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IMPROVEMENTS IN PICTURE WIRE

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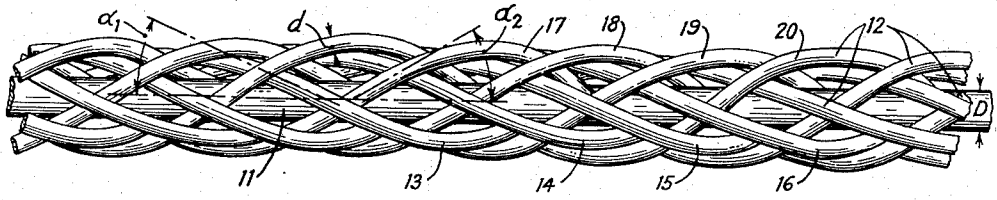


Fig. 1

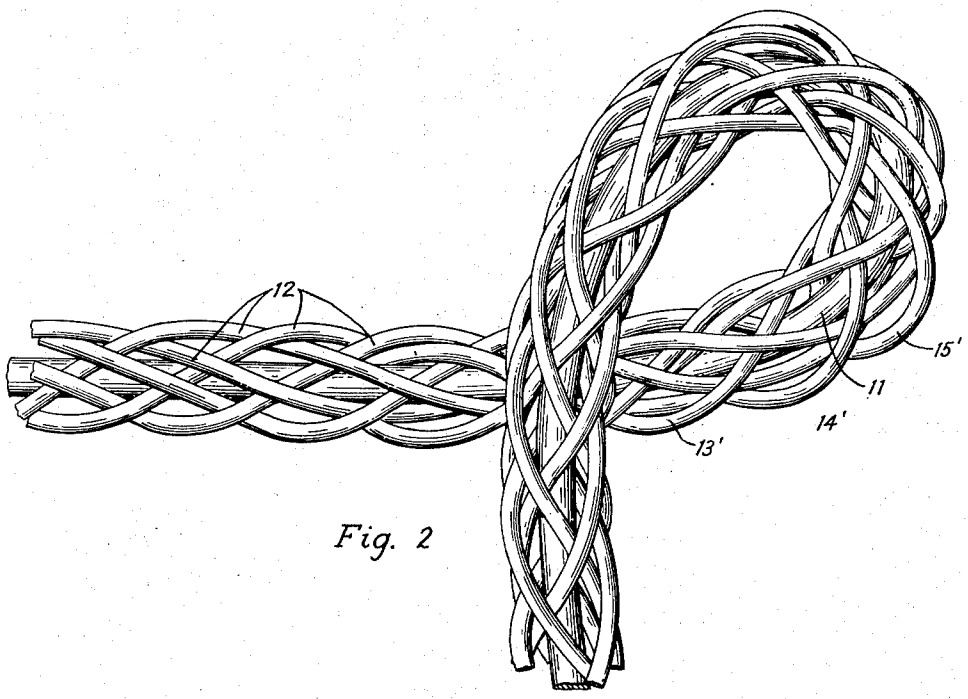


Fig. 2

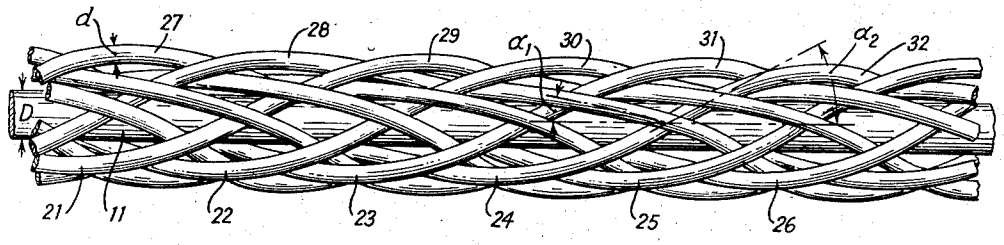


Fig. 3

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IMPROVEMENTS IN PICTURE WIRE

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6 Claims. (Cl. 87—6)

This invention relates to wire or metallic cable and has for its object the production of a strong, yet readily manageable and attractive wire or cable for supporting heavy pictures and mirrors on a wall, and other uses.

The conventional "picture wire" which consists of twisted strands of solid wire has proved unsatisfactory for supporting heavy objects, such as large pictures and mirrors of a weight of the order of fifty pounds or more.

The production of a satisfactory wire or cable for this purpose presents problems which are due to the rather unique conditions under which the wire or cable is used.

At one or at several points the wire or cable is subjected to sharp bending. This occurs near the ends at which the wire or cable is fastened to the object, for example to a stamped sheet metal eye affixed to a mirror. Such eyes generally have sharp edges, and not infrequently a sharp burr is present at the edges produced by worn or poorly matched blanking tools.

