacent to such loops for one or two spaces a one over and one under weave designated 15. The weave 15 is such that the spaces or mesh 16 produced thereby resist radial contraction to a higher degree than the weave in the body of the grip beyond the point 18, so that such portion 15 of the grip body, in the relaxed condition of such body, will remain radially expanded, to a greater extent than the adjacent body portion of different weave, thereby providing the entry end of the grip body with a funnel-like shape. Further, when longitudinal force is exerted on the entry end of the grip, as by the insertion of the end of a cable 17, such portion 15 of the grip body will cause the adjacent body portion to initially expand thereby facilitating the entry of the cable into the body portion. From the point 18 on the grip body, the free ends of the pairs of strands are then woven over two and under two crossing free ends throughout the major portion of the length of the grip body and until about the point 19 on the grip body which is about two or three spaces from the place at which the branches 14 are formed at the draft end of the grip. From the point 19, the free

ends of the pairs of strands are woven over one and under one to the entry ends of the elongated tubes 20 at the junctures of the branches 14 with the grip body. The tubes 20 are made of any suitable material, such as metal, and are bent in a convex fashion to provide a protective cover or guard at the draft end of the grip body against wear of the strands at such end as the gripping device as a whole is drawn through underground conduits and over sheaves in overhead installations.

It will be understood from the foregoing that the entry end of the grip body 10 is formed at the object receiving end thereof to cause it to form a funnel-shaped entry which when a cable or rope is inserted therein facilitates the insertion of the cable or rope into the grip body. When the pressure employed in inserting such cable or rope into the grip is released, the object receiving end of the grip will contract about the object and anchor the grip therein. This end anchorage of the grip on the object can be made more positive by tightly securing around the object receiving end of the grip, one or more fastening bands 21 made of thin sheet metal and of a type known to the art. The over two and under two weave of paired strands between the points 18 and 19 and forming the major portion of the grip permits the contact of more metal with the surface of the cable or rope and enables the grip to exert greater radial compression on the object under applied longitudinal forces. This over two under two weave also permits the use of larger diameter, thus stronger strands, in the grip body than it is possible to provide in the usual grip construction without material loss of flexibility, thereby providing a grip the ultimate mesh strength of which is greatly increased over the conventional grip without any impairment of its effectiveness as a grip. These factors of large diameter strands and increased metal contact combine to provide both such increased grip strength and gripping ability that the work load of this grip is of the degree that it provides a grip which is no longer the weak link in overhead installations, even in those installations in which the pull is 20,000 feet. It has been found by actual test that the breaking strength of these grips have been increased by the design of this invention to the extent that it is now greater than the breaking strength of most conductors. Further, this design provides a flexibleness which together with the increased metal contact afforded thereby enables the grip body to readily adjust to variations in the diameters of synthetic ropes so that it maintains a firm gripping action on the smooth surfaces of this type of rope. These features also make it possible for the grip to be used on a wider range of conductor and rope diameter sizes than is possible with a grip of conventional design. Thus, it has been found that only six sizes of grips are needed to take care of conductor diameters ranging from 0.19 to 2.31 inches and rope diameters ranging from 0.25 to 1.75 inches. As such ranges of conductor and rope diameters cover most utility and high line stringing requirements, the number of different sized grips that need be stocked in line trucks working at locations miles from their central supply warehouse is considerably reduced.

The metal shoulder protectors or tubes 20 are each flattened against the four strands comprising the branch 14 that extend therethrough in a substantially parallel, planar arrangement. The portions of the flattened branches extending beyond the outer ends of the tubes 20 are gathered into two groups within a spaced metal band or ferrule 25 which also encloses the two ends 26,26 of a wire rope loop 27. As will be noted from a consideration of FIGS. 1 and 2, the loop ends 26,26 are axially disposed in side-by-side planar fashion from the band 25 to and through a second band 28 spaced from the band 25 a distance greater than twice the width of such bands. The bands 25,28 and the loop ends 26,26 and strand portions gripped thereby may be designated the draft shank 30. As will be seen more clearly in FIG. 2, the branches 14 are gathered together at the band 25 into two equal groups 29,29 which overlie the two sides of the longitudinally engaged loop ends 26,26 in the draft shank 30. Some of the strands in each group 29 fill in the V-shaped furrows formed on the sides of such

