

Jan. 3, 1967

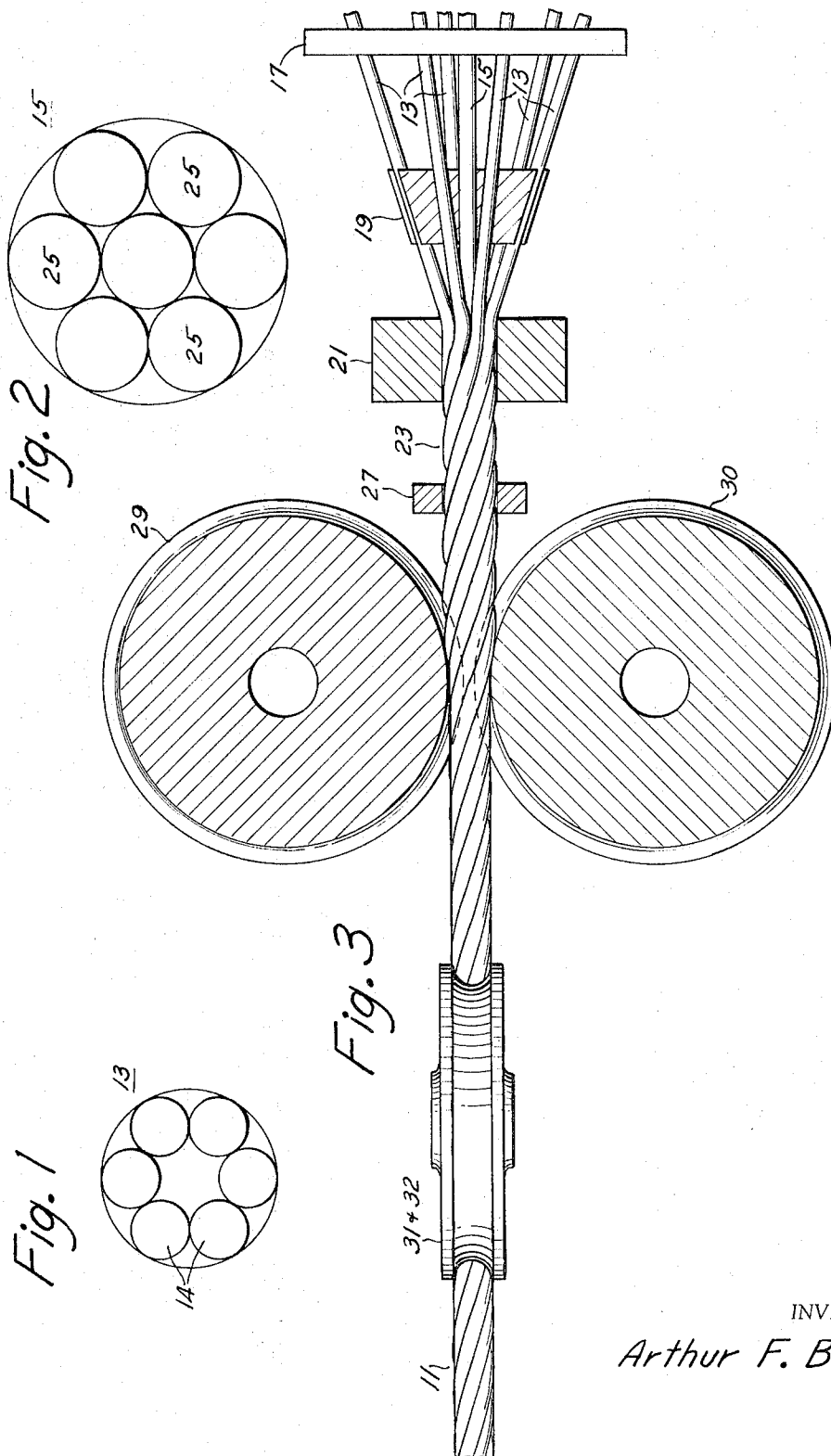
A. F. BEIGHLEY

3,295,310

WIRE ROPE PARTICULARLY USEFUL FOR INDEPENDENT WIRE ROPE CORE

Filed March 27, 1964

3 Sheets-Sheet 1



INVENTOR.

