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(71) Applicant: **EMM. Kouvidis SA**

715 00 Heraklion, Crete (GR)

(72) Inventor: **Kouvidis, Konstantinos**

715 00 Heraklion

Crete (GR)

(54) **An integrated system of conduits and associated items for the antimicrobial and anti-rodent protection of cables in an electrical distribution network**

(57) An integrated system of conduits and associated supplementary items employed to cover cables in an electrical distribution network, comprising rigid or pliable conduit portions (11, 12), clips (17) adapted to support and fixedly mount conduits (11, 12), couplers (13) adapted to connect linearly oriented sequential conduit portions (11, 12), bends (14) adapted to connect perpendicularly oriented sequential conduit portions (11, 12), junction boxes (16) with a plurality of outlets, spout adaptor

members (15) with an end (15b) adapted to fit within the outlets of junction boxes (16) and an end (15a) adapted to receive a conduit portion (11, 12), including double-wall structured pliable or rigid underground conduits (19) connected with couplers (18), wherein all items (11, 12, 13, 14, 15, 16, 17, 18, 19) are manufactured with a thermoplastic material having a composition comprising an anti-microbial additive and/or an anti-rodent additive, each at a percentage by weight of about 1-8%.

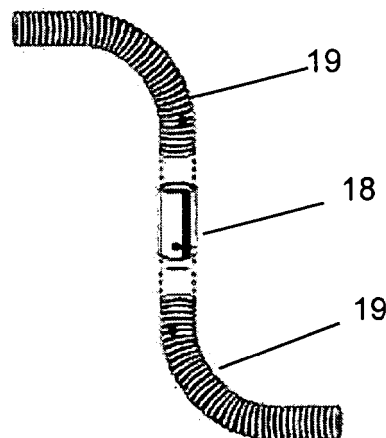


FIG. 9

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Description

THE FIELD OF THE ART

[0001] The invention relates to the antimicrobial and/or anti-rodent protection provided in plastic pipes and accessories employed in covering power supply lines in installations of electrical distribution networks exposed to the ambient environment.

THE BACKGROUND OF THE INVENTION

[0002] An electric power distribution network within a residence, an industrial or a commercial environment comprises appropriately arranged power supply lines providing power for a variety of uses at a plurality of locations within the building, such locations having been determined during the stage of designing the functioning of the building. A thermoplastic composition incorporating an antimicrobial additive in association with compatible physical property modifying agents, such as plasticizers, stabilizers, flame retardants and the like has been employed in various circumstances in association with such electrical power supply installations with a scope of offering protection against attack from a variety of biologically destructive sources, such as fungal growth and microbial attack, thereby diminishing fungal and microbial growth in the surroundings. Antimicrobial additives have been commonly employed in a variety of applications, such as in the production of sanitary articles, of dyes, etc. Such antimicrobial protection is deemed absolutely necessary in hygienically sensitive environments, such as in workshops processing food or pharmaceutical products or in hospital and clinic facilities or in crowded environments, such as schools, sport and recreation centers, restaurants, etc. Reference is made to the following patents of the prior art that describe use of an antimicrobial additive in connection to cables and cords employed in electrical installations.

[0003] US 2009/0101387 discloses a multiple conductor electrical cord, the cord being insulated within a jacket being manufactured with a thermoplastic composition that contains an agent inhibiting biological contamination. This invention is related in particular to wire or cable having at least two conductive electrical wires (core) and having a sheath on this core comprising at least one thermoplastic polymer layer which contains the antimicrobial properties.

[0004] EP 0749128 discloses a filling compound for use in cables and spliced cable connectors, particularly applicable in the field of telecommunication industry, wherein the filling compound comprises amongst other materials an anti-fungal and anti-corrosive ingredient.

[0005] EP 0417713 discloses an electric cable having an outer sheath based on a polymer mixture containing a repellent and insecticide with a scope of providing protection to the cable from the attack of insects, viz-z-viz termites.

[0006] WO 2006/016899 discloses an NBC resistant composition for use in hazardous environments containing nuclear, biological or chemical agents, the composition comprising a terpolymer of an ethylene-propylene-diene monomer (EPDM), a flame retardant and an antimicrobial agent, that may be applied in cables.

