United States Patent

Buettner

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[54] WIRE ROPE FERRULE

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[52] **U.S. Cl.** .....**287/75**, 24/115 A, 24/114.5

[51] **Int. Cl.** **F16g 11/02**, F16g 11/14

[58] **Field of Search** .....24/115 A, 114.5, 123 W; 287/75, 78

[56] **References Cited**

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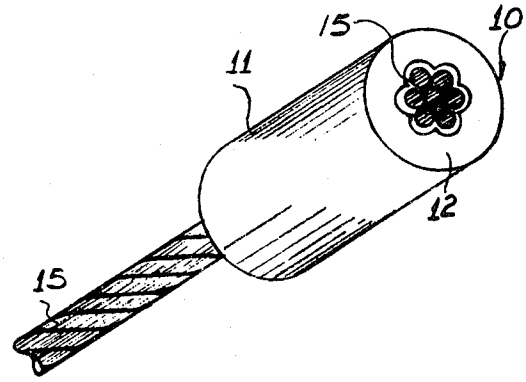
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Attorney—Fetherstonhaugh and Co.

[57] **ABSTRACT**

The invention relates to a swage ferrule for use in enclosing the end of a wire rope. The ferrule comprises a swagable metal body having a longitudinally extending bore preformed to provide integral, parallel, longitudinally extending, alternate ridges and grooves, the inner portions of the ferrule ridges being adapted to lie within a circle of slightly less diameter than an imaginary circle enclosing the outermost portion of the rope wires whereby, prior to swaging, the inner ferrule ridge portions lie within the grooves of the rope, causing straightening of the rope.

5 Claims, 5 Drawing Figures



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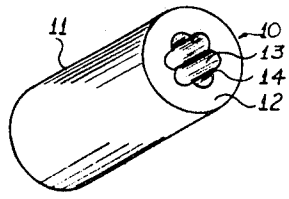


FIG. 1

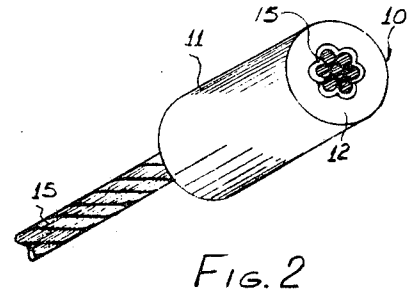


FIG. 2

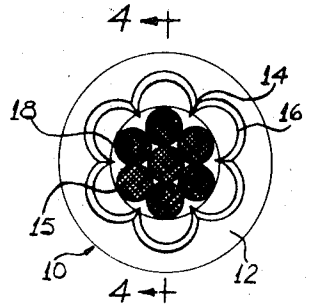


FIG. 3

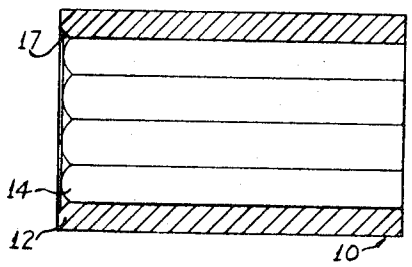


FIG. 4

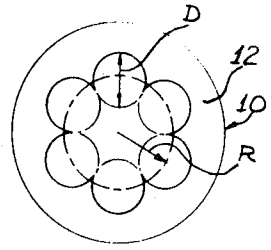


FIG. 5

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WIRE ROPE FERRULE

This invention relates to a swage ferrule for use in enclosing the end of a wire rope. Such ferrules are extensively used with choker or butt hook assemblies and are adapted to be rigidly anchored to the end of the wire rope of such assemblies in a swaging operation.

In a choker or butt hook assembly, a wire rope is provided with a special type of hook intermediate the ends thereof, and the end of the rope is equipped with an enlargement adapted to be received within the hook and to be gripped thereby. Such assemblies are useful, for example, in the lifting and dragging of logs, etc., and when so used the end portion of the rope must be pushed under the log or logs before the rope end can be secured within the hook.