draft shank by the engaged loop ends 26,26 and the remainder of the strands in such groups overlie such furrows and the sides of such loop ends. Thus, the portion of the grip body strands 11 and 12 between the bands 25,28 provide on the draft shank between the latter substantially flat side walls which are designated 29. These walls 29 provide the draft shank with a smooth, slim profile that affords a smooth transition of grip and draft loop as they pass through stringing blocks. It will be noted in FIG. 1 of the drawings, that the wire of which the draft rope 27 is constituted is helically wound and that in the bound ends 26,26 thereof such helical coils are both angularly disposed to the longitudinal axis of the grip and to each other. It will be further observed that the strands 11 and 12 forming the grip body are formed of twisted wires the helices of which in the area of the bound loop ends 26,26 are disposed at angles transverse to the longitudinal axis of the grips and different from the angles that the coils of such loop ends make with the longitudinal axis. Thus, throughout the draft shank 30, the longitudinal limits of which are defined by the bands 25,28, the portions of the strands 11 and 12 therein and the bound loop ends 26,26 are interlocked with one another in inseparable relation against any longitudinal forces tending to separate them.

The bands 25,28 are made of stainless steel and have a high ductility allowing them to be suitably formed and a high yield point to resist any forces tending to reduce their securement of the grip body strands and loop ends together. Suitable stainless steels for the purposes of the invention are designated by the American Iron and Steel Institute as types 302 and 304 stainless steel alloys. The bands 25,28 are swaged in place on the draft shank 30 under extremely high pressure so that the portions of the strands 11 and 12 and the wires of the loop ends 26,26 enclosed by such bands are consolidated together into an inseparable mass and those strand portions forming the periphery of such consolidated mass are forced into the steel alloy material of the bands 25,28 so that such twisted strand portions become embedded in the steel of such bands. During such swaging action the steel of the bands 25,28 will flow around said peripheral strand portions eliminating any spaces therebetween and causing such embedding action. Since the type of steel selected hardens as it is so reduced by pressure, the resulting bond can only be broken by extremely high stresses. It is believed that a better understanding of the manner in which such bands are assembled on the draft shank can best be obtained by comparing the showings of FIGS. 2, 4 and 5 of the drawings. As previously indicated FIG. 2 is a section of the draft shank 30 shown in FIG. 1 while FIGS. 4 and 5 are sections of the draft shank 30' shown in FIG. 3 of the drawings. The shank 30' of FIG. 3 is essentially similar in construction to the draft shank 30 of FIG. 1 except for certain differences which will hereinafter be pointed out. Accordingly, those parts in FIG. 3 which are substantially similar to the parts shown in FIG. 1 have been given the same reference numerals as the latter. FIG. 4, as has been previously indicated, shows the band before it has been compressed, with the enclosed portions of the grip body strands 11 and 12 and the loop ends 26,26 in their normal cross-sectional configuration. The uncompressed band is continuous and large enough to readily receive the grip body and loop end strands. Thus, for a ¾-inch grip the uncompressed band may have an inside diameter of 0.885 inch and a thickness of 0.120 inch. The reduction of the band of FIG. 4 to the form shown in FIG. 5 is done in two steps. FIG. 2 of the drawings indicates generally the shape which the band and the enclosed wire portions will assume as a result of the first of such compression steps. FIG. 5 of the drawings, shows the condition of the band and such enclosed wire portions after the completion of the second compression step. As will be observed from a comparison of FIGS. 4 and 5, the metal band has been compressed so that it has been materially reduced in diameter, approximately one-fourth of an inch. In the reduced condition of the band which is the condition of the bands 25 and 28 shown in FIG. 1 and the bands 25', 28' shown in FIG. 3, the enclosed portions of

