

COMPOSITE CABLE

REFERENCE TO RELATED APPLICATIONS

5 The present application is related to Israel Patent Application Serial No. 171198 filed September 29, 2005 and entitled COMPOSITE CABLE, the contents of which are hereby incorporated by reference, and priority of which is hereby claimed.

FIELD OF THE INVENTION

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 The present invention relates to cables generally and more particularly to cables incorporating textile materials.

BACKGROUND OF THE INVENTION

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 The following published patent documents are believed to represent the current state of the art:

 U.S. Patents 4,438,293 and 4,034,547.

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SUMMARY OF THE INVENTION

The present invention seeks to provide an improved cable.

There is thus provided in accordance with a preferred embodiment of the
5 present invention a composite cable including a tubular core, an outer textile fiber sheath and at least one intermediate layer of a textile material disposed between the tubular core and the outer sheath.

In accordance with a preferred embodiment of the present invention the tubular core includes a conduit which is suitable for flow of fluid therethrough.
10 Preferably, the tubular core includes an optical fiber. Additionally or alternatively, the tubular core includes at least one conducting wire.

In accordance with another preferred embodiment of the present invention the tubular core includes a metal fiber core including a plurality of twisted metal wires disposed around a spun textile fiber center element. Preferably, an outer tubular
15 structure of the tubular core is formed by a plurality of spun textile fibers. Additionally or alternatively, the spun textile fibers include spun cotton fibers.

In accordance with yet another preferred embodiment of the present invention the outer textile fiber sheath and the intermediate layer are assembled using braiding techniques. Preferably, the outer textile fiber sheath and the intermediate layer
20 are assembled using twisting techniques. Additionally or alternatively, the at least one intermediate layer includes a layer of high tenacity fibers.

In accordance with still another preferred embodiment of the present invention the at least one intermediate layer includes a layer of spun polyester. Preferably, the outer textile fiber sheath includes a layer of polyester.

25 In accordance with a further preferred embodiment of the present invention the outer textile fiber sheath includes a fire retardant fiber or finish. Preferably, the outer textile fiber sheath includes a fire resistant fiber or finish.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description, taken in conjunction with the drawings in which:

5 Fig. 1 is a pictorial illustration of a cable constructed and operative in accordance with a preferred embodiment of the present invention;

 Fig. 2 is a sectional illustration of the cable of Fig. 1 taken along section line II - II in Fig. 1;

10 Fig. 3 is a pictorial illustration of a cable constructed and operative in accordance with another preferred embodiment of the present invention;

 Fig. 4 is a sectional illustration of the cable of Fig. 3 taken along section line IV - IV in Fig. 3.

 Fig. 5 is a pictorial illustration of a cable constructed and operative in accordance with yet another preferred embodiment of the present invention;

15 Fig. 6 is a sectional illustration of the cable of Fig. 5 taken along section line VI - VI in Fig. 5;

 Fig. 7 is a pictorial illustration of a cable constructed and operative in accordance with a further preferred embodiment of the present invention;

20 Fig. 8 is a sectional illustration of the cable of Fig. 7 taken along section line VIII - VIII in Fig. 7;

 Fig. 9 is a pictorial illustration of a cable constructed and operative in accordance with a still further preferred embodiment of the present invention; and

 Fig. 10 is a sectional illustration of the cable of Fig. 9 taken along section line X - X in Fig. 9.

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DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Reference is now made to Figs. 1 and 2, which illustrate a cable 10 constructed and operative in accordance with a preferred embodiment of the present invention.

As illustrated generally to scale in Figs. 1 and 2, the cable 10 is preferably a sheath-core cable, which comprises an inner metal fiber core 12 of twisted metal wires 14, preferably made of steel, wound around a spun textile fiber center 15, preferably formed of polypropylene. Preferably, the inner metal fiber core 12 with the textile fiber center 15 meets German Standard DIN 3060 and/or German Standard DIN 3051. Inner core 12 is commercially available from Moseroth Ltd. of Holon, Israel and preferably has an outer diameter of approximately 3mm and a minimum tear strength of approximately 500 Kg. The term "textile" as used herein includes fibers and other materials, which can be twisted or braided.