[0007] A typical electricity distribution network including such in a hygienically sensitive environment, as is the case with a food or a pharmaceutical industry, comprises a variety of power supply conductors that have different dimensions, especially in relation to the number and thickness of the wires employed in each particular case to serve by way of example lighting requirements or motive requirements of operating machinery and further they may include low voltage conductors, such as those employed in the distribution of lines of telephony or of audio and/or visual signal reception lines. Thus a variety of conductors is being employed, each having the necessary length in order to pass from the predetermined locations wherein terminal power supply points are required, these conductors being fastened to form a bundle of wires and guided along predetermined paths to implement the electrical distribution network, each conductor following a path according to the design and predetermined requirements pertaining to the same, such path varying in length and in the number and location of intermediate terminal points from the path followed by other conductors.

[0008] The object of the invention is to provide protection from microbial growth and/or rodent attack in the overall electrical distribution network in hygienically sensitive facilities, such as in industries processing food or pharmaceutical products including storage facilities for such products, or in clinics and hospitals, etc. Taking into consideration that in most electrical installations in such industrial, commercial or clinic facilities the electrical distribution network is exposed to ambient conditions and is not embedded within the wall structure of the building as is the case with electrical installations in a domestic environment, the conductors are enclosed within appropriately sized and formed conduits and a plurality of supplementary items, such as bends, clips, couplers, spouts, adaptors and junction boxes being employed to implement an integrated electrical distribution network.

[0009] The requirement of varying conductor specification and varying lengths of the plurality of conductors employed to implement an electrical installation exposed to ambient conditions as mentioned herein above, as well as the variety of intermediate terminal points and paths followed by each one of the conductors renders the application of the cited patents of the prior art inapplicable in solving anti-contaminant problems in the case of the present invention, since such patents mainly concentrate in providing a specific antimicrobial protection to a specific single or a multiple conductor cable and cannot solve the problem of offering a substantial, economically viable, antimicrobial protection in the case of electrical installations employing a variety of cables with varying scopes

and specifications, varying terminal points and varying lengths. Furthermore the prior art does not provide for anti-rodent protection that, under certain circumstances, e.g. in underground conduits of cables or in facilities that are left unattended for long periods, such as may happen in storage facilities, may become a priority hazard or even the sole hazard that needs to be tackled. Further, since such exposed electrical installations are being covered with the aforementioned appropriately sized and formed conduits and the aforementioned plurality of supplementary items, such as bends, clips, couplers, spouts, adaptors and junction boxes employed to implement the electrical distribution network, it is often awkward or even impossible to appropriately clean and maintain such a complex structure in a condition that will inhibit microbial growth and further act as a repellent of possible rodent attack.

[0010] Thus, the object of the invention is to provide an integrated system of conduits and associated supplementary items, such as bends, clips, couplers, spouts, adaptors and junction boxes employed to thoroughly cover the variety of power supply cables in electrical installations exposed to ambient conditions, such integrated system of conduits and associated supplementary items acting so as to eliminate microbial growth and/or rodent attack thereby adequately protecting electrical conductor cables being guided therein and advantageously diminishing microbial growth in the surrounding environment, this integrated system comprising rigid and pliable conduits covering the power supply conductors all along the length of the same, as well as bends, clips, couplers, spouts, adaptors and watertight junction boxes provided at predetermined designed locations along the lengths of such rigid or pliable conduits with a scope of connecting and fixedly supporting sequential lengths of the above-mentioned rigid and pliable conduits, including underground conduits used to transfer electric power and/or telecommunication cables to the site of the electrical installation, wherein manufacturing of the aforementioned conduits and associated items is made with a thermoplastic material that comprises a mixture of about 1-8% of an anti-microbial additive and of about 1-8% of an anti-rodent additive.

[0011] It is expected that as long as the entire surface of the electrical installation being exposed to ambient conditions is made with such a thermoplastic material that comprises an anti-microbial and an anti-rodent additive, the entire system comprising the rigid or pliable conduits and the supplementary connecting and supporting items, as well as the cables being guided within such conduits are safely protected from either microbial growth or rodent attack and thereby advantageously prevent microbial growth in the surrounding environment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The invention will be made apparent to those skilled in the art by reference to the accompanying draw-

ings in which:

Fig. 1 shows a typical rigid linear conduit portion employed in the system of antimicrobial and anti-rodent protective plastic items for coverage of conductor cables in an electrical distribution network in accordance to the invention.

Fig. 2 shows a typical pliable conduit portion employed in the system of antimicrobial and anti-rodent protective plastic items of the invention.

Fig. 3 shows a typical coupler item employed in the system of antimicrobial and anti-rodent protective plastic items of the invention.

