April 27, 1965 S. EGE 3,180,925

CONDUCTOR STRAND

Filed Sept. 15, 1961

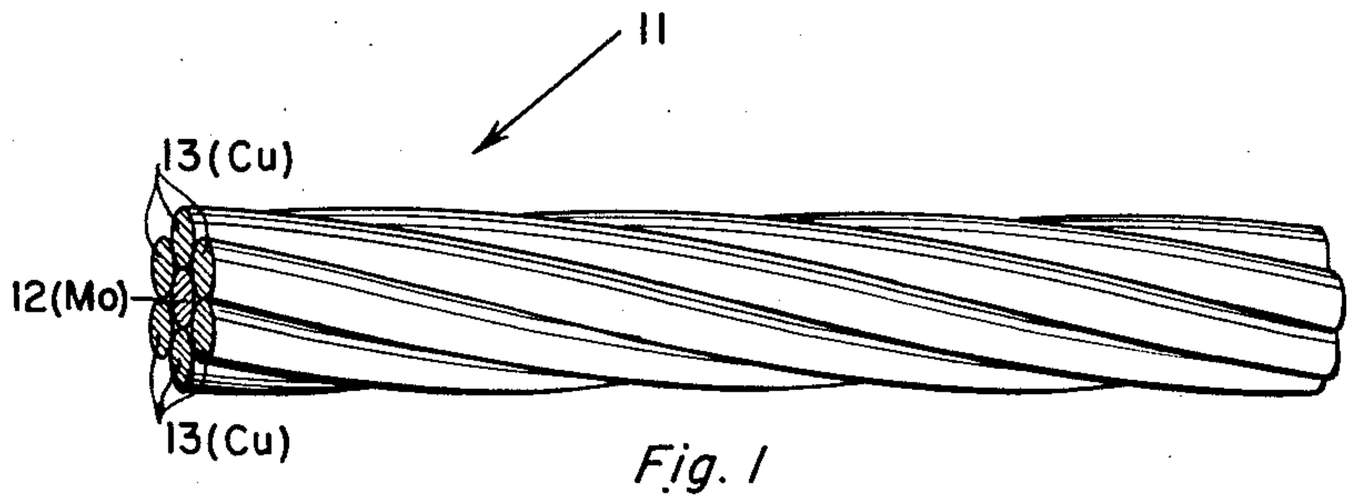

Fig. 1

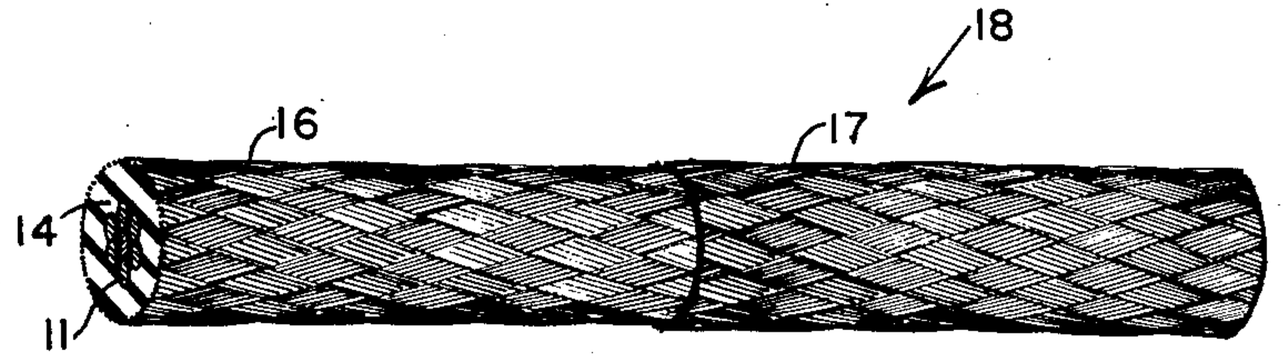

Fig. 2

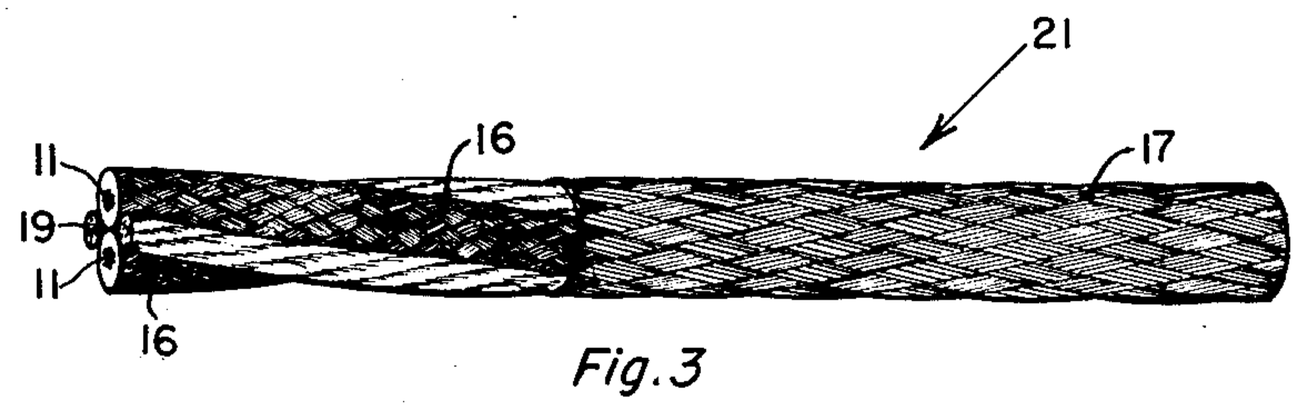

Fig. 3

INVENTOR.

SIGMUND EGE

BY V.F. Dodge

HIS AGENT

United States Patent Office

3,180,925

Patented Apr. 27, 1965

3,180,925

CONDUCTOR STRAND

Sigmund Ege, Hastings on Hudson, N.Y., assignor to Anaconda Wire and Cable Company

Filed Sept. 15, 1961, Ser. No. 138,372
8 Claims. (Cl. 174—102)

My invention relates to electrical conductors and particularly to composite conductors with a molybdenum core.

In the manufacture of electric cables which are expected to maintain circuit integrity under severe conditions such as exposure to high temperatures or flame it is known to apply an inorganic insulation or an insulation comprising a large inorganic component over a stranded copper wire and to cover the insulated core with a metallic sheath such as a copper braid. It is known to use silicone rubber for the aforementioned insulation and to cure the silicone at elevated temperatures before applying the braid.

In order to obtain the maximum conductivity for a given conductor size it is customary to use soft or annealed copper strands for the conductor. In any event the strands become annealed during the vulcanization of the silicone rubber insulation and this usually overcomes any work hardening of the copper in prior processing. Specifications for flame-proof cables of the type under consideration usually require that they should retain circuit integrity after a test involving direct exposure to a gas flame for a period such as one hour. Known cables have evidenced a high percentage of failures during this flame test caused by short circuiting between the copper conductor and the metallic sheath and it is an object of my invention to produce a cable that will not short circuit during the flame test.