Arthur F. Beighley

Jan. 3, 1967

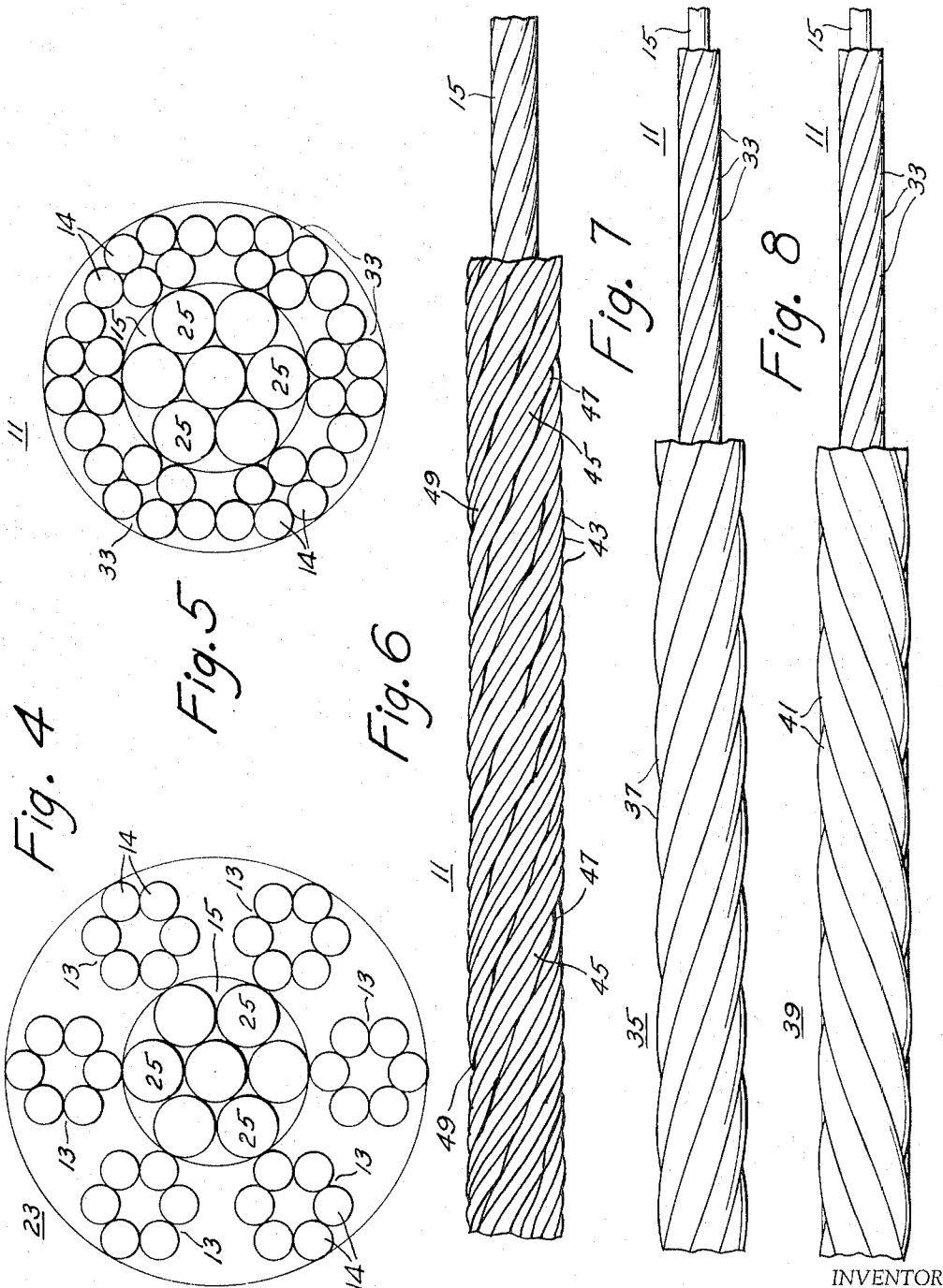
A. F. BEIGHLEY

3,295,310

WIRE ROPE PARTICULARLY USEFUL FOR INDEPENDENT WIRE ROPE CORE

Filed March 27, 1964

5 Sheets-Sheet 2



INVENTOR

Arthur F. Beighley

Jan. 3, 1967

A. F. BEIGHLEY

3,295,310

WIRE ROPE PARTICULARLY USEFUL FOR INDEPENDENT WIRE ROPE CORE

Filed March 27, 1964

3 Sheets-Sheet 3

Fig. 10

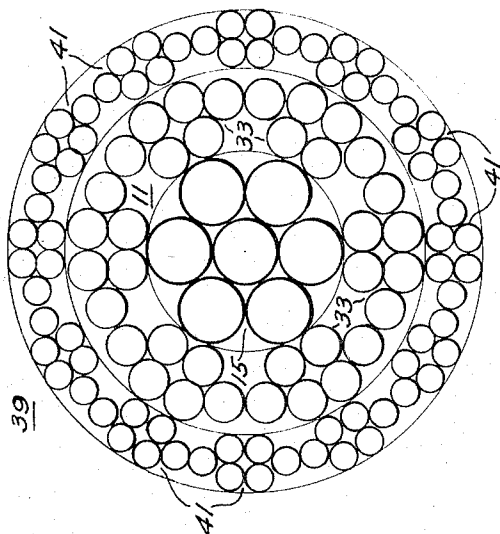
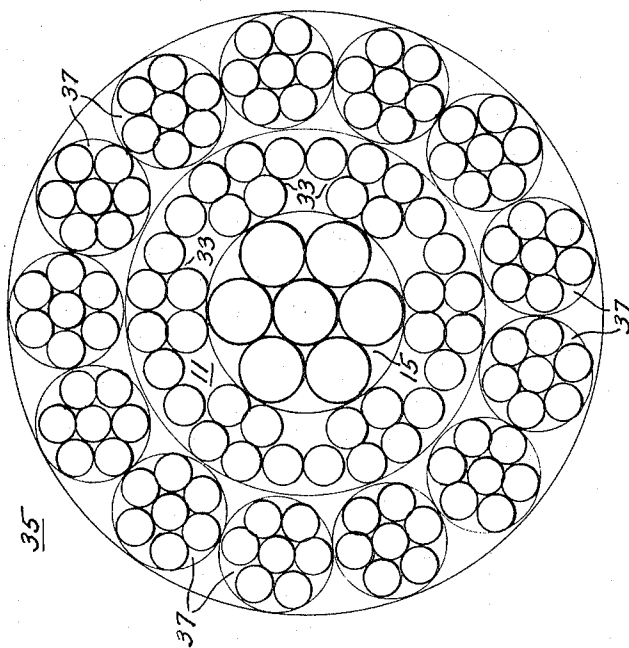


Fig. 9



INVENTOR

Arthur F. Beighley

1

3,295,310

WIRE ROPE PARTICULARLY USEFUL FOR INDEPENDENT WIRE ROPE CORE

Arthur F. Beighley, Williamsport, Pa., assignor, by mesne assignments, to Bethlehem Steel Corporation, a corporation of Delaware

Filed Mar. 27, 1964, Ser. No. 355,323

4 Claims. (Cl. 57-145)

This invention is directed to an improvement in wire ropes and to a method for making the same.

An object of this invention is to produce a wire rope particularly useful as an independent wire rope core having an outer surface with a bearing area greater than that of an ordinary rope.

A further object of this invention is to produce a wire rope particularly useful as an independent wire rope core comprising a wire core strand and plurality of centerless outer wire strands flattened about the core strand.