Fig. 4 shows a typical bend portion employed in the system of antimicrobial and anti-rodent protective plastic items of the invention.

Fig. 5 shows a typical spout adaptor item employed in the system of antimicrobial and anti-rodent protective plastic items of the invention.

Fig. 6 shows a typical junction box item employed in the system of antimicrobial and anti-rodent protective plastic items of the invention.

Fig. 7 shows a typical clip item employed in the system of antimicrobial and anti-rodent protective plastic items of the invention.

Fig. 8 shows an illustrative view of a portion of an electrical distribution network wherein have been illustratively employed the antimicrobial and anti-rodent protective plastic items of the invention.

Fig. 9 shows an illustrative view of a portion of an underground double-wall structured conduit with antimicrobial and anti-rodent protection.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0013] The integrated system of antimicrobial and anti-rodent protective plastic items of the invention comprises all necessary items for providing a full coverage of the cables in a typical electrical installation that is not inbuilt in the wall and is exposed to ambient conditions, namely the following items used in accordance to the designed functioning of the electrical installation:

the appropriate lengths of rigid linear conduit portions 11 and lengths of pliable conduit portions 12 being depicted in Fig. 1 and Fig. 2 respectively;

a plurality of couplers 13 adapted to connect linearly oriented sequential lengths of the abovementioned

rigid linear conduit portions 11 and/or lengths of pliable conduit portions 12 (Fig. 3);

a plurality of bends 14 adapted to connect perpendicularly oriented sequential lengths of the above-mentioned rigid linear conduit portions 11 and/or lengths of pliable conduit portions 12 (Fig. 4);

a plurality of junction boxes 16 covered with appropriately configured cover plates 16a (Fig. 6) and provided with a plurality of outlets arranged at the lateral sides thereof, these outlets being provisionally covered with plug-in seals 16b and adapted to receive spout adaptor members 15 in selected ones of these outlets after removal of the plug-in seals 16b;

a plurality of spout adaptor members 15 (Fig. 5), each with an end 15b adapted to fit within one of the above-mentioned outlets of junction boxes 16 after removal of the corresponding provisionally provided plug-in seal 16b and an end 15a adapted to receive an appropriate length of a rigid linear conduit portion 11 or an appropriate length of a pliable conduit portion 12, and

a plurality of clips 17 (Fig. 7) adapted to support the abovementioned lengths of rigid linear conduit portions 11 and lengths of pliable conduit portions 12 and fixedly mount the same onto a surface whereupon the electrical distribution network is being installed. According to an illustrative embodiment of the invention, the abovementioned clips 17 are appropriately sequentially spaced at distances of the order of 50 cm for vertically oriented conduit portions and of the order of 40 cm for horizontally oriented conduit portions.

[0014] As illustratively shown in Fig. 8, the necessary number of each one of the abovementioned items is being employed to accomplish a specifically designed electrical distribution network.

[0015] Fig. 9 illustratively shows two portions of a special make of an underground conduit 19 intermediately connected by means of a coupler 18, such underground conduits being employed to transfer electric power or telecommunication signals with cables being guided therein at the site of the electrical distribution network and being manufactured in a co-extrusion process with a double wall structure with a corrugated exterior wall surface and an inner smooth wall surface, either in the depicted pliable mode of conduits following desired curved paths or in a rigid mode of conduits extending in a linear direction.

[0016] To provide the desired antimicrobial protection of an electrical distribution network all the abovementioned items are made from a thermoplastic material that advantageously contains an anti-microbial additive at a percentage by weight of about 1-8%. In order to provide a further anti-rodent capacity, the thermoplastic material

contains an anti-rodent additive at a percentage by weight of about 1-8% as well. In accordance with a preferred embodiment of the invention the thermoplastic material advantageously contains both an antimicrobial additive and an anti-rodent additive, each at a percentage by weight of about 1-8% and when both additives being used the added percentages by weight of the two constituent additives will not exceed 8%.

[0017] In accordance with a preferred embodiment of the invention the antimicrobial additive can be selected to be silver ion commercially available by Biocote Ltd, whilst the anti-rodent additive is a non-hazardous and non-toxic animal and bird repellent and can be selected to be based on a quaternary ammonium adduct of Benzyl diethyl [(2,6-Xylylcarbamolyl Methyl)] Ammonium Benzoate, N-[(4-hydroxy-3-methoxyphenyl)methyl]-8-methyl-, (E)-; 8-Methyl-N-vanillyl-6- and capsaicin derivatives.

