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COMPOSITE ELECTRICAL CONDUCTOR

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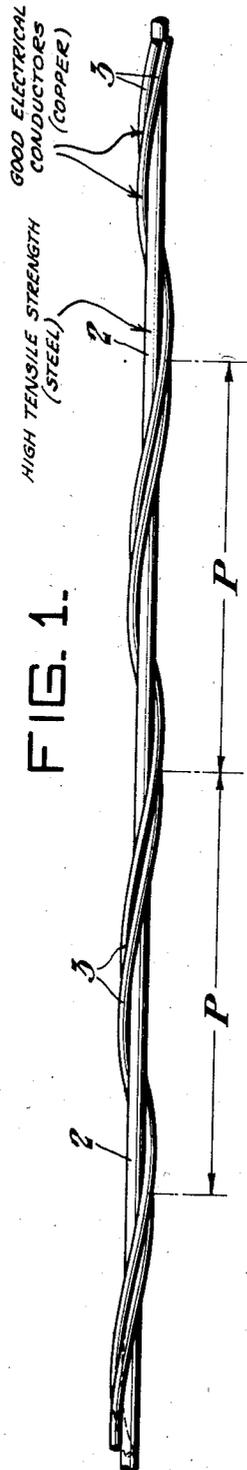


FIG. 1.

FIG. 2.



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COMPOSITE ELECTRICAL CONDUCTOR

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5 Claims. (Cl. 174-129)

This invention relates to overhead electric transmission lines, especially of the type now being commonly used in carrying out rural electrification projects, and particularly to an improved composite electrical conductor therefor.

It is well known that rural electric transmission lines are characterized by the use of poles which are spaced greater distances than is normally considered good practice. Economy dictates that these poles be relatively short, it following that the conductors must be strung under relatively high tension to prevent them sagging an excessive amount. Economy also dictates that the conductors be of a relatively inexpensive construction.

A single wire conductor is of such a shape that the wind gives rise to excessive transverse vibration which so stresses the conductor as to cause its premature fracture through fatigue. Two intertwined wires, through some form of propeller action in the wind, result in torsional vibration, this resulting in the premature failure of this type of a conductor also through fatigue.

A conductor consisting of three intertwined wires has substantially a triangular cross section, and it has been found that a conductor having such a cross section is less subject to the action of the wind than conductors having other forms of cross sections. Also, a conductor strand made of three intertwined wires is not particularly subject to either transverse or torsional vibration, although it still has some tendency to vibrate either transversely or torsionally. It is for these reasons that the three-wire conductor strand is generally used for rural electrification purposes.

Because of electrical reasons, as is well known to those skilled in the art, these three-wire conductor strands are made with one or two of the wires of copper and with the remainder of the wires made of steel or some other suitable high-strength material, or with one or two of the wires of low carbon steel and with the remainder of the wires of high carbon steel and usually with all of the wires having the same diameter.

However, an electrical conductor consisting of three intertwined wires, as above described, is unsatisfactory for long spans for the reason that there is too great a degree of elongation in the conductor, thereby resulting in an excessive sag between the poles or points of support. That is, the amount of steel contained in the steel wire of the same diameter as the copper wires does not provide sufficient overall tensile strength in the conductor.

Since, for reasons of good practice, it has been found undesirable to increase the tensile strength of the steel in the steel wire, the only alternative remaining was to increase its diameter and maintain the original diameter of the copper wires, but if the size of the steel wire is increased, in such an

intertwisted construction, it has been found that while the tensile strength of the construction was increased materially, it showed creeping characteristics, that is, the individual wires move relative to one another due to the force of the wind, which, of course, is undesirable.

In the present invention there is provided a composite electrical conductor in which any creeping of the individual wires relative to each other has been reduced to a minimum or practically eliminated, and at the same time, a conductor having a high tensile strength so as to permit long spans without excessive sag and tension in the conductor thereby reducing the number of poles or points of support per mile to a minimum and a consequent reduction in the cost of such lines.

Accordingly, it is one of the objects of the present invention to provide an improved composite electrical conductor for overhead transmission lines which is simple and inexpensive in its construction and use, and one which not only possesses the high tensile strength necessarily required of such a conductor, but all the other characteristics required of a good electrical conductor.

It is another object of the invention to provide an improved composite electrical conductor which is strong and rugged and one which requires less material per unit of length in its construction than any conductor heretofore suggested or used so as to provide a high-strength low-weight ratio conductor and, at the same time, a conductor which has a minimum amount of sag or elongation per unit of length.

Various other objects and advantages of this invention will be more apparent in the course of the following specification and will be particularly pointed out in the appended claims.

In the accompanying drawing there is shown, for the purpose of illustration, one embodiment which my invention may assume in practice.

In the drawing:

Figure 1 is a plan view of a portion of the improved composite electrical conductor of my invention; and

Figure 2 is a cross section thereof.

