Sept. 4, 1956 J. J. MORRISON 2,761,893

TRAVELING ELECTRICAL CABLE

Filed May 23, 1952

FIG. 1.

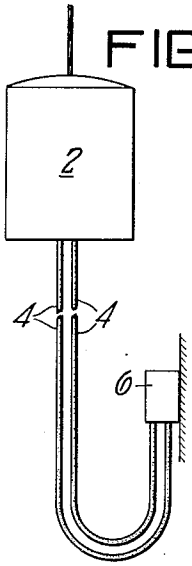


FIG. 3.

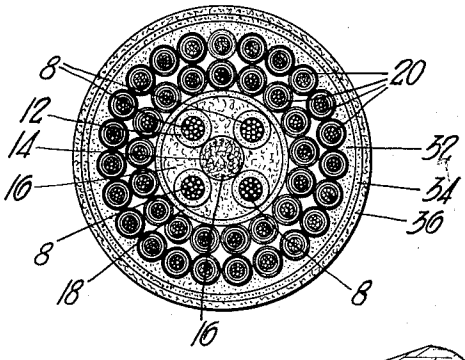


FIG. 2.

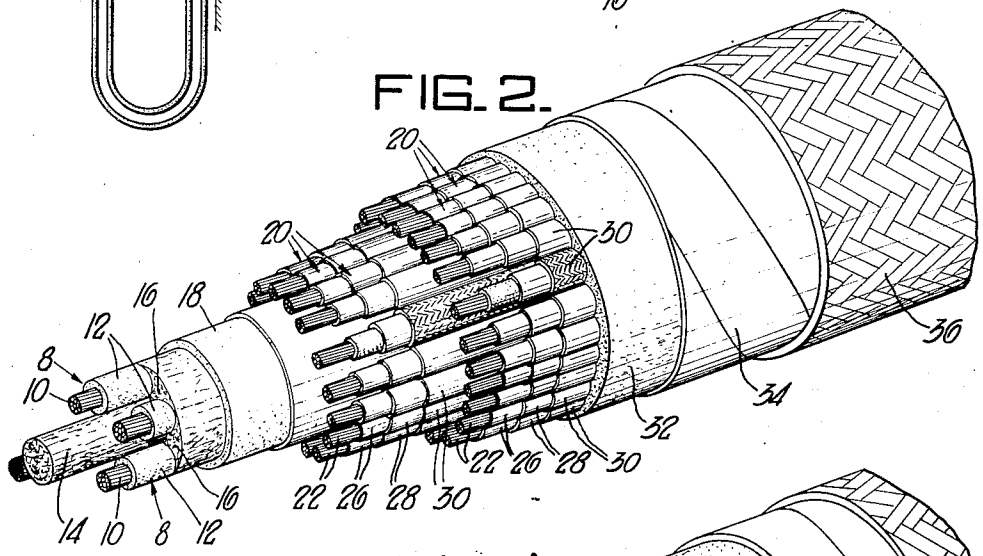


FIG. 4.

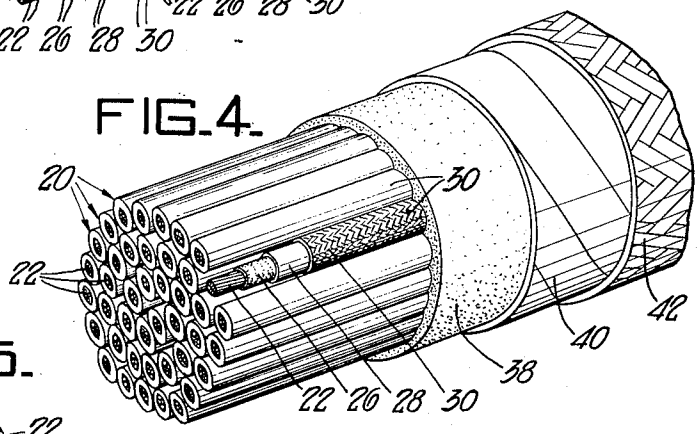
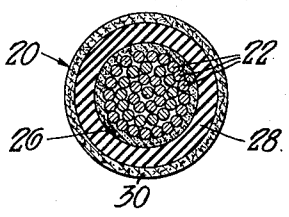


FIG. 5.



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TRAVELING ELECTRICAL CABLE

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7 Claims. (Cl. 174—116)

This invention, which is a continuation-in-part of my copending application, Serial No. 53,415, filed October 8, 1948, now abandoned, relates to a traveling electrical cable and more particularly to such a cable for use in supplying electricity to elevators. These cables consist of varying numbers of insulated conductors with the conductors usually being made up of individual copper wires of the number required to give the desired area. One end of each cable is stationary, being attached to a junction box approximately at the half-way point in the vertical rise of the elevator hatch. The other end of the cable is attached to the bottom of the elevator car with a small excess in length to form a loop below the car when at ground level and which loop travels as the car rises so that it is near the junction box when the car is at the top of the building. As a result of conditions resulting from centrifugal force, windage, vibration, etc., the adjustment and balance of all the cables on the car, which number may be as high as 20, must be precise since if the cable fails to run evenly or to track properly, it will be thrown out of position and damaged.