EXAMPLE I

[0018] The thermoplastic raw material comprising an antimicrobial additive has an illustrative composition of 96% HDPE (High density polyethylene), 2% master batch pigment and 2% master batch of the anti-microbial additive.

EXAMPLE II

[0019] The thermoplastic raw material comprising an anti-rodent additive has an illustrative composition of 96% HDPE (High density polyethylene), 2% master batch pigment and 2% master batch of the anti-rodent additive.

EXAMPLE III

[0020] The thermoplastic raw material comprising an antimicrobial and an anti-rodent additive has an illustrative composition of 94% HDPE (High density polyethylene), 2% master batch pigment, 2% master batch of the anti-rodent additive and 2% master batch of the anti-microbial additive.

[0021] The thermoplastic raw material can be selected from the group comprising polyethylene (PE), high density polyethylene (HDPE), polypropylene (PP), polyvinylchloride (PVC), polycarbonate (PC), polycarbonate / Acrylonitrile Butadiene Styrene (PC/ABS).

[0022] The various constituent parts of the integrated system of antimicrobial protective plastic items of the invention are made in a variety of sizes and dimensions of each part to fit applications of varying requirements.

[0023] Specimens of the various items of the integrated system of antimicrobial protective plastic items of the invention have been tested in accordance with the method of "Determination of Antibacterial Activity using Test Based on ISO 22196:2011 (Measurement of antibacterial activity on plastic surfaces). The specific specimens

were made by a thermoplastic material with a composition including an antimicrobial additive containing the drastic substance Silver Ion commercially available by BioCote Ltd. In particular the specimens included:

rigid conduits, corrugated conduits and bends made from PVC with a composition that contained 2% by weight of the antimicrobial additive,

rigid conduits, corrugated conduits and bends made from PC with a composition that contained 3% by weight of the antimicrobial additive,

couplers made from HDPE with a composition that contained 3,5% by weight of the antimicrobial additive,

clips made from PC/ABS with a composition that contained 3% by weight of the antimicrobial additive,

junction boxes made from PC with a composition that contained 3% by weight of the antimicrobial additive,

cover plates for junction boxes made from PE with a composition that contained 3% by weight of the antimicrobial additive, and

adaptor members made from HDPE with a composition that contained 3% by weight of the antimicrobial additive.

[0024] The tests were carried out with a scope of establishing the **antibacterial activity**, i.e. the difference in the logarithm of the viable cell count found on an antibacterial-treated product and an untreated product after inoculation with and incubation of bacteria and the **antibacterial effectiveness**, i.e. the ability of an antibacterial agent to inhibit the growth of bacteria on the surface of a plastic treated with the agent, as determined by the value of the antibacterial activity.

[0025] The tests provided data showing the difference in the population of the specific bacteria (E Coli) and of the specific bacteria MRSA after contact thereof with the surface of the samples for 24 hours at 35°C under RH of 95% relative to the initial population of bacteria.

[0026] The data exhibited results as listed in the Certificate of Efficacy provided by the certified agency BioCote Ltd for the various constituent parts of the integrated system of antimicrobial protective plastic items of the invention that have been tested and these results presented a relative reduction in the population of the bacteria being tested (difference in the population following contact with the surface of the samples listed for 24 hours at 35°C under RH of 95% relative to initial population) that exceeded percentages ranging from 99.49-99.94% in the measurements made in relation to the bacteria E.coli and percentages from 99.38-99.93% in the meas-

urements made in relation to the bacteria MRSA (staphylococcus). The integrated system of antimicrobial protective plastic items for electrical distribution networks of the invention has also been found effective against other microbes, such as salmonella, Klebsiella pneumoniae, Streptococci, Enterococci, Pseudomonas aeruginosa, Acinetobacter baumannii, Legionella, Lactobacilli and Clostridium difficile.

