AN ELECTRICALLY HEATED SMOKING SYSTEM WITH IMPROVED HEATER

The present invention relates to an electrically heated smoking system including a heater for heating an aerosol-forming substrate.

US-A-5 353 813, discloses a bladed tubular array for use as an external heating element in an electrical smoking article. The heating element comprises a number of carbon blades arranged around a reinforcing tube of spiral wound paper board. One electrical connection is formed at a free end of the blades, while a common ring of carbon connects the other end of the carbon blades to form a common electrical connection. When the blades are powered, they heat to provided a heating zone with a temperature in the range of 300 °C to about 900 °C.

The inventors have appreciated that it would be advantageous to provide an electrically heated smoking system which is easier to manufacture and also requires fewer components in its construction.

According to one aspect of the present invention, there is provided an electrically heated smoking system for receiving an aerosol-forming substrate the system comprising: at least one heater for heating the substrate to form the aerosol, and a power supply for supplying power to the at least one heater, characterised in that the at least one heater comprises a plurality of electrically conductive tracks on an electrically insulating substrate, wherein the electrically insulating substrate is rigid and is arranged to be inserted into the aerosol-forming substrate, the electrically conductive tracks having temperature coefficient of resistance characteristics such that the electrically conductive tracks can act as both a resistive heater and as a temperature sensor.

According to another aspect of the present invention, there is provided a heater for use in an electrically heated smoking system, characterised by the heater comprising a plurality of electrically conductive tracks on an electrically insulating substrate, wherein the electrically insulating substrate is rigid and is arranged to be inserted into an aerosol-forming substrate, the one or more electrically conductive tracks having temperature coefficient of resistance characteristics such that the one or more electrically conductive tracks can act as both a resistive heater and as a temperature sensor.

According to a further aspect, there is provided the use of a heater in an electrically heated smoking system, characterised by the heater comprising a plurality of electrically conductive tracks on an electrically insulating substrate, wherein the electrically insulating substrate is rigid and is arranged to be inserted into an aerosol-forming substrate, the one or more electrically conductive tracks having temperature coefficient of resistance characteristics such that the one or more electrically conductive tracks can act as both a resistive heater and as a temperature sensor.

~~According to a first aspect of the invention, t~~There is provided an electrically heated smoking system for receiving an aerosol-forming substrate, the system comprising: at least one heater for heating the substrate to form the aerosol, and a power supply for supplying power to the at least one heater, wherein the at least one heater comprises one or more electrically conductive tracks on an electrically insulating substrate, the one or more electrically conductive tracks having temperature coefficient of resistance characteristics such that the one or more electrically conductive tracks can act as both a resistive heater and as a temperature sensor.

~~According to the first aspect of the invention, t~~There is also provided a heater for use in an electrically heated smoking system, the heater comprising one or more electrically conductive tracks on an electrically insulating substrate.

~~According to the first aspect of the invention, t~~There is also provided use of a heater in an electrically heated smoking system, the heater comprising one or more electrically conductive tracks on an electrically insulating substrate, the one or more electrically conductive tracks having temperature coefficient of resistance characteristics such that the one or more electrically conductive tracks can act as both a resistive heater and as a temperature sensor.

By using a heater comprising electrically conductive tracks on an electrically insulating substrate, which can act as both a heater and as a temperature sensor, the number and size of components required in the electrically heated smoking system can be reduced. This allows the size of the electrically heated smoking system to be reduced. In addition, the electrically insulating substrate can be very thin, allowing further size reduction. In addition, some or all of the necessary

electronics, wiring and connections may be incorporated on the same electrically insulating substrate as the heater. In addition, the heater may be manufactured more straightforwardly and cost effectively than some prior art heaters which require each heating element to be individually formed. The heater allows a great deal of flexibility in the design: the electrically conductive tracks can be arranged on the electrically insulating substrate as desired and in order to give the desired heat distribution.

Preferably, the electrically heated smoking system further comprises electronic circuitry arranged to control supply of power from the power supply to the at least one heater. Preferably, the power supply supplies power to the at least one heater in dependence upon the temperature sensed by the one or more electrically conductive tracks and a desired temperature. That is to say, feedback is provided which allows the power supply to maintain the heater, and the aerosol-forming substrate, at a particular desired temperature. This is achieved without the need for a separate temperature sensor. Preferably, the electrically heated smoking system includes electronic circuitry arranged for this purpose. Preferably, the desired temperature is a temperature at which the heater heats, but does not burn, the aerosol-forming substrate.