In order that the wire rope end can be readily passed under the logs and similar articles, the rope end is preferably free of obstructions that might cause the rope to catch on the logs. Also, the enlargement at the end of the rope, which is secured by the hook, must be firmly secured to the wire rope end so that it can withstand the rough usage and impact forces applied thereto when using the butt hook assembly.

The most common type of ferrule used for this purpose over the years has been a cylindrical piece of metal with a smooth axial bore therethrough. This piece of metal is simply slipped over the end of the wire rope and the ferrule is swaged to the wire rope by subjecting it to a very high pressure in one direction and then rotating the ferrule through 90° and again subjecting it to this very high pressure to secure the ferrule to the wire rope. An improvement of this ferrule is described in Ehmann, U.S. Pat. No. 2,832,118, issued Apr. 29, 1958, which describes a ferrule having spiral grooving inside the axial bore so that it is actually threaded onto the end of the wire rope. After the ferrule has been threaded onto the end of the wire rope, the swaging is carried out in the usual manner by applying pressure to the exterior of the ferrule in two directions thus securing the ferrule to the wire rope.

According to the present invention, it has very surprisingly been found that an even better ferrule can be made by having the ridges and corresponding grooves in the bore of the ferrule actually parallel to one another. These ridges and grooves are so dimensioned that the ridges fit within the various strands making up the wire rope. This means that when the ferrule is slid over the end of the wire rope, the strands of the wire rope are straightened by the action of the ridges and when pressure is applied to the ferrule to swage it to the wire rope, the ridges of the ferrule splay out the separate strands of the twisted wire rope and provide an extremely secure fit.

In comparative tests which were conducted, it was found that the ferrules according to the present invention where considerably superior to the ferrules with spiral ridges in holding strength. In fact, it was found that the ferrules of the present invention simply did not break away from the cable but the wire rope itself broke under test. It is particularly interesting to note that the break in the wire rope actually took place in the center of the test length and the wire rope did not break adjacent to ferrule. Thus, the ferrules of the present invention take full advantage of the strength of the wire rope, whereas those presently available on the market are considerably weaker than the wire rope to which they are connected.

A preferred embodiment of the invention is illustrated in the accompanying drawings, in which:

FIG. 1 is a perspective view of a ferrule according to the invention;

FIG. 2 is a perspective view of a wire rope having the ferrule of this invention swaged thereto;

FIG. 3 is an end elevation showing the wire cable in position before swaging;

FIG. 4 is a longitudinal sectional view taken along line 4—4 of FIG. 3; and

FIG. 5 is a cross-sectional view of the ferrule showing its dimensions.

The ferrule, which is designated by the numeral **10** in the drawings, has a generally cylindrical body portion **11** with

ends **12**. A longitudinally extending bore or opening **13** passes through the ferrules **10** and is adapted to receive a wire rope **15**.

This wire rope is a typical rope formed by spirally winding together a plurality of individual strands. The rope can be formed by any number of strands and the strands may have any desired diameter, and the rope itself may be of varied diameters.

The surface of the opening **13** is formed with a series of ridges **14** and a series of grooves **16**. The number of these ridges corresponds to the number of strands of the wire rope.

As can be seen from FIG. **3**, the inner edges of the ferrule ridges **14** lie within a circle of slightly less diameter than an imaginary circle **18** enclosing the outermost portions of the wire rope. These ridges **14** preferably extend about one sixty-fourth to about one-sixteenth inch inside the imaginary circle **18**. Since the ridges **14** extend within this imaginary circle **18**, it means that when the wire rope **15** is inserted into the ferrule **10**, the ridges **14** must pass between the strands of the wire rope. The result is that the wire rope is straightened as it slides into the ferrule.

As shown in FIG. **4**, the entrance face **17** of the opening **13** is bevelled to ease the entry of the wire rope **15** into the opening.