The average user of the wire or cable has little mechanical skill, and it frequently happens that the cable is kinked while being attached to the object or it is kinked while the picture or mirror is being hung. Kinks produce a very unfavorable stress and tend to result in breaking of the wire or cable, unless it is designed to withstand such abnormal stress by a particular construction.

Two further requirements must be met. Firstly, the cable must be manageable, i. e., it must not be too stiff to permit attaching by twisting its ends without the use of tools, and the wire must be of attractive appearance, since it is occasionally exposed to view.

The invention provides a wire or cable of improved construction meeting the aforementioned requirements. The wire or cable is characterized by a central core and an outer covering so applied that the covering protects the core and that both core and covering share in carrying the load of the object to be suspended.

The outer covering consists of strands of solid wire and is so constructed that it forms an open mesh structure tightly enveloping the core. The individual strands of the covering are so arranged that they are free to shift when the cable is bent around a small radius.

In conventional stranded picture wire the strands on the inside radius tend to buckle and kink, with the result that they cease to support the load. At the same time an excessive load is placed on the strands at the outer radius, resulting from the normal load to be supported plus a further load which is produced by the bending which tends to elongate the strands at the outer radius.

A cable incorporating the invention comprises an outer covering of the braided type, produced by disposing one-half of the number of strands in clockwise direction about the core wire and by disposing the other half of the strand wires in counter-clockwise direction about the core. The clockwise and the counter-clockwise strands intermesh by passing over and under one another. The covering is taut about the core and is thereby effective to support a portion of the total load.

Braided coverings per se are, of course, well known in the art. However, in the majority of cases these coverings are not designed to carry a portion, let alone the major portion, of the load, a function which cannot be fulfilled if the covering is applied over yielding or resilient material, for example insulating material. The construction of the covering involved in the invention is characterized by further details and features which will be described in detail further below.

The objects, features and advantages of this invention will appear more fully from the detailed description which follows, accompanied by drawings showing, for the purpose of illustration, preferred embodiments of this invention. The invention also resides in certain new and original features of construction in combination of elements hereinafter set forth and claimed. Although the characteristic features of this invention which are believed to be novel will be particularly pointed out in the claims appended hereto, the invention itself, its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part of it in which:

Fig. 1 is a side view of a cable comprising an outer covering of eight strands;

Fig. 2 is a perspective view illustrating the behavior of the various strands of the cable when distorted into a kink or loop; and

Fig. 3 is a side view of the cable comprising an outer covering of twelve strands.

In the following description and in the claims various details will be identified by specific names for convenience. The names however are intended to be generic in their application. Corresponding reference characters refer to corresponding parts in the several figures of the drawings.

The drawings accompanying, and forming part of, this specification disclose certain specific details of the invention for the purposes of explanation of broader aspects, but it is understood that the details may be modified in various respects without departing from the principles of the invention.

The wire or cable shown in Figure 1 comprises a central core wire **11** having a diameter D. The core wire is tightly enclosed by an outer open-mesh covering **12** composed of a plurality of strands of solid wire. The illustrated cable comprises eight strand wires **13, 14, 15, 16** and **17, 18, 19, 20.** The strand wires have a diameter *d*, which is less than the diameter D of the core wire and bears a certain dimensional relationship to it which will be explained further below.

It is readily apparent that four of the strand wires, the wires **13, 14, 15** and **16** extend about the core wire **11** in one direction, whereas the remaining strands **17, 18, 19** and **20** extend about the core wire in the opposite direction.

The wires of each group extend substantially parallel to one another, but are spaced from one another by a distance which, in the illustrated example, is slightly more than the dimension *d*. Similarly, the wires **17, 18, 19** and **20** which compose the other group extend substantially parallel to one another, and are also spaced from one another so as to leave a space slightly larger than *d* between them.

The strands of the envelope form an open mesh structure in that the strands pass over and under one another. More particularly, each strand passes, in sequence, first over two others, then under two others, then over two others, etc. Observing strand **14** for example, it passes under strand **17**, then over strands **18** and **19** and then under strand **20.** Strand **19**, in turn, passes over strand

13 and then under strands 14 and 15, whereafter it passes over strand 16.

This peculiar form of intermeshing imparts a predetermined undulation to each strand of wire. For example, at a point where a strand passes over two others it has a convex curvature and at a point where it passes under two others it has a concave curvature. The radii of these curvatures are relatively large and, as will be shown hereinafter, change when the cable is bent around a small radius or formed into a loop. At the same time the strands have freedom to shift laterally, which they are free to do by reason of the spaces between them.