A stranded conductor is comprised of seven copper wires of equal diameter with six of the wires wrapped helically around a single wire core. I have discovered that a cable which invariably passes the flame test can be made by substituting a molybdenum wire for the center copper core while the six outer wires are not changed.

The practice of my invention involves an electrical conductor comprising a molybdenum core and a plurality of copper wires wrapped helically around it and preferably a round molybdenum core wire with six round copper wires wrapped around it, all the wires having the same diameter. It also involves the aforementioned conductor surrounded by a layer of incombustible insulation such as silicone rubber covered with a glass braid and a metallic sheath such as a braid over the glass.

A more thorough understanding of my invention may be obtained by reference to the appended drawing.

In the drawing:

FIGURE 1 is a perspective view of a conductor of my invention.

FIGURE 2 is a perspective view of a cable made to my invention.

FIGURE 3 is a perspective view of a paired cable made to my invention.

Referring to FIGURE 1 a conductor indicated generally by the numeral **11** has a central wire **12** of molybdenum which is wrapped with six copper wires **13**. I prefer to employ molybdenum wire with a temper such that the tensile strength is no less than 145,000 p.s.i. and the elongation 5–15% but I have found that molybdenum of other tempers is also effective and I do not wish to be limited to the preferred values. Similarly I prefer, but do not wish to be limited to, copper wires **13** that are dead soft or fully annealed so as to obtain maximum conductivity and flexibility for my conductor.