Details of the construction of the ferrule **10** are illustrated in FIG. **5**. From this it can be seen that the ridges **14** and grooves **16** are formed by means of a series of partial cylindrical recesses in the wall of opening **13**. These partial cylindrical recesses are based on the diameter D and the axes of these partial cylindrical recesses occur on the imaginary circle of radius R.

When a wire rope **15** has been positioned in a ferrule **10** as shown in FIG. **3**, the ferrule is placed between the jaws of a swaging dye and pressure is applied by means of the jaws to compress the ferrule and thereby rigidly anchor it to rope **15**. In this swaging operation, the ferrule **10** is distorted such that its diameter is decreased and the ridges **14** are pressed into the wire rope, splaying out the separate strands of the wire rope and resulting in an extremely secure fit.

The invention is also illustrated by the following nonlimitative examples.

Example 1

A series of different ferrules were produced having varying dimensions to be used with wire ropes of a variety of diameters.

These were produced according to the design shown in FIG. **5** and the various dimensions are shown in table 1 below. In this table, D represents the diameter of each partial cylindrical groove, R represents the radius of the imaginary circle passing through the axis of each groove, L is the length of the ferrule and OD represents the outside diameter of the ferrule, all dimensions being in inches.

TABLE 1

Wire Rope	Ferrule				
Dia	R	D	L	OD	
				Before Swaging	After Swaging
7/16	3/16	3/16	1⅛	1¼	1⅛
1/2	13/64	13/64	1⅛	1¼	1⅛
9/16	7/32	7/32	1⅛	1¼	1⅛
5/8	17/64	17/64	1⅝	1⅜	1½
3/4	19/64	19/64	1⅝	1¾	1½
7/8	21/64	21/64	1¾	2	1-3/4
1¾					

EXAMPLE 2

A series of tests were conducted to compare the holding strength of various ferrules. The ferrules tested were the usual

plain bore ferrules, ESCO ferrules with spiral ridges in the bore and ferrules with parallel ridges in the bore according to this invention.

The ferrules were all swaged onto the ends of identical samples of wire rope and then subjected to a pull. Table 2 below shows the maximum pull in pounds before break for the ferrules on wire ropes of different sizes.

TABLE 2

Wire Rope Size	7/16"	1/2"	5/8"	3/4"
Plain Bore Ferrule	15,500	18,000	22,500	—
ESCO Spiral Ferrule	19,000	20,500	34,000	40,000
Ferrule of this Invention	22,000	26,500	42,000	59,000

The values shown for the ferrules of this invention all represent the pull at which the test length of wire rope broke at the center of the length. Thus, with the ferrules of this invention not only is outstanding gripping obtained but there is also apparently no weakening of the wire rope in the vicinity of the ferrule.

The embodiment of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In combination with a spirally wound end portion of a wire rope in which the exterior wires provide alternating ridges and grooves, a one-piece ferrule member adapted to be swaged about said rope end portion and comprising a swagable metal body having a longitudinally extending bore preformed to provide integral, parallel, longitudinally extending, alternate ridges and grooves, the inner portions of the ferrule ridges lying within a circle of slightly less diameter than an imaginary circle enclosing the outermost portions of the rope wires, the ridges and grooves of the ferrule member being at least straighter than the spirally-curved exterior wires of said end portion of said wire rope, and the ridges of the ferrule being spaced so as to lie within grooves of the rope, whereby, prior to swaging, said inner ferrule ridge portions lie within the grooves of said rope, causing at least partial straightening of the exterior wires of the rope.

2. The structure of claim 1, in which the number of grooves in the ferrule is equal to the number of strands in the wire rope.

3. The structure of claim 1, in which the inner portions of the ferrule ridges lie within a circle having a radius of one sixty-fourth to one-sixteenth inch less than the radius of the imaginary circle enclosing the outermost portions of the wire rope.

4. The combination of claim 1, wherein the ferrule is swaged to the wire rope.

5. The combination of claim 1 wherein the ridges and grooves of the ferrule member are straight and are generally parallel to the axis of the bore of said ferrule member, so as to cause at least substantial straightening of said exterior wires relative to their original spiral configurations.

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