Preferably formed over the inner core 12 is a braided layer 16 of spun polyester fibers and preferably formed over layer 16 is a braided layer 18 of high tenacity fibers such as aramid, which is commercially available from Teijin Ltd., of Osaka, Japan, under the trademark TEIJIN® and under the product designation T-1000. Alternately, braided layer 18 may be comprised of other high tenacity fibers such as ultra high molecular weight polyethylene, carbon fibers, polyphenylenebenzobisoxazole or any other suitable high tenacity fiber, wherein high tenacity is defined as 15grams/denier and higher.

Preferably formed over layer 18 is a braided layer 20 of spun polyester fibers and preferably formed over layer 20 is an outer textile fiber sheath 22, which is preferably a braided layer of high-strength polyester fibers. Sheath 22 preferably includes a fire retardant fiber, commercially available from KoSa of Charlotte, N.C., under the trademark Avora®FR and under the product designation FR HT, and has an outer diameter of 8.5 mm. Alternatively, sheath 22 is finished with a flame retardant finish such as AFLAMMIT® PE available from Thor of Speyer, Germany.

In a preferred embodiment of the present invention, layers 15, 16, 18, 20 and 22 comprise fibers which are braided or twisted as illustrated by the weave patterning shown in Fig. 1.

Functional characteristics of the cable 10 are a tear strength of 1750 Kg and a weight, which preferably does not exceed 85 Kg per 1000 meters. The cable is suitable for lowering loads from substantial heights in fire emergencies.

It is appreciated that one or more of the layers 16, 18, 20 and 22 may be
5 obviated. Alternatively, additional textile layers may be added.

It is also appreciated that the tear strength and weight may vary according to the specific use of the cable.

Reference is now made to Figs. 3 and 4, which illustrate a cable 110
constructed and operative in accordance with another preferred embodiment of the
10 present invention.

As illustrated generally to scale in Figs. 3 and 4, the cable 110 is preferably a sheath-core cable, which comprises an electrical wire core 112 formed of a coating 114 such as a plastic coating, and of at least two conducting wires 115. The electrical wire core may be a standard power wire used to empower electrical appliances, such as
15 power cables commercially available from Superior Cables Ltd. of Kiryat-Bialik, Israel, or any other suitable type of wire. Additionally, electrical wire core 112 may include any suitable number of conducting wires 115.

Preferably formed over the electrical wire core 112 is a braided layer 116 of spun polyester fibers. The space between electrical wire core 112 and braided layer 116
20 is preferably filled by spun textile fibers 117, such as cotton fibers. Preferably formed over layer 116 is a braided layer 118 of high tenacity fibers such as aramid, which is commercially available from Teijin Ltd., of Osaka, Japan, under the trademark TEIJIN® and under the product designation T-1000. Alternately, braided layer 118 may be comprised of other high tenacity fibers such as ultra high molecular weight
25 polyethylene, carbon fibers, polyphenylenebenzobisoxazole or any other suitable high tenacity fiber, wherein high tenacity is defined as 15grams/denier and higher.

Preferably formed over layer 118 is a braided layer 120 of spun polyester fibers and preferably formed over layer 120 is an outer textile fiber sheath 122, which is preferably a braided layer of high-strength polyester fibers. Sheath 122 may include a
30 fire retardant or a fire resistant fiber, such as a fire retardant fiber which is commercially available from KoSa of Charlotte, N.C., under the trademark Avora®FR and under the

product designation FR HT. Alternatively, sheath 122 may be finished with a flame retardant finish such as AFLAMMIT® PE available from Thor of Speyer, Germany.

In a preferred embodiment of the present invention, layers 116, 118, 120 and 122 comprise fibers which are braided or twisted as illustrated by the weave patterning shown in Fig. 3.

Functional characteristics of the cable 110 are a tear strength of 1750 Kg and a weight, which preferably does not exceed 85 Kg per 1000 meters. The 110 cable is suitable for providing electrical power to substantial heights, for example for machinery used by a person working on a high building.

It is appreciated that the tear strength of 1,200 Kg is determined according to the EN1891 Standard. The tear strength and weight of cable 110 may vary according to the specific use of the cable.

It is also appreciated that one or more of the layers 116, 118, 120 and 122 may be obviated. Alternatively, additional textile layers may be added.

Reference is now made to Figs. 5 and 6 which illustrate a cable 210 constructed and operative in accordance with yet another preferred embodiment of the present invention.