the grip body strands 11 and 12 and the loop ends 26,26, are compressed and distorted and so embedded in the steel of the band that they all form a consolidated, substantially solid mass in which the enclosed wire portions completely fill the area encircled by the compressed band. As a result of the aforesaid construction the grip body 10 and the loop 27 of the grip are inseparably bound together by the composite draft shank 30 thereof into a strong permanent assembly which enables the ultimate extra high strength of the mesh body to be fully utilized. Such utility of the strength of the body is assured by forming the rope 27 in accordance with the invention with a number of wire strands the total strength of which greatly exceed that of the wire strands 11 and 12 utilized in the formation of the grip body so that the draft loop 27 per se, is inherently stronger than the grip body per se. It is within the contemplation of this invention to attain such results using a grip body woven with single strands instead of paired strands as above described and with bands made of aluminum instead of steel. The aluminum material however, should have qualities comparable to those of the stainless steel, namely, it should be soft enough to swage but hard enough to hold against any forces that may be encountered in the use of the grip and tending to reduce the securement of the band made of such material to the enclosed strand portions. An aluminum suitable for such purposes is the type designated 6061-T6 by the Aluminum Association. It is also within the contemplation of the invention to use but one band in the manner of bands 28 and 28' instead of two bands 25 and 28, or 25' and 28'.

Mounted on the band 28 in the embodiment of FIG. 1 is a tube 31 of heat shrinkable plastic material. The tube 31 is slightly wider than the band 28 so that the sides 32 thereof project beyond the sides of the band 28. Thus, when the tube 31 is properly heat shrunk in place on the band 28, the sides 32 thereof will enclose the sides of the band to both inseparably lock the tube onto the band and cover the ends of the strands 11 and 12 which protrude beyond it (consider the partial showing of the strands protruding beyond the band 28' in FIG. 3 of the drawings). The tube 31 may be made with a distinctive color for a particular size of grip. Thus, the tube 31 may be made of black plastic material for a ¼-inch grip, white for a ½-inch grip, red for a ¾-inch grip, blue for a 1-inch grip, yellow for a 1¼-inch grip and clear for a 1½-inch grip which constitute the six sizes previously indicated as capable of taking care of the entire range of high line stringing requirements. With the grips so marked, a worker in the field can readily select from a stock of grips the correct grip for the particular job on which it should be used. This method of job-site grip election is accurate, easy and fast and has been found to effect a major saving in installation costs. Instead of providing the tube 31 with such distinctive coloring, an additional oval tubular aluminum band made with a distinctive anodized color in the manner above described may be secured to the draft shank. Such an aluminum band designated 35 is shown in FIG. 3 of the drawings. The band 35 preferably is stamped with indicia 36 indicating the grip size, and the ranges of cable size and rope size on which such grip may be used. Indicia of this nature may also be provided on the tube 31. The band 35 may be used in association with a plastic tube mounted on band 28' in the manner of tube 31 on band 28, or it may be utilized alone to perform the primary function of band 31, namely, to cover the protruding ends of the strands 11 and 12 to afford a protection against such ends during the handling of the grip. As previously indicated, band 35 is a continuous, oval-shaped band of any suitable material, such as aluminum. This band may have interior cross-sectional dimensions which enable it to readily slide on the loop ends 26,26 and over the protruding ends of the strands 11 and 12 to come into abutting relation with the outer side of the band 28', as shown in FIG. 3. The band 35 is urged into and maintained in such abutting relation by the spreading resiliency produced in the unbound portions of the loop ends 26,26 on which such band is mounted by the stresses created in the formed loop 27. When the grip supporting a length of cable is attached to an anchoring member, the

additional stresses thus placed on such loop tend to lengthen it and to permit movement of the band 35 away from the band 28' so as to close the loop area, thereby rendering the detachment of such loop from the anchoring member less probable during usage of the grip.