In FIGURE 2 I have shown my conductor **11** insulated

with a silicone rubber compound **14** and covered with a glass braid **16** and a metallic braided sheath **17** to form a cable indicated generally by the numeral **18**. It will be understood, however, that my invention is not limited to silicone rubber, but will apply to any insulation capable of withstanding high temperatures. If the insulation is destroyed to the degree that it leaves no dielectric barrier around the conductor, the cable will, of course, lack utility, but the particular degree of temperature resistance required of the insulation will depend on the service and emergency conditions it is anticipated that the cable will encounter. When silicone rubber burns it leaves an insulating residue and it is one of the functions of the glass braid **16** to retain this residue in place. Generally speaking, short circuits between conductors and sheaths due to increases in temperature insufficient to destroy the insulation do not constitute a problem at temperatures below 300° C. so that my invention will have utility when used with any insulation capable of maintaining a dielectric barrier at 300° C. or higher. Such insulations include the polyfluorocarbons, asbestos, glass fiber, inorganic powders such as magnesium oxide and blends or compounds of these materials.

In FIGURE 3 two of the conductors with glass braids but without any metallic sheath **17** have been twisted together, fillers **19** have been laid in the valleys and the braid sheath **17** has been applied over the twisted pair to form a cable indicated generally by the numeral **21**. In this case the metallic sheath is applied over both of the insulated conductors so that short circuiting might occur between any one of the conductors **11** and the sheath **17** of the cable **21**. It will be understood that a plurality of the cables **18** or **21** may be combined into a single multiconductor cable structure that will retain the advantages hereinbefore enumerated.

Example 1

Cables were constructed by stranding seven soft copper wires .0113 inch in diameter, six around one with a .44-inch lay. Silicone rubber insulation was extruded over these conductors to a diameter of .078 inch and cured at 250°–500° F. for 23 hours. Braids of 150–1/O glass fiber were then applied over the insulation in 16-carrier braiders. Two of the glass-braided conductors were twisted together and braided with a sheath of .005 soft copper in a 16-carrier braider with 90% coverage.

Example 2

Cables were constructed identical to Example 1 except that a molybdenum center wire replaced the center one of the copper conductors.

Multipair cables were formed by stranding **12** of the pairs of Example 1 with appropriate fillers and covering. Multipair cables were also formed by stranding three of the pairs of Example 2 with appropriate fillers and covering. Six specimens of the multipair cable made with cables of Example 1 and three specimens of the multipair cable made with the cables of Example 2 were exposed over a 2-foot length for a period of one hour to an open gas flame. Five of the multipair cables of Example 1 failed this test by short circuiting of conductor to shield, and none of the cables of Example 2 failed.

I have invented a new and useful article of manufacture for which I desire an award of Letters Patent.

I claim:

1. An electrical conductor comprising a molybdenum core and a plurality of copper wires wrapped helically around said core.

2. An electrical conductor comprising a round molybdenum core wire and six round copper wires wrapped helically around said core, all of said wires being equal in diameter.

3. An electric cable comprising a molybdenum core, a plurality of copper wires wrapped helically around said core, a layer of insulation capable of maintaining a dielectric barrier at 300° C. surrounding said wires, and a metallic sheath over said insulation.

4. The cable of claim 3 wherein said sheath is a braid.

5. An electric cable comprising a molybdenum core, a plurality of copper wires wrapped helically around said core, a layer of silicone rubber insulation surrounding said wires, a flame resistant fibrous braid over said insulation, and a metallic sheath over said fibrous braid.

6. The cable of claim 5 wherein said sheath is a braid.

7. An electric cable comprising a molybdenum core, a plurality of copper wires wrapped helically around said core, a layer of insulation comprised of a composition selected from the group consisting of silicone rubber, polyfluorocarbon, asbestos, glass fiber and magnesium oxide surrounding said wires, and a metallic sheath over said insulation.

8. The cable of claim 7 wherein said sheath is a braid.

References Cited by the Examiner

UNITED STATES PATENTS

990,040	4/11	Franke	174—126
2,863,032	12/58	Morris	174—102

OTHER REFERENCES

"Advertisement by General Electric Co., "General Electric Review," July 1955, vol. 58, No. 4, page 2.

JOHN F. BURNS, *Primary Examiner.*

JOHN P. WILDMAN, DARRELL L. CLAY, *Examiners.*