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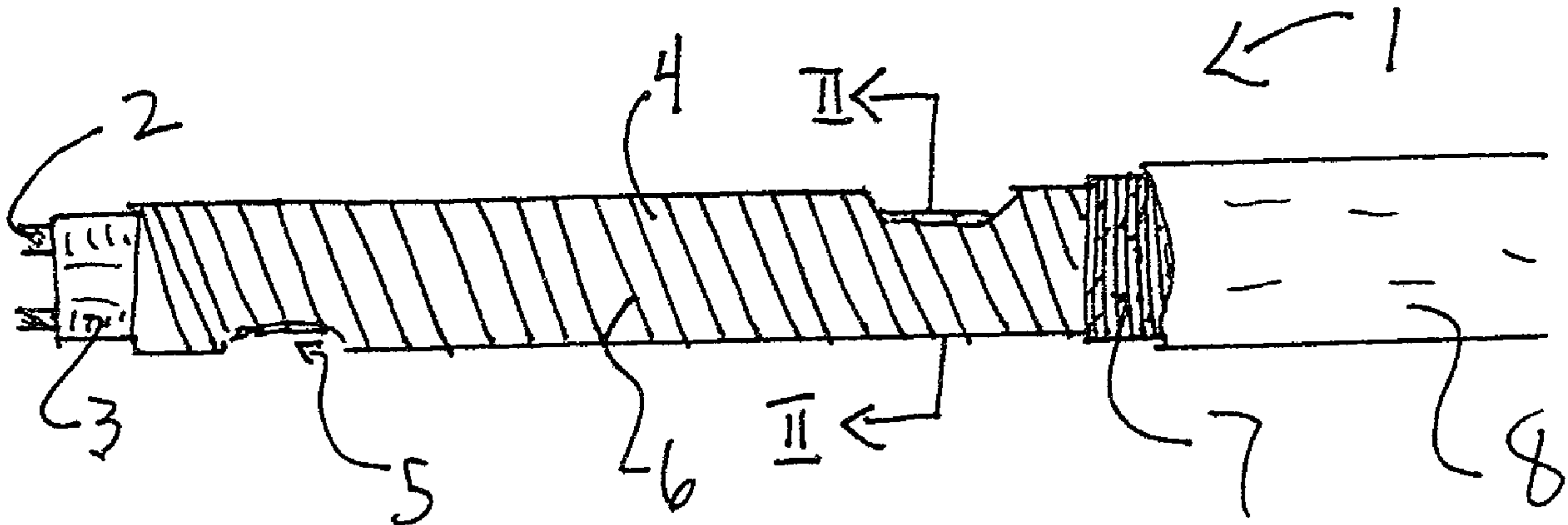
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(54) Titre : CABLE CHAUFFANT

(54) Title: HEATING CABLE



(57) Abrégé/Abstract:

A heating cable includes at least a pair of electrode wires arranged in a parallel spaced apart relationship. A layer of conductive polymeric material is extruded over said electrode wires, portions of said polymeric material being stripped off alternate ones of the wires, to expose same at spaced apart locations. A heater wire is spirally wound over the polymeric material, to electrically bridge the spaced apart locations of exposed electrode wire; and an outer layer of insulating jacket is applied over the heater wire.



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A heating cable includes at least a pair of electrode wires arranged in a parallel spaced apart relationship. A layer
5 of conductive polymeric material is extruded over said electrode wires, portions of said polymeric material being stripped off alternate ones of the wires, to expose same at spaced apart locations. A heater wire is spirally wound over the polymeric material, to electrically bridge the spaced apart locations of
10 exposed electrode wire; and an outer layer of insulating jacket is applied over the heater wire.

The present invention relates to the field of heating cables.

5 It is known to manufacture heating cables for use in electric heat tracing utilizing a construction consisting of a pair of spaced apart parallel electrode or bus wires, for instance made of uninsulated stranded copper wire, over which is extruded a polymer core interspersed with carbon black. When a voltage is applied across the electrode wires, current will flow
10 through the polymer due to the inclusion of the carbon black therein. The so-called conductive polymer shows significant resistance, however, which increases as the temperature of the cable increases. The result is a self limiting cable, since at a predetermined temperature (determined experimentally, and
15 variable according to the amount of carbon black) resistance will increase to infinity, and the flow of current through the polymer will be interrupted. There has been a practical maximum heat output of about 12 watts per foot of such cable.