Claims

1. An integrated system of conduits and associated supplementary items employed to thoroughly cover a variety of cables in an electrical distribution network, comprising appropriate lengths of rigid linear conduit portions (11) and lengths of pliable conduit portions (12), clips (17) adapted to support said lengths of rigid linear conduit portions (11) and lengths of pliable conduit portions (12) and fixedly mount the same onto a surface whereupon said electrical distribution network is installed, couplers (13) adapted to connect linearly oriented sequential lengths of said rigid linear conduit portions (11) and/or lengths of said pliable conduit portions (12), bends (14) adapted to connect perpendicularly oriented sequential lengths of said rigid linear conduit portions (11) and/or lengths of said pliable conduit portions (12), junction boxes (16) covered with appropriately configured cover plates (16a) and provided with a plurality of outlets provisionally covered with plug-in seals (16b), spout adaptor members (15) with an end (15b) adapted to fit within said outlets of said junction boxes (16) following removal of the plug-in seals (16b) provisionally covering the same and an end (15a) adapted to receive an appropriate length of a rigid linear conduit portion (11) or an appropriate length of a pliable conduit portion (12) and double-wall structured pliable or rigid underground conduits (19) with a corrugated exterior wall and an inner smooth wall intermediately connected by means of couplers (18), said underground conduits (19) being employed to transfer electric power or telecommunication signals with cables being guided therein at the site of the electrical distribution network, **characterised in that** said integrated system of conduits and associated supplementary items used in the electrical distribution network including said double-wall structured pliable or rigid underground conduits used to transfer electric power or telecommunication signals with cables being guided therein at the site of electrical distribution network are being manufactured with a thermoplastic material having a composition comprising an anti-microbial additive at a percentage by weight of about 1-8% and/or an anti-rodent additive at a percentage by weight of about 1-8%.

2. The integrated system of conduits and associated supplementary items employed to thoroughly cover a variety of cables in an electrical distribution network including said double-wall structured pliable or rigid underground conduits used to transfer electric power or telecommunication signals with cables being guided therein at the site of electrical distribution network according to claim 1, being manufactured with a thermoplastic material having a composition comprising both an antimicrobial additive and an anti-rodent additive, wherein the added percentages by weight of said antimicrobial additive and said anti-rodent additive lies within a range that does not exceed 8%. 5 10
3. The integrated system of conduits and associated supplementary items employed to thoroughly cover a variety of cables in an electrical distribution network including said double-wall structured pliable or rigid underground conduits used to transfer electric power or telecommunication signals with cables being guided therein at the site of electrical distribution network according to claims 1 and 2, wherein the thermoplastic material used in manufacturing said system of conduits and associated supplementary items of the electrical distribution network and said underground conduits can be selected from a group comprising polyethylene (PE), high density polyethylene (HDPE), polypropylene (PP), polyvinylchloride (PVC), polycarbonate (PC), polycarbonate / Acrylonitrile Butadiene Styrene (PC/ABS). 15 20 25 30

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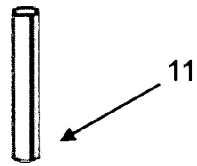