Preferably, the electrically heated smoking system further comprises a thermally insulating material for insulating the at least one heater. The thermally insulating material may insulate the material from the outside of the electrically heated smoking system. Preferably, the heater comprises a portion of electrically insulating substrate which has a thermally insulating or/and reflective structure thereon.

~~According to a second aspect of the invention, t~~There is provided an electrically heated smoking system for receiving an aerosol-forming substrate, the system comprising: at least one heater for heating the substrate to form the aerosol, the at least one heater comprising one or more electrically conductive tracks on an electrically insulating substrate; a power supply for supplying power to the at least one heater; and a thermally insulating material for insulating the at least one heater.

~~According to the second aspect of the invention, t~~There is also provided a thermally insulating material for use in an electrically heated smoking system having a heater comprising one or more electrically conductive tracks on an electrically insulating substrate.

~~According to the second aspect of the invention, t~~There is also provided use of a thermally insulating material in an electrically heated smoking system having a heater

comprising one or more electrically conductive tracks on an electrically insulating substrate. The thermally insulating material reduces heat loss from the heater and also protects a user using the electrically heated smoking system from burning. The thermally insulating material is

preferably positioned around the aerosol forming substrate so as to provide the greatest thermal insulation. The thermally insulating material must be a material which will not degrade in the high temperatures reached in the electrically heated smoking system. Not all thermally insulating materials will be suitable. Preferably, the thermally insulating material comprises a metal or another non-combustible material. In one example, the metal is gold. In another example, the metal is silver. A metal is advantageous as it may reflect heat back into the electrically heated smoking system.

Preferably, the thermally insulating material comprises a plurality of air cavities. The air cavities are arranged in a regular pattern. In one preferred embodiment, the air cavities are hexagonal and arranged in a honeycomb structure. The thermally insulating material may be provided on the electrically insulating substrate in addition to the electrically conductive tracks. This allows the electrically conductive tracks and thermally insulating material to be manufactured as one element. For some methods of manufacture, the electrically conductive tracks and the thermally insulating material may be made as part of the same process. Alternatively, the thermally insulating material may be provided in the electrically heated smoking system as a separate element.

~~As in the first aspect of the invention, t~~The electrically insulating substrate can be very thin, allowing size reduction. In addition, some or all of the necessary electronics, wiring and connections may be incorporated on the same electrically insulating substrate as the heater. In addition, the heater may be manufactured more straightforwardly and cost effectively than some prior art heaters which require each heating element to be individually formed. The heater allows a great deal of flexibility in the design: the electrically conductive tracks can be straightforwardly arranged on the electrically insulating substrate as desired and in order to give the desired heat distribution.

Preferably, the electrically heated smoking system further comprises electronic circuitry arranged to control supply of power from the power supply to the at least one heater. Preferably, the power supply supplies power to the at least one heater in dependence upon a desired temperature. Preferably, the electrically heated smoking system includes electronic circuitry arranged for this purpose. Preferably, the desired temperature is a temperature at which the heater heats, but does not burn, the aerosol-forming substrate.

Preferably, the one or more electrically conductive tracks have temperature coefficient of resistance characteristics such that the one or more electrically conductive tracks can act as resistive heaters and as a temperature sensor.

In one embodiment ~~of either aspect of the invention~~, the one or more electrically conductive

tracks comprise a plurality of portions, each portion being separately connectable to the power supply. This provides a number of advantages. First, it allows the different portions to be heated for different durations, which may enhance the smoking experience, depending on the nature of the aerosol-forming substrate. Second, it allows the different portions to be heated at different temperatures, which may also enhance the smoking experience, depending on the nature of the aerosol-forming substrate. Third, it allows a particular portion of the heater to be activated at any one time. This allows only a portion of the aerosol-forming substrate to be heated at any one time. This may be advantageous as it means that each portion of the aerosol-forming substrate may be heated only once, and not reheated.

In one embodiment ~~of either aspect of the invention~~, the electrically conductive track or tracks comprise a single track of electrically conductive material. A first end of the single track is connectable to the power supply and a second end of the single track is connectable to the power supply. In that case, the power supply may also be connectable to one or more central sections of the single track to provide a plurality of portions, each portion being separately connectable to the power supply. In another embodiment of either aspect of the invention, the electrically conductive track or tracks comprise a plurality of tracks of electrically conductive material, each track being separately connectable to the power supply.

~~In both aspects of the invention, t~~The electrically conductive tracks are arranged on the electrically insulating substrate in a formation most suitable to heat the aerosol-forming substrate. Any number of configurations is possible.