As illustrated generally to scale in Figs. 5 and 6, the cable 210 is preferably a sheath-core cable, which comprises an inner core tube 212 suitable for flow of liquid therethrough.

Preferably formed over the core tube 212 is a braided layer 216 of spun polyester fibers. The space between core tube 212 and braided layer 216 is preferably filled by spun textile fibers 217, such as cotton fibers. Preferably formed over layer 216 is a braided layer 218 of high tenacity fibers such as aramid, which is commercially available from Teijin Ltd., of Osaka, Japan, under the trademark TEIJIN® and under the product designation T-1000. Alternately, braided layer 218 may be comprised of other high tenacity fibers such as ultra high molecular weight polyethylene, carbon fibers, polyphenylenebenzobisoxazole or any other suitable high tenacity fiber, wherein high tenacity is defined as 15grams/denier and higher.

Preferably formed over layer 218 is a braided layer 220 of spun polyester fibers and preferably formed over layer 220 is an outer textile fiber sheath 222, which is preferably a braided layer of high-strength polyester fibers. Sheath 222 may include a

fire retardant or a fire resistant fiber, such as a fire retardant fiber which is commercially available from KoSa of Charlotte, N.C., under the trademark Avora®FR and under the product designation FR HT. Alternatively, sheath 222 may be finished with a flame retardant finish such as AFLAMMIT® PE available from Thor of Speyer, Germany.

5 In a preferred embodiment of the present invention, layers 216, 218, 220 and 222 comprise fibers which are braided or twisted as illustrated by the weave patterning shown in Fig. 5.

Functional characteristics of the cable 210 are a tear strength of 1750 Kg and a weight, which preferably does not exceed 85 Kg per 1000 meters. The cable 210
10 is suitable for providing liquids to substantial heights, for example for providing water to rescue teams working in substantial heights in fire emergencies.

It is appreciated that the tear strength of 1,200 Kg is determined according to the EN1891 Standard. The tear strength and weight of cable 210 may vary according to the specific use of the cable.

15 It is also appreciated that one or more of the layers 216, 218, 220 and 222 may be obviated. Alternatively, additional textile layers may be added.

Reference is now made to Figs. 7 and 8, which illustrate a cable 310 constructed and operative in accordance with a further preferred embodiment of the present invention.

20 As illustrated generally to scale in Figs. 7 and 8, the cable 310 is preferably a sheath-core cable, which comprises an inner core tube 312 suitable for flow of gases therethrough.

Preferably formed over the core tube 312 is a braided layer 316 of spun polyester fibers. The space between core tube 312 and braided layer 316 is preferably
25 filled by spun textile fibers 317, such as cotton fibers. Preferably formed over layer 316 is a braided layer 318 of high tenacity fibers such as aramid, which is commercially available from Teijin Ltd., of Osaka, Japan, under the trademark TEIJIN® and under the product designation T-1000. Alternately, braided layer 318 may be comprised of other high tenacity fibers such as ultra high molecular weight polyethylene, carbon fibers,
30 polyphenylenebenzobisoxazole or any other suitable high tenacity fiber, wherein high tenacity is defined as 15grams/denier and higher.

Preferably formed over layer 318 is a braided layer 320 of spun polyester fibers and preferably formed over layer 320 is an outer textile fiber sheath 322, which is preferably a braided layer of high-strength polyester fibers. Sheath 322 may include a fire retardant or a fire resistant fiber, such as a fire retardant fiber which is commercially available from KoSa of Charlotte, N.C., under the trademark Avora®FR and under the product designation FR HT. Alternatively, sheath 322 may be finished with a flame retardant finish such as AFLAMMIT® PE available from Thor of Speyer, Germany.

In a preferred embodiment of the present invention, layers 316, 318, 320 and 322 comprise fibers which are braided or twisted as illustrated by the weave patterning shown in Fig. 7

Functional characteristics of the cable 310 are a tear strength of 1750 Kg and a weight, which preferably does not exceed 85 Kg per 1000 meters. The cable 310 is suitable for providing gases to substantial heights, for example for providing oxygen to rescue teams working in substantial heights in fire emergencies.

It is appreciated that the tear strength of 1,200 Kg is determined according to the EN1891 Standard. The tear strength and weight of cable 310 may vary according to the specific use of the cable.