The pitch of successive turns of the same strand wire about the core may also be expressed in terms of the pick of the strand wires, that is the number of successive convexly curved strand portions counted on one side of the cable per lineal inch. However for the purpose of the invention it is convenient to refer to the angles α_1 and α_2 which the strands form, in side view, with the axis of the core. Angle α_1 is the angle between the axis of the core wire 11 and the side projection of an inner wire portion, such as 13, and angle α_2 is the angle between the axis of the core wire 11 and the side projections of an outer wire portion, such as 17. The angle α_1 is by nature somewhat smaller than α_2 and is of the order of 20 degrees. In one form of cable it may approximate 15 degrees and in another type of cable it may approximate 25 degrees. The difference between α_1 and α_2 is of the order of 10 degrees.

The angle α_1 is important for two reasons. Being acute and relatively small it indicates that the strands extend predominantly in the same direction as the core. The angle further determines, indirectly, the radii of curvature of the strand wires at the convex and concave portions.

It is also apparent in Figure 1 that the covering is relatively non-compressible. Referring, for example, to the point at which the strand 14 overlies the strand 18, increased tension in the strand 14, caused by the load, meets with no play or slack in the construction of the covering, since at the point of intersection the wire 18 lies directly on the core wire and the wire 14 lies directly on the wire 18. This makes the cable incompressible at this point with the result that the strands carry a substantial portion of the load.

Under an abnormally large load which would tend to stretch the cable, particularly the central core wire 11, the covering offers increasing resistance to elongation by reason of the fact that the load tends to flatten the relatively shallow convex portions of the covering. Under such circumstances the major portion of the load is carried by the covering with the result that the elastic limit of the core wire is not exceeded.

Figure 2 illustrates the behavior of the cable of Figure 1 when formed into a loop or kink. It is readily apparent that the covering, which surrounds the core, limits the degree of tightness with which the core wire can be looped upon itself. The covering thus prevents failure of the cable by breakage of the core wire as a result of a tight kink in the core wire.

Looping of the cable causes the strands of the covering to shift at the loop and to change their respective curvatures. For example, at the points 13', 14', and 15' in Figure 2 the strands 13, 14 and 15 are curved to a smaller radius than normal. Simultaneously, the strands, 13, 14 and 15 increase their respective spacing, thereby tending to open up at the outside of the loop. This feature precludes overstressing of the strands at the outside of the loop. By way of comparison the strands of conventional picture wire are not free to shift, but are readily overstressed. The reverse action takes place on the inside of the loop, where the strand wires tend to reduce their respective spacing without, however, producing any sharp angular bends in them.

Figure 3 illustrates a cable in which twelve strands of wire 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31 and 32

surround the core wire 11. The strand wires are divided into two groups of six, six wires extending about the core in a clockwise direction and six wires extending about the core in counter-clockwise direction. Again, the several strands pass over and under one another in such a way that each strand passes, in sequence, under two others, then over two others, then under two others, etc.

This arrangement is accomplished by making the total number of strand wires a multiple of four. Eight strands are used in the cable of Figure 1, twelve strands being used in the cable of Figure 3.

It was found that the important spacing of the strand wires and the proper and most advantageous concave and convex curvatures, as well as the most advantageous distribution of the total load between the core wire and the covering is obtained by a certain relationship between the diameters D and *d*, taking into consideration the number of strands in the covering.

The diameter of the core wire should be approximately equal to one-fifth of the product obtained by multiplying the diameter of the strand wire by the number of the strand wires.

Example 1.—Cable comprising an eight-strand covering over the single core wire.

Strand wire diameter d=0.016 inch
Core wire diameter D=0.0286 inch
α_1=22°; α_2=30°;

Applying the above formula:

$8 \times 0.016 = 0.128 \div 5 = 0.0256$. In the commercial embodiment No. 70 gage wire was used having a diameter of 0.0286 inch which is within 15% of the figure calculated by the formula.

Example 2.—Cable comprising a twelve-strand covering over a single core wire.

Strand wire diameter d=0.016 inch
Core wire diameter D=0.0384 inch
α_1=14°; α_2=26°;

Calculation.—$12 \times 0.16 = 0.192 \div 5 = 0.0384$. Commercially used wire of No. 65 gage having a diameter of 0.0348 is within 10% of the calculated dimension.

Example 3.—Cable comprising a twelve-strand covering over a single core wire.

Strand wire diameter d=0.016 inch
Core wire diameter D=0.041 inch
α_1=15°; α_2=27°;

Calculation.—Same as in Example 2. Commercially used core wire of 0.041 representing wire gage No. 59 is also within 10 %of the calculated dimension 0.0384.