A further object of this invention is to produce a wire rope comprising a core strand, a first layer of centerless wire strands flattened about the wire core strand, and a second layer of centerless wire strands flattened about the first layer.

It is a further object of the present invention to provide a method of fabricating a wire rope having an increased outer bearing surface by providing a series of centerless wire strands and a core strand, laying the centerless strands about the core strand in evenly spaced relationship and passing the resulting rope through a compacting arrangement to flatten the centerless strands about the central core strand.

It is a still further object of the present invention to provide a wire rope with an independent wire rope core in which the rope has more useful strength than heretofore.

It is a still further object of this invention to produce a wire rope with improved non-rotating characteristics or torque balance under load.

Other objects will be apparent from the following description and from the drawings, in which

FIGURE 1 shows a cross-section of a six wire centerless outer strand suitable for use in producing the rope of my invention;

FIG. 2 shows a cross-section of a central seven wire core strand suitable for use in producing the rope of my invention;

FIG. 3 shows a diagrammatic elevation of one means for producing the rope of this invention;

FIG. 4 shows a cross-section of one embodiment of this invention before flattening the centerless outer strands around the wire core strand;

FIG. 5 shows a cross-section of the same embodiment of this invention after flattening the centerless outer strands around the wire core strand.

FIG. 6 shows an elevation of the outer flattened surface of an independent wire rope core made according to one embodiment of the invention;

FIG. 7 shows an elevation of a wire rope with an independent wire rope core formed according to the present invention;

FIG. 8 shows an elevation of a non-rotating wire rope formed according to the present invention;

FIG. 9 shows a cross-section of the wire rope embodiment of this invention shown in FIGURE 7;

FIG. 10 shows a cross-section of the non-rotating wire rope shown in FIGURE 8.

2

A wire rope 11 embodying the present invention and particularly suitable for use as an independent wire rope core, hereinafter referred to by the common industry abbreviation IWRC, may be fabricated as shown in FIGURE 3, wherein six six-wire centerless strands 13, which have been fabricated in the normal manner upon a conventional stranding machine but without the inclusion of the normal center wire, are laid around a seven wire core strand 15. Wire core strand 15 as shown in FIGS. 2 and 4 is composed of wires 25 larger than the wires 14 of the outer centerless strands 13. However, core strand 15 may, if desired, be formed of a different number of wires, for example nineteen wires, or twelve wires over a fiber core or alternately even a small conventional independent wire rope core.

The six centerless outer strands 13 and wire core strand 15 are pulled first through a rotating lay plate 17, through a floating outer strand spacing guide 19 and then through a stationary first forming die 21 to form centerless strands 13 and core strand 15 into a temporary laid-up wire rope section 23 in which the six outer centerless strands 13 are evenly supported upon the six outer wires 25 of core strand 15 in spaced relationship to each other. In order to maintain outer strands 13 in proper spaced relationship to each other until acted upon by compression means, a second strand spacing guide 27 may be located beyond stationary first forming die 21. Centerless strands 13 are laid around core strand 15 in the same direction as they are stranded so that a lang lay temporary wire rope section 23 is formed. After passing through spacing guide 27, rope section 23 with its outer centerless strands 13 evenly spaced about central strand 15 is passed through pairs of rotating squeezer rolls 29, 30, and 31, 32 arranged in different planes. In FIGURE 3 squeezer roll 32 is obscured by roll 31. Rolls 29, 30 and 31, 32 compress outer centerless strands 13 into a flattened form 33 about the surface of core strand 15 to form the finished rope 11 shown in cross-section in FIGURE 5.

As used herein with respect to the outer strands of the rope, the word "flattened" refers to the configuration of the strands themselves, and not to the configuration of the individual wires comprising the strands. The rollers 29, 30 and 31, 32 by which the flattening is accomplished are not intended to, and do not, materially deform the individual wires, but merely deform the outer strands themselves from a circular to a substantially flattened cross-section, this being made possible by the fact that the outer strands are initially formed centerless.