It is also appreciated that one or more of the layers 316, 318, 320 and 322 may be obviated. Alternatively, additional textile layers may be added.

Reference is now made to Figs. 9 and 10, which illustrate a cable 410 constructed and operative in accordance with a still further preferred embodiment of the present invention.

As illustrated generally to scale in Figs. 9 and 10, the cable 410 is preferably a sheath-core cable, which comprises a round inner core 412 including a tube 413 suitable for flow of liquid therethrough, a tube 414 suitable for flow of gases therethrough, two conducting wires 415, and an optical fiber 416. The outer layer of inner core 412, which surrounds tubes 413 and 414, conducting wires 415 and optical fiber 416, is preferably formed of spun textile fibers 417, such as cotton fibers, and provides the round structure of inner core 412. Alternately, fibers 417 may be configured to provide a different shape to inner core 412, such as a rectangular shape or any other suitable shape, and thereby to determine the shape of cable 410, which generally corresponds to the shape of inner core 412.

Preferably formed over the inner core 412 is a braided layer 418 of spun polyester fibers. Preferably formed over layer 418 is a braided layer 420 of high tenacity fibers such as aramid, which is commercially available from Teijin Ltd., of Osaka, Japan, under the trademark TEIJIN® and under the product designation T-1000.

5 Alternately, braided layer 420 may be comprised of other high tenacity fibers such as ultra high molecular weight polyethylene, carbon fibers, polyphenylenebenzobisoxazole or any other suitable high tenacity fiber, wherein high tenacity is defined as 15grams/denier and higher.

Functional characteristics of the cable 410 are a tear strength of 1750 Kg

10 and a weight, which preferably does not exceed 85 Kg per 1000 meters. The cable 410 is suitable for providing any of liquids, gases, optical power or electricity to substantial heights, for example to rescue teams working in substantial heights in fire emergencies.

It is appreciated that the tear strength of 1,200 Kg is determined according to the EN 1891 Standard. The tear strength and weight of cable 410 may vary according

15 to the specific use of the cable.

It is also appreciated that one or more additional braided textile layers, or any other suitable layer, may be added surrounding layers 418 and 420 or therebetween.

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described hereinabove.

20 Rather the present invention includes both combinations and subcombinations of the various features described hereinabove as well as modifications thereof which would occur to persons skilled in the art upon reading the foregoing description and which are not in the prior art.

C L A I M S

1. A composite cable comprising:
a tubular core;
an outer textile fiber sheath; and
at least one intermediate layer of a textile material disposed between said tubular core and said outer sheath.
2. A composite cable according to claim 1, and wherein said tubular core includes a conduit which is suitable for flow of fluid therethrough.
3. A composite cable according to either of claims 1 and 2, and wherein said tubular core includes an optical fiber.
4. A composite cable according to any of claims 1 to 3, and wherein said tubular core includes at least one conducting wire.
5. A composite cable according to any of claims 1 to 4, and wherein said tubular core includes a metal fiber core comprising a plurality of twisted metal wires disposed around a spun textile fiber center element.
6. A composite cable according to any of claims 1 to 5, and wherein an outer tubular structure of said tubular core is formed by a plurality of spun textile fibers.
7. A composite cable according to claim 6, and wherein said plurality of spun textile fibers comprise spun cotton fibers.
8. A composite cable according to any of claims 1 to 7, and wherein said outer textile fiber sheath and said at least one intermediate layer are assembled using braiding techniques.

9. A composite cable according to any of claims 1 to 8, and wherein said outer textile fiber sheath and said at least one intermediate layer are assembled using twisting techniques.
10. A composite cable according to any of claims 1 to 9, and wherein said at least one intermediate layer comprises a layer of high tenacity fibers.
11. A composite cable according to any of claims 1 to 10, and wherein said at least one intermediate layer comprises a layer of spun polyester.
12. A composite cable according to any of claims 1 to 11, and wherein said outer textile fiber sheath comprises a layer of polyester.
13. A composite cable according to any of claims 1 to 12, and wherein said outer textile fiber sheath includes a fire retardant fiber or finish.
14. A composite cable according to any of claims 1 to 13, and wherein said outer textile fiber sheath includes a fire resistant fiber or finish.