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J. F. KENDRICK

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DRILLING CABLE WITH INSULATED CONDUCTOR

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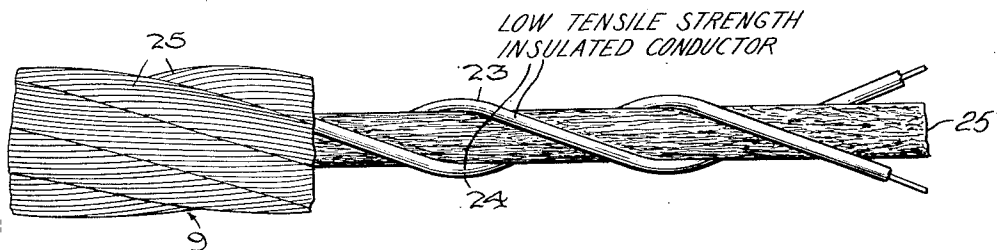


Fig. 1

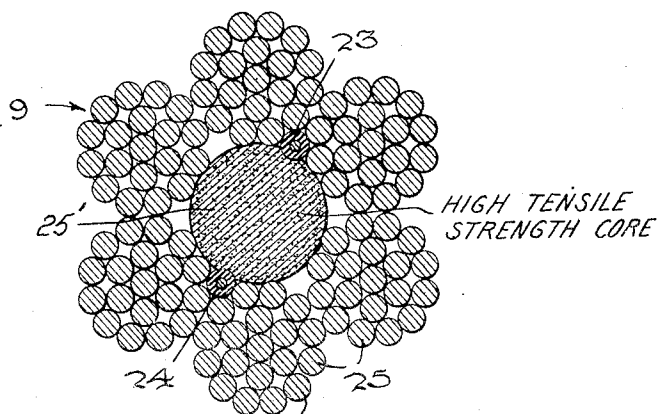


Fig. 2

HIGH TENSILE BARE
WIRE STRANDS

INVENTOR.
JOHN F. KENDRICK

BY *Raymond M. Matson*

AGENT

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DRILLING CABLE WITH INSULATED CONDUCTOR

John F. Kendrick, Columbus, Ohio

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5 Claims. (Cl. 174-108)

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This application is a continuation-in-part of application Ser. No. 782,877, now abandoned filed October 29, 1947, Drilling Cable which was a continuation-in-part of parent application Ser. No. 590,498, now abandoned filed April 26, 1945, Drilling Motion Indicator for Cable-Tool Drills which has been replaced by a continuation-in-part parent application Ser. No. 121,919, filed October 18, 1949, Method and Apparatus for Drilling Motion Indicator. Also pending as a continuation-in-part of the above parent application is application Ser. No. 124,563, filed October 31, 1949, Impact Switch.

This invention pertains to the construction of a drilling cable with one or a plurality of insulated conductors, positioned spirally internally in the groove between adjacent strands of the cable and their common core. An insulated conductor has not yet been successfully built into a drilling cable for use with a drilling motion indicator for the cable tool drill. The economic importance of such an indicator is fully developed in the parent application of which this is a continuation-in-part.

In cable-tool drilling, a bit, as part of a string of tools, is attached to the lower end of the drilling cable, which is reciprocated and manipulated at the surface, so that the bit strikes the bottom of the well or bore hole with impact, to effect the drilling. The ordinary drilling cable consists of a plurality of strands wound helically around a common core. When drilling, the varying tension in the cable coats with the spiral structure to cause the bit to spin, which is essential to the drilling of a round hole. As the cable is run into the hole, it is elongated by its own dead weight and that of the tools. This dead weight coats with the spiral construction of the cable to cause it to untwist, which results in further elongation. In operation, the cable is subjected to two secondary vibrations. One of these is a very complex summation of transverse traveling waves, which is generated by the bit striking the formation, and which is reflected back and forth between the rope socket at the top of the string of tools, and the clamp at the surface of a splice, which may be located at some intermediate point in the cable. It subjects the strands to highly concentrated stresses cyclically applied. The other vibration is the natural vibration of the drilling cable which is generated by the inertia of the cable and tools, and which rolls up the cable, somewhat like surf rolling up onto a beach, with a half wavelength less than the length of the drilling cable, and which operates

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to reduce the tension locally in the drilling cable. Reducing the tension in an untwisted helical cable will cause it to kink or "dog-leg." A swivel rope socket at the top of the string of tools overcomes this trouble in shallow and intermediate drilling, by enabling the cable to retwist, through the functioning of the swivel, when the tension between it and the rope socket is reduced at the beginning of the down-stroke of the tools. This retwisting is very rapid. A minimum linear velocity of the tools is required to permit the swivel to function, which cannot be achieved in deep drilling, due to the limitation in s. p. m. imposed by the resonance peak, which is explained fully in my copending application, Serial No. 112,858, filed August 29, 1949 to replace parent application Serial No. 585,871, filed March 31, 1945, now abandoned, "Method and Apparatus for Limiting Stresses in Elongated Elastic Structures."