In a first embodiment of ~~either~~ the above aspects of the invention, the electrically insulating substrate is rigid and is arranged to be inserted into the aerosol-forming substrate. If the electrically insulating substrate is appropriately sized and is rigid, it may be inserted directly into the aerosol-forming substrate. The electrically insulating substrate may be reinforced in some way in order to provide sufficient rigidity. In that case, if a thermally insulating material is provided, it may be provided to surround the aerosol-forming substrate.

In a second embodiment of ~~either~~the above aspects of the invention, the electrically insulating substrate is tubular and the one or more electrically conductive tracks are on the inside of the tubular electrically insulating substrate. Such an arrangement may be used as an external heater. The external heater may be used to surround or partially surround the aerosol-forming substrate. In one embodiment, the aerosol-forming substrate is solid and is in the form of a cylindrical plug. In that case, preferably the internal diameter of the external heater is the same as or slightly bigger than the external diameter of the aerosol-forming plug. In the second embodiment, if a thermally insulating material is provided, it may be provided to surround the aerosol-forming substrate and

external heater. The thermally insulating material may be provided on the electrically insulating substrate and the external heater may be formed by rolling the electrically insulating substrate so that the electrically conductive tracks are towards the inside of the tube and the thermally insulating material is towards the outside of the tube.

In a third embodiment of ~~either~~the above aspects of the invention, the electrically insulating substrate is tubular and the one or more electrically conductive tracks are on the outside of the tubular electrically insulating substrate. Such an arrangement may be used as an internal heater. The internal heater may be inserted into the aerosol-forming substrate. In one embodiment, the aerosol-forming substrate is solid and comprises a hollow tube of aerosol-forming substrate. In that case, preferably the external diameter of the internal heater is the same as or slightly smaller than the internal diameter of the tube of aerosol-forming substrate. In that case, if a thermally insulating material is provided, it may be provided to surround the aerosol-forming substrate.

~~In both aspects of the invention, t~~The at least one heater may comprise an end heater for heating the end of the aerosol-forming substrate, the end heater comprising one or more electrically conductive tracks on an electrically insulating substrate. In one embodiment, the end heater comprises a spiral electrically conductive track on a circular or substantially circular electrically insulating substrate.

~~In both aspects of the invention, t~~The electrically conductive tracks preferably comprise an electrically resistive material. More preferably, the electrically conductive tracks are metallic. Most preferably, the electrically conductive tracks comprise one or more of: silver, platinum, copper, nickel and palladium. Other materials are possible, for example electrically "conductive" ceramics (such as, for example, molybdenum disilicide), carbon, graphite, metal alloys and composite materials made of a ceramic material and a metallic material. Such composite materials may comprise doped or undoped ceramics. Examples of suitable doped ceramics include doped silicon carbides. Examples of suitable metals, as well as those listed above, include titanium, zirconium and tantalum. Examples of suitable metal alloys include stainless steel, nickel-, cobalt-, chromium-, aluminium- titanium- zirconium-, hafnium-, niobium-, molybdenum-, tantalum-, tungsten-, tin-, gallium-, manganese- and iron-containing alloys, and super-alloys based on nickel, iron, cobalt, stainless steel, Timetal® and iron-manganese-aluminium based alloys. Timetal® is a registered trade mark of Titanium Metals Corporation, 1999 Broadway Suite 4300, Denver, Colorado. In composite materials, the electrically resistive material may optionally be embedded in, encapsulated or coated with an insulating material or vice-versa, depending on the kinetics of energy transfer and the external physicochemical properties required.

~~In both aspects of the invention, t~~The electrically conductive tracks may be plated with a

protective layer. The electrically conductive tracks may be plated with one or more of: gold, nickel and glass. Plating the electrically conductive tracks may be advantageous if the electrically conductive tracks comprise a material which will readily oxidize or corrode in some way.

~~In both aspects of the invention, p~~Preferably, the electrically insulating substrate comprises one or more of: paper, glass, ceramic, anodized metal, coated metal, and Polyimide. The ceramic may comprise mica, Alumina (Al_2O_3) or Zircona (ZrO_2). Other suitable materials may be used.

In a first embodiment of ~~either~~the above aspects of the invention, the at least one heater is formed by: providing the electrically insulating substrate; depositing an electrically conductive paste onto the electrically insulating substrate using a template to define a pattern for the electrically conductive paste; and drying the electrically conductive paste to form the electrically conductive tracks.

In that first embodiment, the electrically insulating substrate may be any suitable electrically insulating material but is preferably a ceramic or an anodized metal. In that first embodiment, the electrically conductive paste may be any suitable paste but preferably includes metal particles. The metal may be silver. The electrically conductive paste may also include binders and plasticizers.