Prior to my invention it was thought that these cables must have great flexibility in order to track properly with the ability to track improving as the flexibility became greater. For that reason, a rubber insulation was normally used over each of the conductors. I have found that by using a synthetic resin insulation and proportioning the ratio between the area of each conductor and the area of the conductor plus the surrounding insulation a stiffer cable is produced which works better than the more flexible cables. I have also found that this ratio may be greater than that normally used so that a greater number of conductors can be placed in one cable.

It is therefore an object of my invention to provide a traveling electrical cable which will track better than the cables now in general use.

This and other objects will be more apparent after referring to the following specification and attached drawings, in which:

Figure 1 is a schematic view of the cable attached to the elevator car;

Figure 2 is a perspective view of the completed cable with parts exposed;

Figure 3 is a transverse sectional view of the cable of Figure 2;

Figure 4 is a perspective view of a second type of cable with parts exposed; and

Figure 5 is a sectional view through an individual insulated conductor.

Referring more particularly to Figure 1 of the drawings, reference numeral **2** indicates an elevator car. One end of each of a plurality of traveling electrical cables **4** is attached to the elevator car **2**. The other ends of the cables **4** are attached to a junction box **6**. While only two cables are shown the actual number will ordinarily be much greater. As the elevator car **2** travels up and down the cables **4** travel therewith thus increasing and

decreasing the length of the loop in the cables. One type of cable which is particularly suited for very high lift high speed elevators is shown in Figures 2 and 3. In addition to the electrical conductors these cables are preferably furnished with a stranded steel wire core. In the embodiment shown in Figure 2 the core consists of four strands **8** with each of the strands being formed from a plurality of steel wires **10** stranded together with a left-hand lay. Each of the strands **8** is covered with a cotton covering **12** therearound which is preferably applied as follows: The first braid layer is formed of No. 8 cotton thread of three ply and seventeen ends. This means that 17 groups of three threads twisted together are formed and laid helically on the steel core. On top of this braid layer is helically laid 18 groups of three threads twisted together. The second layer is laid in the opposite direction to the first layer. On top of the second layer is then helically laid an additional braid of soft cotton formed of No. 26 cotton thread of two ply and three ends. Four of these covered strands are then stranded with a right hand lay about an ammonium phosphate saturated jute center **14** and an ammonium phosphate saturated jute filler **16** is laid in the valleys between the strands in order to form a substantially circular core. A cotton covering **18** is then applied over the assembled core. Covering **18** preferably consists of a first layer formed of No. 8 cotton thread of two ply and five ends and a second layer of No. 10 thread of two ply and three ends. A coating of wax and/or paraffine is applied on top of this coating **18**. A plurality of copper conductor assemblies **20** are then applied about the steel core. As shown, a first layer of seventeen of these conductor assemblies are stranded about the core assembly and then a second layer consisting of twenty-three additional conductor assemblies are stranded on top of the seventeen conductors. The first layer is laid left hand and the second layer right hand. Each of the conductor assemblies **20** consists of twenty-six No. 30 wires **22** bunched together with a one inch long lefthand lay to form a size No. 16 conductor. The copper conductors **22** are annealed at a temperature of about 500° to 600° F. either before or after the wires are bunched. A cotton binder or separator **26** is placed over the conductor **22**. The separator **26** forms substantially 100% coverage which permits sliding of the conductors in the synthetic insulation **28** which surrounds the separator **26**. Substantially 100% coverage means that the coverage may vary from 98% to 101%. The separator **26** may be made of paper, cellophane, or other approved material in place of the cotton. A tracer thread may be wound about the conductor at the same time that the separator is placed thereon. The insulation **28** is a synthetic resin which may be thermoplastic or thermo-setting. I have found that polymers of vinyl chloride, such as polyvinyl chloride, are very satisfactory materials. A particular type of insulation which has proved very satisfactory is known as "Ampyrol" which is a basic synthetic resin consisting of vinyl chloride copolymerized with vinyl acetate and a suitable liquid plasticizer. One specific type of synthetic resin may be made up as follows: Approximately 35 lbs. of polyvinyl chloride in powder form is mixed with approximately 12 lbs. of di-ortyl phthalate liquid plasticizer, about 1.7 lbs. of a powdered stabilizer and about .7 lb. of spindle oil. These substances are mixed together in batches in a mixer for about ten minutes at room temperature and then worked in calendering rolls for about 15 minutes. The calendering rolls are heated internally by steam to a temperature of from 260° to 280° F. After the batch has been properly worked in the rolls it is cut into strips, cooled, and then ground into coarse granules about 1/16 of an inch in diameter. These granules are then placed in an extruding