Finished rope 11 has a smaller diameter than temporary laid-up wire rope section 23 as may be seen by comparing FIGURES 4 and 5, and when used as an IWRC the flattened outer strands 33 provide a large bearing surface for the outer strands of the wire rope.

FIG. 5 is a somewhat idealized view of the finished rope or IWRC with the flattened outer strands 33 cut in one particular section. Flattened outer strands 33 cut in another section may appear to assume a form in which three wires of an outer strand overlies three other wires of the same strand. Cut in other sections outer strands 33 will appear to assume other intermediate forms as a result of their progressive rotation. In actual practice, the outer strands may also tend to be displaced from a position directly over the core wires 25.

As shown in FIG. 6 the outer strands are of lang lay. Lang lay strands provide longer individual dwell times of the individual wires of the strands in the bearing surface of the IWRC as described hereafter and compress

more easily but regular lay strands may be desirable in certain applications. Although the centerless outer strands 13 are shown as composed of six wires each, the number of wires in each outer strand may be varied. Six wires have been found to be particularly suitable, however, since six wire centerless strands are conveniently made and maintain their shape until compressed. Furthermore, the number of outer strands 13 may be varied if desired.

FIGS. 7 and 9 disclose another embodiment of the present invention, comprising wire rope 35 fabricated by laying outer strands 37 about IWRC 11 in the normal manner. IWRC 11 is the increased bearing surface IWRC made according to the present invention. The outer strands are prevented from cutting into IWRC 11 by the increased surface contact area of IWRC 11 available to support strands 37. The IWRC is consequently not scored and caused to disintegrate by the cutting action of the outside strands and the useful life of the rope during which the full strength of the rope is developed is consequently very considerably lengthened.

The centerless strands 33 of IWRC 11 in FIGURES 7 and 9 are of lang lay. The outer strands 37 may be either regular lay or lang lay.

As an alternative (not illustrated) to the construction shown in FIGS. 7 and 9, the outer strands 37 may themselves be made centerless and may be flattened around the flattened strands 33.

FIGURES 8 and 10 disclose a non-rotating rope 39 embodying the present invention. The rope comprises a plurality of centerless strands 41 flattened around an IWRC 11, said IWRC 11 in turn consisting of a plurality of centerless strands 33 flattened around a wire core strand 15. The rope 39 differs from the rope 35 of FIG. 9 in that the lay of the outer strands 41 is opposite to the lay of the flattened strands 33 of the IWRC. The lay of the outer strands of the IWRC 11 is arranged to be shorter than the lay of the outer strands 41 to compensate for the effect of the increased number of strands in the outer layers.

The cutting of the IWRC wires by the outer strands is particularly acute in the usual non-rotating rope since the outer layer of strands cross the strands of the IWRC at a more acute angle. Consequently the life of the IWRC's of such ropes are very abbreviated and as soon as the integrity of the IWRC is broken the rope as a whole will, of course, no longer be non-rotating. In the non-rotating rope of FIGURES 8 and 10, wear is decreased by not only using a flattened IWRC but also by flattening the outer strands of the rope.

It will be noted in FIGURE 6 that completed rope or IWRC 11 has a distinctive surface pattern in which each outer wire 43 rises abruptly to the outer surface of the rope and then is maintained continuously as an integral part of the surface for an interval of approximately one-third of one lay of the outer flattened strand 33 or in other words approximately one-third of the way around the surface of the rope before disappearing relatively abruptly away from the surface of the rope. For instance, in FIGURE 6 outer wire 45 is seen to rise to the surface of the IWRC 11 at point 47 and stay or dwell in the surface until a point 49 is reached when it quickly passes to the back of the strand 45 next to the core strand 15. This long dwell time of each wire in the outer surface can be compared with the mere fraction of a lay in which the outer wires of a conventional outer strand of a conventional wire rope or IWRC stay in the direct surface contact area of the rope. It is this long surface dwell of each individual wire in the rope of the present invention which provides the particularly effective bearing surface of the rope when used as an IWRC.