20 Another principal type of electric heat tracing cable is known as a zone heater. It comprises two or three parallel insulated stranded copper (or other suitable) wires, over which a jacket made from a plastics material may be extruded. At regular spaced intervals, the insulation and any jacketting over
25 alternate ones of the electrode wires is stripped off to expose the copper wire. High resistance heater wire is then helically wound over the electrode wires, electrically bridging the exposed portions of the wire. It will be understood, then, that when

voltage is applied across the electrode wires, current will flow through the resistance wire which will then produce heat. The resistance wire may be a conventional heater wire, such as a nichrome wire, or it may be one exhibiting positive temperature coefficient of resistance behaviour (PTC) such as an iron-nickel alloy wire.

The object of the present invention is to provide a conductive polymer self limiting heating cable that has increased thermal output.

In a broad aspect the present invention relates to a heating cable including: i) at least a pair of electrode wires arranged in a parallel spaced apart relationship; ii) a layer of conductive polymeric material extruded over said electrode wires, portions of said polymeric material being stripped off alternate ones of said wires, to expose said wires at spaced apart locations; iii) a heater wire spirally wound over said polymeric material, to electrically bridge said spaced apart locations of exposed electrode wire; and iv) an outer layer of insulating jacket over said heater wire.

In drawings that illustrate the present invention by way of example:

Fig. 1 is a side view of a cable embodying the present invention, with layers thereof successively exposed;

Fig. 2 is a cross sectional view through line II-II of Fig. 1;

Fig. 3 is a side view of a cable of an alternative embodiment of the present invention, with layers thereof successively exposed;

Fig. 4 is a cross sectional view through line IV-IV of Fig. 3.

Referring first to Figs. 1 and 2 a cable 1 is shown comprised of the following layers:

- i) stranded copper electrode wire 2;
- ii) carbon black impregnated conductive polymer 3.
A suitable polymer for such use is a polyolefin such as polyethylene or a fluoropolymer such as teflon, with about a 12-16% carbon black particle content;
- iii) primary insulation jacket 4, that is stripped off at alternate locations 5 which stripping extends through conductive polymer layer 3 to expose electrode wires 2;
- iv) heater wire 6, spirally wound around jacket 4 to electrically bridge the stripped locations 5. Wire 6 may be a conventional heater wire such as a nickel-chromium wire, or a PTC exhibiting wire such as a 70/30 iron/nickel alloy wire like Kanthol* or it may be an elongated resistor core composed of a core of insulating material such as

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fibreglass yarn over which is spirally wound a conventional or PTC heater wire;

v) fibreglass insulation layer 7, which may be either a braid or a spirally wound layer of yarn.

5 Fibreglass layer 7 may be omitted if the cable will not be subject to significant physical or thermal stresses;

vi) exterior insulation jacket 8, which will be any suitable insulating layer, such as polyethylene
0 or teflon.

Referring to Figs. 3 and 4, it will be observed that a similar cable is shown, but without the inclusion of primary insulating jacket 4, whereby heater wire 6 is wound directly over
5 the core of conductive polymer 3, and contacts electrode wires 2 at stripped off locations 5.

It has been observed, utilizing the cable of the present invention that there is an increase in thermal output of
10 from about 20 to about 60% over that obtainable utilizing the conductive polymer core alone as a heat generating means.

The most preferred embodiment of the present invention is the embodiment utilizing a heater wire such as Kanthol* 70%
25 iron, 30% nickel alloy, which possesses PTC characteristics. By varying the gauge of such heater wire, the spacing of the loops over the core, and the length of the zone (i.e. distance between stripped off locations which will be typically 18" to 36"), one

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skilled in the art will be able to obtain a cable having suitable characteristics for a desired application.

5 Numerous variations will be obvious to one skilled in the art. It is to be understood that the invention is not meant to be limited by the description of preferred embodiments contained herein, the only limitations being those inherent in a proper construction of the claims appended hereto.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:-

1. A heating cable including:
 - i) at least a pair of electrode wires arranged in a parallel spaced apart relationship;
 - ii) a layer of conductive polymeric material extruded over said electrode wires, portions of said polymeric material being stripped off alternate ones of said wires, to expose said wires at spaced apart locations;
 - iii) a heater wire spirally wound over said polymeric material, to electrically bridge said spaced apart locations of exposed electrode wire; and
 - iv) an outer layer of insulating jacket over said heater wire.
2. A cable as claimed in claim 1, further including an inner layer of insulating material over said polymeric material, and over which said heater wire is wound, said inner layer of insulating material also being stripped off at said spaced apart locations.
3. A cable as claimed in claim 2, further including a layer of fibreglass over said heater wire, and under said outer layer of insulating material.
4. A cable as claimed in claims 1, 2 or 3, wherein said heater wire is selected from the group including nickel chromium

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heater wires, iron nickel alloy heater wires exhibiting PTC characteristics, and elongated resistor cores composed of a core of insulating material around which is wound a layer of heater wire.