What is claimed is:

1. A wire cable grip composed of wires interwoven to form an open-mesh body having a cable receiving end and a draft end, said wires extending beyond the draft end of said body, and a plurality of branches constituting the shoulder of said grip being formed by dividing said wires beyond the draft end of said body into a plurality of groups, and said wires beyond such shoulder being gathered into two groups to form a draft shank, a draft loop constituted of metal wires woven into rope form and having two straight ends disposed axially of the grip in side-by-side planar arrangement and forming therebetween V-shaped troughs on opposite sides thereof, the two groups of wire portions being located on opposite sides of said loop ends, filling the V-shaped troughs formed by the sides of such loop ends and covering the sides of such loop ends, and a metal band bonding the loop ends and grouped wire portions into a permanently assembled draft shank between the draft loop and said grip shoulder, said metal band being continuous and compressed on the enclosed body and loop wire portions to form a consolidated, substantially solid mass in which the peripherally located wire portions are embedded in the metal of such band.

2. A cable grip as defined in claim 1 in which the grip body is composed of paired wires which at the cable receiving end of said body form a plurality of double strand loops at the outer extremity of said body and are woven over one paired wire and under one paired wire for at least one space, and are then woven for at least the major portion of the length of such body over two paired wires and under two paired wires, said loops and one over one weave at the cable receiving end of said body, causing the latter to resist radial contraction to a higher degree than the over two and under two body weave, whereby said cable receiving end is provided with a funnel-like shape to facilitate the entry of a cable or rope thereunto, and under the force exerted to effect such insertion initiates the expansion of such body weave to facilitate the threading of the rope or cable therethrough.

3. A cable grip as defined in claim 2, in which the paired wires extend into said branches and in each of said branches are in parallel planar arrangement, and including elongated flattened tubes enclosing the planarly arranged wires in branches and being bent outwardly in convex fashion.

4. A cable grip as defined in claim 1, in which said loop is composed of a plurality of groups of helically twisted wire strands and said strand groups are twisted helically into rope form so that in the draft shank the rope coils forming the loop end portions are disposed at angles to the longitudinal axis of the grip and to each other, and in which said grouped body wires in the draft shank are formed of twisted strands whose helicies are disposed at an angle to the longitudinal axis of the grip, the helicies of the grouped body wires and of the loop end portions being interlocked in permanent relation, the strand groups forming said loop having a higher tensile strength than said grouped body wires.

5. A cable grip as defined in claim 1, including a second band on said draft shank bonding said side loop ends and group ends together, said two bands being located in spaced relation on said loop ends and grouped wire portions and made of a metal having a high yield point against any forces tending to separate them from such locations, said metal bands being both compressed to a size substantially smaller than the size in which they were assembled on the draft shank, and the portions of the loop ends and grouped wires enclosed by both said bands, being deformed and consolidated into an inseparable mass filling the interiors of said bands and being peripherally embedded in the metal of such bands.

6. A cable grip as defined in claim 5, in which the portions of the two groups of wires extending between said two bands

are arranged on said loop ends to form plane outer layers over the sides of such loop ends.

7. A cable grip as defined in claim 1, in which said band is located on said two groups of wires so that the ends of said wires protrude beyond such band, and a tube covering the protruding ends of said wires.

8. A cable grip as defined in claim 7, in which said tube is made of heat shrinkable plastic material and is mounted on said band so that one shrunk end thereof projects beyond such band and encloses said protruding wire ends.

9. A cable grip as defined in claim 7 in which said tube is located on said loop ends between said loop and said band and has one end abutting the end of said band so as to cover said protruding wire ends.

10. A cable grip as defined in claim 7, in which said tube is

of a given color that identifies the particular size of said cable grip.

11. A cable grip as defined in claim 1, including an identification band mounted on said draft shank and having a given color peculiar to the size of said cable grip.

12. A cable grip as defined in claim 11, in which said identification band is located on said draft shank between said loop and the metal band.

13. A cable grip as defined in claim 11, in which said identification band is mounted on and encloses said metal band.

14. A cable grip as defined in claim 11, in which said identification band is provided with indicia related to the particular grip.

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