The manner of compaction of the strands upon the surface of the rope also tends to lock the strands partially in position so that the rope itself has improved non-rotating properties which are equal or superior to regular

lay ropes and clearly superior to the rotational properties of lang lay ropes.

The instant method of forming increased bearing surface IWRC and rope by flattening the outer centerless spaced strands of a temporarily laid-up wire rope section is very much faster and convenient than any previous method of forming specially shaped rope. By the present method flattened IWRC's and flattened wire rope may be formed at a rate equal to the rate of production of ordinary wire rope. The present invention has thus made the use of increased bearing surface IWRC's and flattened wire rope practical in applications where specially formed ropes and IWRC's have not previously been usable because of the unavailability of large amounts of suitable IWRC's. IWRC's of this nature, for instance, have not previously been practical for use in ordinary wire ropes. Furthermore, since the IWRC of the present invention is disintegration resistant as a result of its increased bearing surface, its use in a conventional wire rope adds greatly to the useful life of the rope.

While a preferred embodiment of the present invention has been described, certain changes may be made under particular circumstances. As pointed out above, a greater number of wires may be contained in the core strand of the rope. Likewise the outer centerless strands may be formed from a different number of wires than shown although a six wire centerless strand has been found most suitable. Different number of strands having various lays of different length and direction may also be used. Stationary dies rather than squeezer or compaction rolls may be used to compress the outer strands of the rope.

While the present invention has been described hereinabove in considerable detail, it should not be understood that it is to be narrowly limited to the exact and specific particulars disclosed and/or described as such substitutions, modifications or equivalents as are included within the scope and spirit of the invention or pointed out in the appended claims are also included.

I claim:

1. An IWRC comprising:

- (a) a helically laid seven-wire core strand,
- (b) six six-wire centerless outer strands helically laid around said core strand and flattened thereagainst,
- (c) the diameters of the wires of said outer strands being smaller than the diameters of the wires of the core strand,
- (d) the outer strands having substantially the same lay as the core strand, and
- (e) the outer strands being of lang lay construction.

2. A wire rope comprising:

- (a) a helically laid wire core strand,
- (b) a plurality of centerless wire strands helically laid around and flattened against the core strand,
- (c) the lay length of the centerless strands being substantially the same as the lay length of the core strand, and
- (d) a plurality of round wire strands helically laid around said centerless wire strands.

3. A wire rope having an increased useful strength comprising:

- (a) a non-distintegrating IWRC having a central stranded core and a series of flattened centerless wire strands lang laid around the central stranded core,
- (b) the individual wires of each flattened strand having a dwell time in the direct bearing surface area of the outer flattened strands of one-third or more of a complete lay of the outer strands, and
- (c) a series of outer rope strands laid around the IWRC upon the flattened bearing surface thereof in the direction of lay of the IWRC.

4. A non-rotating wire rope comprising:

- (a) a non-disintegrating IWRC having a central stranded core and a series of flattened centerless wire strands lang laid around the central stranded core,

5

- (b) the individual wires of each flattened strand having a dwell time in the direct bearing surface area of the outer flattened strands of one-third or more of a complete lay of the outer strands, and
- (c) a series of flattened centerless outer wire strands laid around the IWRC upon the flattened bearing surface thereof in the opposite lay direction from the lay of the IWRC.

References Cited by the Examiner

UNITED STATES PATENTS

1,137,690	4/1915	Batchelor	57—148
1,429,529	9/1922	Pyburn	57—145

6

2,061,559	11/1936	Brown et al.	57—153
2,503,987	4/1950	Anderson	57—138
2,779,149	1/1957	Schuller	57—166 X

FOREIGN PATENTS

975,386	7/1945	Germany.
1,003,097	2/1957	Germany.
1,588	of 1909	Great Britain.
6,909	of 1913	Great Britain.

10 FRANK J. COHEN, *Primary Examiner.*STANLEY N. GILREATH, *Examiner.*D. E. WATKINS, *Assistant Examiner.*