What is claimed is:

1. As an article of manufacture, a picture wire comprising no more than two layers, namely an inner core and an outer covering, said inner core consisting of a single solid wire of a certain diameter, said outer covering consisting of strands of solid wire equal in number to a multiple of four, the diameter of the strands being smaller than the diameter of said core wire, said strands being disposed at an angle, inside view, of substantially 20 degrees to the core axis, one-half of the number of strand wires enveloping the core in a clockwise sense, and extending substantially parallel to and spaced from, one another, the other half of the number of strands enveloping said core in a counter-clockwise sense, and extending substantially parallel to and spaced from, one another, the clockwise and the counter-clockwise strands intermeshing by passing over and under one another, the diameter of the core wire being approximately equal to one-fifth of the product obtained by multiplying the diameter of the strand wires by the number of the strand wires.

2. As an article of manufacture, a picture wire comprising no more than two layers, namely an inner core

and an outer covering, said inner core consisting of a single solid wire of a certain diameter, said outer covering consisting of strands of solid wire equal in number to a multiple of four, the diameter of the strands being smaller than the diameter of said core wire, said strands being disposed at an angle, in side view, of substantially 20 degrees to the core axis, one-half of the number of strand wires enveloping the core in a clockwise sense, and extending substantially parallel to and spaced from, one another, the other half of the number of strands enveloping said core in a counter-clockwise sense, and extending substantially parallel to and spaced from, one another, the clockwise and the counter-clockwise strands intermeshing by passing over and under one another in such a way that each strand passes, in sequence, under two others, then over two others, then under two others, and so forth, the diameter of the core wire being approximately equal to one-fifth of the product obtained by multiplying the diameter of the strand wires by the number of strand wires.

3. As an article of manufacture, a picture wire comprising no more than two layers, namely, a central inner core of a single solid wire of a certain diameter and an open-mesh outer covering in tight contact with said core, said covering consisting of eight strands of solid wire of substantially one-half said certain diameter, the strands being disposed at an angle, in side view, of substantially 20 degrees to the core axis, four strands enveloping said core in a clockwise sense and extending substantially parallel to, and spaced from, one another, the other four strands enveloping said core in a counter-clockwise sense and extending substantially parallel to, and spaced from, one another, the clockwise and counter-clockwise strands passing over and under one another, the diameter of the core wire being approximately equal to one-fifth of the product obtained by multiplying the diameter of the strand wires by the number of the strand wires.

4. As an article of manufacture, a picture wire comprising no more than two layers, namely, a central inner core of a single solid wire of a certain diameter and an open-mesh outer covering in tight contact with said core, said covering consisting of eight strands of solid wire of substantially one-half said certain diameter, the strands being disposed at an angle, in side view, of substantially 20 degrees to the core axis, four strands enveloping said core in a clockwise sense and extending substantially parallel to, and spaced from, one another, the other four strands enveloping said core in a counter-clockwise sense and extending substantially parallel to, and spaced from, one another, the clockwise and counter-clockwise strands passing over and under one another in such a way that each strand passes, in sequence, under two others,

then over two others, then under two others, and so forth, the diameter of the core wire being approximately equal to one-fifth of the product obtained by multiplying the diameter of the strand wires by the number of the strand wires.

5. As an article of manufacture, a picture wire comprising no more than two layers, namely, a central inner core of solid wire of a certain diameter and an open-mesh outer covering in tight contact with said core, said covering consisting of twelve strands of solid wire of substantially one-half of said certain diameter, the strands being disposed at an angle, in side view, of substantially 20 degrees to the core axis, six strands enveloping said core in a clockwise sense and extending substantially parallel to, and spaced from, one another, the other six strands enveloping said core in a counter-clockwise sense and extending substantially parallel to, and spaced from, one another, the clockwise and the counter-clockwise strands passing over and under one another, the diameter of the core wire being approximately equal to one-fifth of the product obtained by multiplying the diameter of the strand wires by the number of the strand wires.

6. As an article of manufacture, a picture wire comprising no more than two layers, namely, a central inner core of solid wire of a certain diameter and an open-mesh outer covering in tight contact with said core, said covering consisting of twelve strands of solid wire of substantially one-half of said certain diameter, the strands being disposed at an angle, in side view, of substantially 20 degrees to the core axis, six strands enveloping said core in a clockwise sense and extending substantially parallel to, and spaced from, one another, the other six strands enveloping said core in a counter-clockwise sense and extending substantially parallel to, and spaced from, one another, the clockwise and counter-clockwise strands passing over and under one another in such a way that each strand passes, in sequence, under two others, then over two others, then under two others, and so forth, the diameter of the core wire being approximately equal to one-fifth of the product obtained by multiplying the diameter of the strand wires by the number of the strand wires.

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