machine having its cylinders heated to approximately 350° F. and the resin is extruded onto the conductor and then immediately water-cooled. Colored braid **30** of cotton or rayon fibre is then applied on the outside of the insulation. The braid may vary in accordance with an established color code for circuit identification. The braided insulated conductor is then coated with a colorless lacquer which prevents the braid from fraying. I have found that by using the synthetic resin the cable will absorb and suppress to a large degree the varying static and dynamic forces developed by centrifugal force, windage, vibration, etc., in the movement of the cable, this resulting in much better tracking when the ratio between the area of the conductor and the area of the conductor plus the surrounding insulation is correct. This ratio is equal to d^2/D^2, where d is the diameter of the conductor including the separator, if any, and D is the outside diameter of the insulation surrounding the conductor. Satisfactory results are obtained when the transverse area of each conductor is between 30% and 50% of the transverse area of the conductor plus the surrounding insulation, but best results are obtained when the ratio is between 40% and 50%.

Surrounding the cable conductors **20** is a cotton covering **32** which in turn is covered by rubber filled tape **34**. A braid **36** saturated with a flame resistant compound surrounds the entire cable.

In some instances the steel core may be omitted and a plurality of conductor assemblies **20** may be cabled together as shown in Figure 4. Surrounding the cable conductors are a cotton covering **38**, rubber filled tape **40** and braid **42** which correspond to the cotton covering **32**, rubber filled tape **34** and braid **36** of Figure 2.

While two embodiments of my invention have been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. A traveling electrical cable comprising a plurality of steel supporting strands, each of said strands including a plurality of steel wires stranded together with a lefthand lay, a cotton covering over said strands, a jute center around which said strands are stranded with a righthand lay, a jute filler in the valleys between said strands, a cotton covering over said assembled strands, a plurality of conductors of No. 16 AWG or coarser stranded about the covered assembled strands with a lefthand lay, each of said conductors including a plurality of annealed copper wires bunched together with a lefthand lay, a separator having substantially 100% coverage surrounding each of said conductors, a synthetic resin insulation surrounding each of said conductors, the transverse area of each conductor being between 30% and 50% of the transverse area of the conductor plus the surrounding insulation.

2. A traveling electrical cable according to claim 1 in which a plurality of conductors similar to the first mentioned conductors are stranded about the first mentioned conductors with a righthand lay.

3. A traveling electrical cable comprising a plurality of steel supporting strands, each of said strands including a plurality of steel wires stranded together, a covering of fibrous material over said strands, a center filler around which said strands are stranded with a lay opposite to the lay of the wires, a filler in the valleys between said strands, a covering of fibrous material over said assembled strands, a plurality of conductors of No. 16 AWG or coarser stranded about the covered assembled strands, each of said conductors including a plurality of annealed copper wires bunched together with a lay of the same direction as the conductors, a synthetic resin insulation surrounding each of said conductors, the transverse area of each conductor being between 30% and 50% of the transverse area of the conductor plus the surrounding insulation.

4. A traveling electrical cable according to claim 3 in which a plurality of conductors similar to the first mentioned conductors are stranded about the first mentioned conductors with a direction of lay opposite to that of the first mentioned conductors.

5. A traveling electrical cable comprising a plurality of steel supporting strands, each of said strands including a plurality of steel wires stranded together, a covering of fibrous material over said strands, a center filler around which said strands are stranded with a lay opposite to the lay of the wires, a filler in the valleys between said strands, a covering of fibrous material over said assembled strands, a plurality of conductors of No. 16 AWG or coarser stranded about the covered assembled strands, each of said conductors including a plurality of annealed copper wires bunched together with a lay of the same direction as the conductors, a separator having substantially 100% coverage surrounding each of said conductors, a synthetic resin insulation surrounding each of said conductors, the transverse area of each conductor being between 30% and 50% of the transverse area of the conductor plus the surrounding insulation.

6. A traveling electrical cable according to claim 5 in which a plurality of conductors similar to the first mentioned conductors are stranded about the first mentioned conductors with a direction of lay opposite to that of the first mentioned conductors.

7. A traveling electrical cable comprising a plurality of steel supporting strands, each of said strands including a plurality of steel wires stranded together with a lefthand lay, a cotton covering over said strands, a jute center around which said strands are stranded with a righthand lay, a jute filler in the valleys between said strands, a cotton covering over said assembled strands, a plurality of conductors of No. 16 AWG or coarser stranded about the covered assembled strands with a lefthand lay, each of said conductors including a plurality of annealed copper wires bunched together with a lefthand lay, a synthetic resin insulation surrounding each of said conductors, the transverse area of each conductor being between 30% and 50% of the transverse area of the conductor plus the surrounding insulation.

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