It is an object of this invention to provide a drilling cable, so constructed that it may be used effectively with a drilling motion indicator. It is another object of this invention to install one or more insulated conductors in a drilling cable in such a way that they will be protected against crushing and supported in tension by the coaction of the strands of the cable and their common core. Still another object is to provide a construction, wherein the insulated conductors will be constrained by the adjacent strands to elongate and contract, untwist and retwist, slowly or rapidly, with a minimum of relative movement between the conductors and the adjacent strands. Again, it is an object to install one or more insulated conductors in a drilling cable, without reducing the area of the steel, and hence the tensile strength of the cable.

Other objects and advantages of my invention, together with a further understanding of its nature and the detailed features of construction thereof, will be apparent from the detailed illustrations and specifications that follow, wherein:

Figure 1 is a fragmentary plan view of the cable comprising the present invention showing the relative positions assumed by the armored strands, conductors, and the core, and

Figure 2 is a transverse sectional view of the cable.

Referring to the drawings, Figures 1 and 2 show the insulated conductors 23 and 24 spirally disposed in the grooves between adjacent strands and their common core in the drilling cable 9. While two such conductors are shown, only one may be used in conjunction with a ground or a plurality of conductors may be used. When a

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plurality of insulated conductors are used, they may be divided into groups with approximately the same number of insulated conductors, and the insulated conductors of each group may be connected in parallel for balance and to reduce resistance. It is desirable that these conductors be insulated with an oil resistant insulation and that they be positioned helically in the groove between two adjacent strands 25 and the common core 25 of the drilling cable, especially when a copper conductor is used, so that any tendency to creep is minimized and so that the conductor or conductors will have the same stretch, distributed in the same way, as the drilling cable. Also, the conductors can be installed in the cable easily, when it is assembled. Under normal drilling conditions, the cable is elongated longitudinally by its own weight, the weight of the tools and by inertia. It untwists slowly, and retwists rapidly due to the geometry of the helix and the operation of the swivel rope socket. Slack may be thrown into it at some point along its length. Placing the insulated conductor helically in the groove between two adjacent strands and their common core minimizes the crushing forces, as adjacent strands abut to form a ring, which absorbs the compressive forces tangentially. The strands of the drilling cable support the insulated conductor or conductors, which have relatively low tensile strengths. The insulated conductors can elongate, untwist and retwist with the drilling cable, with the minimum of relative movement between the strands and the insulated conductor and with the minimum of cold working. While a standard 6 x 19 drilling cable is illustrated, a wide range of special drilling cables, such as Filler Wire, Seale, Warrington, Preformed and Independent Wire Center, to mention the more common, may be substituted equally satisfactorily. Inasmuch as the voltage drop is not an important factor, a stranded steel wire insulated conductor can be substituted for a stranded copper wire insulated conductor with advantages including lower cost and greater strength and elasticity. It is evident that, in this construction, the insulated conductor is constrained by the adjacent strands of the drilling cable to follow the complicated movements of the cable during drilling operations and that there is definite coaction between them. While maintaining a minimum of relative movement between strands and conductor the coaction is more rolling than sliding.

To summarize, I have disclosed herein the construction of a drilling cable with associated insulated electrical conductors, wherein the conductors are constrained by the strands of the cable to conform to the complicated reactions of the cable during drilling. This definite coaction is accomplished without any reduction in the area of the steel in the cable, so there is no loss in strength. The composite cable can be made cheaply at production rates and will make the substantial economies of higher speed drilling available to the industry.

What I claim as new and desire to secure by Letters Patent is:

1. A cable comprising a core, a layer of laterally abutting bare wire strands helically disposed around said core in contact therewith so as to form a plurality of continuous helical grooves of

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the same direction of lay and said strands between adjacent strands and said core, and an insulated electrical conductor positioned in at least one of said grooves.

2. A cable comprising a core, a layer of laterally abutting bare wire strands helically disposed around said core in contact therewith so as to form a continuous helical groove of the same direction of lay as said strands between each pair of adjacent strands and said core, and an insulated electrical conductor positioned in at least one of said grooves.

3. A cable comprising a core, a layer of laterally abutting bare wire strands helically disposed around said core in contact therewith so as to form a plurality of continuous helical grooves of the same direction of lay as said strands between adjacent strands and said core, and an insulated electrical conductor positioned in at least one of said grooves, said conductor being supported in tension by said strands and said core whereby it is protected against crushing and constraining to parallel the twisting and elongating motions of the abutting strands of said cable.

4. A cable comprising a core, a layer of laterally abutting bare wire strands helically disposed around said core in contact therewith so as to form a continuous helical groove of the same direction of lay as said strands between each pair of adjacent strands and said core, and an insulated electrical conductor positioned in at least one of said grooves, said conductor being supported in tension by said strands and said core whereby it is protected against crushing and constraining to parallel the twisting and elongating motions of the abutting strands of said cable.

5. A cable comprising a core, a plurality of bare wire strands helically disposed around said core, the adjacent strands of said helically disposed strands being in abutting contact so as to form a continuous internal helical groove of the same direction of lay as said strands between each pair of abutting strands and said core, and an insulated electrical conductor positioned in said internal groove, and supported in tension, whereby said insulated electrical conductor is protected against crushing and constrained to parallel the motion, including untwisting, retwisting and elongation of the cable by said adjacent strands.

JOHN F. KENDRICK.

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