Referring more particularly to the drawing, the improved composite electrical conductor of my invention comprises a galvanized relatively straight steel or steel alloy wire 2 having a relatively high tensile strength or a wire made from some other suitable high tensile strength material such as bronze, high-strength aluminum, aluminum alloy, brass, chrome, chrome-nickel and the like, which is adapted to form a core and having a diameter preferably of approximately .112 to .115 of an inch. There is helically wound or twisted around the steel wire core in side-by-side relation a pair of galvanized copper wires 3 or other suitable wires having the quality of a good

electrical conductivity such as aluminum, manganese, iron, zinc and the like and with each having a diameter preferably of approximately .093 of an inch. That is, the steel or high tensile strength wire 2 is made straight and acts as a core for the two copper or other good conductor wires 3 which are wrapped therearound in side-by-side relation to one another. It will be understood that the two copper wires 3 are not preformed but are merely stranded together about the straight steel wire core 2. In some instances, and for certain uses, it might be desirable that the wire core 2 and the outer wires 3 be of the same material.

According to the present invention, the length of the pitch, as designated at P in Figure 1 of the drawing, between the helices of the pair of copper wires 3, is approximately from twelve to eighteen times the overall or effective diameter of the conductor or strand. It will be understood that the overall or effective diameter as referred to herein means the diameter of a circle circumscribing the three wires, namely, the steel wire 2 and the two copper wires 3, in their assembled position. In the present instance, in using a steel wire having a diameter of .115 of an inch and copper wires each having a diameter of .093 of an inch, the length of the pitch P or lay of the pair of copper wires is twelve to eighteen times the overall or effective diameter of .208 of an inch, which equals approximately $2\frac{1}{2}$ to 4 inches. That is, the pitch or lay of the pair of copper wires 3 about the steel wire 2 can be anywhere between $2\frac{1}{2}$ and 4 inches in the present case and still provide a satisfactory conductor within accordance with the teachings and principles of my invention.

It is preferable that the steel wire 2 have an elongation of approximately from five to six percent and with the copper wires 3 having a maximum elongation of approximately one and one-half percent. The reason for this is to permit the full strength of the steel wire to absorb any stress to which the conductor is subjected before any material amount of stress is transmitted to the copper wires and causes premature failure thereof. As will be readily seen, such a result is obtained from the manner in which the pair of copper wires is shaped or wound around the steel wire core. That is, the copper wires so arranged will tend to be deformed about the steel wire before being subjected to any excessive strain. Thus, it will be seen that when the conductor is under stress, the steel wire will stretch and reach the limit of its five to six percent elongation at about the same time that the copper wires are beginning to reach the limit of their one and one-half percent elongation, and the result would be that this construction favors the elongation limitations of the high drawn copper wires. It will be understood that in a three-wire conductor strand made of copper and steel wires of the conventional intertwisted type as heretofore used, such a result will not be obtained for the reason that when the conductor was under stress, the copper wires were usually under such stress that they broke before the steel wire, with its extra elongation, had a chance to carry its share of the load up to its full capacity.

As a result of my invention, it will be seen that the steel wire of the composite conductor acts entirely as a structural member and the copper wires act entirely as electrical conductors. It will also be seen that in the conductor of the present invention, all of the advantages of a sin-

gle straight steel wire conductor are obtained, and yet, at the same time, the cross section of the present conductor at any point in triangular as shown in Figure 2 of the drawing, thereby obtaining all those advantages of a three-wire conductor. It will be seen further that my improved conductor, due to its construction, can be strung with longer spans for the same amount of sag with any given tension than any three-wire conductor heretofore proposed or used.

While I have shown and described an embodiment of my invention, it will be understood that I do not wish to be limited exactly thereto, since various modifications may be made without departing from the scope of the invention, as defined in the appended claims.

I claim:

1. As a new article of manufacture, a composite electrical conductor consisting solely of three wires with one of said wires being a relatively straight steel wire having a diameter of about .112 to .115 of an inch with a relatively high tensile strength, and a pair of wires with each having a diameter of about .093 of an inch wrapped around said steel wire in side-by-side relation and having the quality of good electrical conductivity.

2. As a new article of manufacture, a composite electrical conductor consisting solely of three wires with one of said wires being a relatively straight steel wire having a relatively high tensile strength with an elongation of approximately from five to six percent which is adapted to form a core, and a pair of wires wrapped around said steel wire core in side-by-side relation having the quality of good electrical conductivity with each having a maximum elongation of approximately one and one-half percent.

3. As a new article of manufacture, a composite electrical conductor consisting solely of three wires with one of said wires being a relatively straight wire having a relatively high tensile strength which is adapted to form a core, and having a diameter of approximately from .112 to .115 of an inch, and a pair of wires helically wound around said high tensile strength wire core in side-by-side relation having the qualities of good electrical conductivity with each of said last mentioned wires having a diameter of approximately .093 of an inch, and with the pitch of the helices of said helically wound wires being approximately from $2\frac{1}{2}$ to 4 inches.

4. A composite electrical conductor as defined in claim 3 wherein the relatively high tensile strength core wire has an elongation of approximately from five to six percent and each of the helically wound wires has a maximum elongation of approximately one and one-half percent.

5. As a new article of manufacture, a composite electrical conductor consisting solely of three wires with one of said wires being a relatively straight wire having a relatively high tensile strength which is adapted to form a core, and having a diameter of approximately from .112 to .115 of an inch, and a pair of wires helically wound around said high tensile strength wire core in side-by-side relation having the qualities of good electrical conductivity with each of said last mentioned wires having a diameter of approximately .093 of an inch, and with the pitch of the helices of said helically wound wires being approximately from 12 to 18 times the overall diameter of the completed conductor.

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