FIG. 1

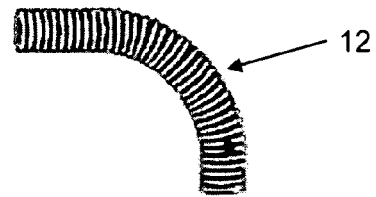


FIG. 2

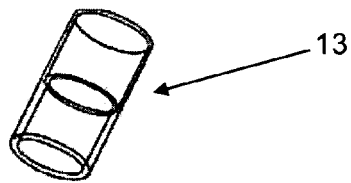


FIG. 3

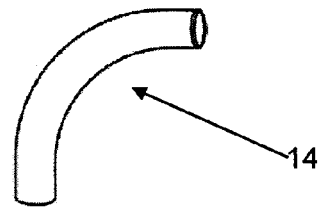


FIG. 4

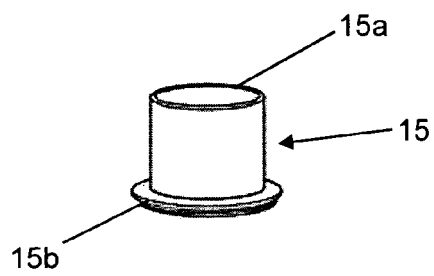


FIG. 5

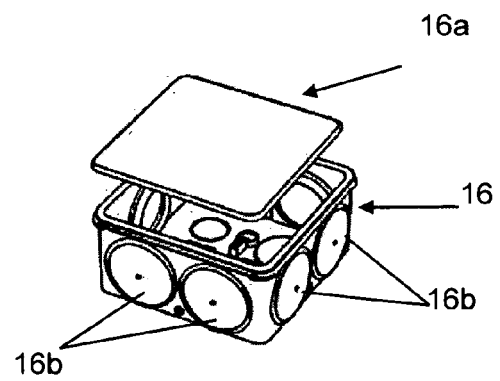


FIG. 6

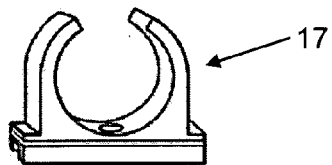


FIG. 7

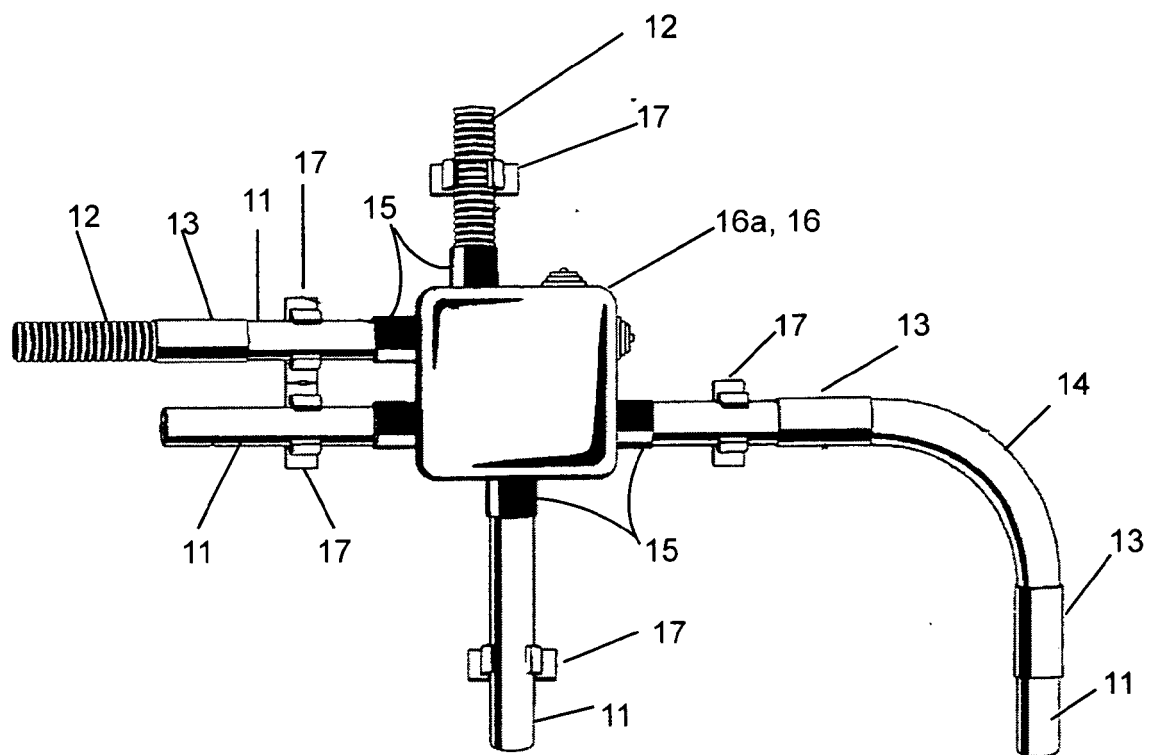


FIG. 8

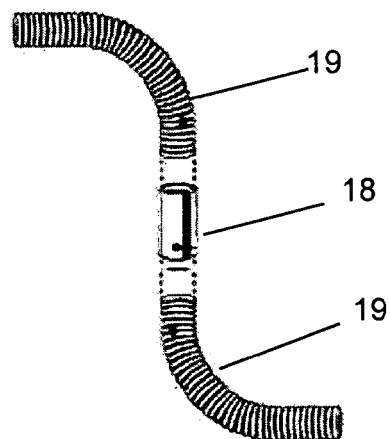


FIG. 9



EUROPEAN SEARCH REPORT

Application Number
EP 12 38 6019

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y,D	US 2009/101387 A1 (PARSONS WALTER BRIAN [US] ET AL) 23 April 2009 (2009-04-23) * paragraphs [0011], [0016] - [0019]; claims 1-10 *	1-3	INV. H01B7/28
Y	US 2 222 638 A (SZILARD JULIUS A) 26 November 1940 (1940-11-26) * claims 1-19 *	1-3	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 21 November 2012	Examiner Lehnert, Andreas
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 38 6019

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The members are as contained in the European Patent Office EDP file on
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21-11-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009101387 A1	23-04-2009	CA 2641280 A1	23-04-2009
		US 2009101387 A1	23-04-2009

US 2222638 A	26-11-1940	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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- EP 0749128 A [0004]
- EP 0417713 A [0005]
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