In a second embodiment ~~of either aspect of the invention~~, the at least one heater is formed by: providing the electrically insulating substrate; covering substantially the entire surface of the electrically insulating substrate with an electrically conductive material; protecting portions of the electrically conductive material with a mask defining a pattern for the electrically conductive material; and removing the unprotected portions of the electrically conductive material.

In that second embodiment, the electrically insulating substrate may be any suitable electrically insulating material but is preferably polyimide. In that second embodiment, the electrically conductive material may be any suitable material but preferably includes metal alloys. The metal may be copper. The electrically conductive tracks may be plated with one or more protective layers. In one embodiment, the copper electrically conductive tracks are plated with a first layer of nickel and a second layer of gold.

In a third embodiment ~~of either aspect of the invention~~, the at least one heater is formed by: providing the electrically insulating substrate; coating the electrically insulating substrate with a metal film; coating the metal film with a layer of photoresist material; protecting portions of the photoresist material with a mask defining a pattern for the

electrically conductive paste; removing the unprotected portions of the photoresist material using a light source and chemicals (the exposed photoresist material being soluble in specific solution); removing the portions of the metal film unprotected by the photoresist material; and removing the remaining photoresist material to reveal the metal film in the form of the electrically conductive tracks.

In that third embodiment, the electrically insulating substrate may be any suitable electrically

insulating material but is preferably ceramic. Most preferably, the substrate is Alumina (Al_2O_3) or Zircona (ZrO_2). In that third embodiment, the metal film may be any suitable metal film but is preferably platinum film. The electrically conductive tracks may be plated with one or more protective layers. In one embodiment, the electrically conductive tracks are plated with a layer of glass.

~~In both aspects of the invention, t~~The aerosol-forming substrate preferably comprises a tobacco-containing material containing volatile tobacco flavour compounds which are released from the aerosol-forming substrate upon heating. Alternatively, the aerosol-forming substrate may comprise a non-tobacco material.

~~In both aspects of the invention, p~~Preferably, the aerosol-forming substrate further comprises an aerosol former. Examples of suitable aerosol formers are glycerine and propylene glycol.

In ~~both~~the above aspects of the invention, the aerosol-forming substrate is preferably a solid substrate. In a preferred embodiment, the aerosol-forming substrate comprises a tubular substrate having a cavity for receiving the at least one heater. The solid substrate may comprise, for example, one or more of: powder, granules, pellets, shreds, spaghettis, strips or sheets containing one or more of: herb leaf, tobacco leaf, fragments of tobacco ribs, reconstituted tobacco, homogenised tobacco, extruded tobacco and expanded tobacco. The solid substrate may be in loose form, or may be provided in a suitable container or cartridge. Optionally, the solid aerosol-forming substrate may contain additional tobacco or non-tobacco volatile flavour compounds, to be released upon heating of the substrate.

In ~~both~~the above aspects of the invention, optionally, the solid aerosol-forming substrate may be provided on or embedded in a thermally stable carrier. In a preferred embodiment, the carrier is a tubular carrier having a thin layer of the solid substrate deposited on its inner surface, or on its outer surface, or on both its inner and outer surfaces. Such a tubular carrier may be formed of, for example, a paper, or paper like material, a non-woven carbon fibre mat, a low mass open mesh metallic screen, or a perforated metallic foil or any other thermally stable polymer matrix. Alternatively, the carrier may take the form of powder, granules, pellets, shreds, spaghettis, strips or sheets.

In ~~both~~the above aspects of the invention, the solid aerosol-forming substrate may be deposited on the surface of the carrier in the form of, for example, a sheet, foam, gel or slurry. The solid aerosol-forming substrate may be deposited on the entire surface of the carrier, or alternatively, may be deposited in a pattern in order to provide a non-uniform flavour delivery during use.

In ~~both~~the above aspects of the invention, alternatively, the carrier may be a non-woven fabric or fibre bundle into which tobacco components have been incorporated. The non-woven fabric or fibre

bundle may comprise, for example, carbon fibres, natural cellulose fibres, or cellulose derivative fibres.

In ~~both~~the above aspects of the invention, alternatively, the aerosol-forming substrate may be a liquid substrate. If a liquid aerosol-forming substrate is provided, the electrically heated smoking system preferably comprises means for retaining the liquid. For example, the liquid aerosol-forming substrate may be retained in a container. Alternatively or in addition, the liquid aerosol-forming substrate may be absorbed into a porous carrier material. The porous carrier material may be made from any suitable absorbent plug or body, for example, a foamed metal or plastics material, polypropylene, terylene, nylon fibres or ceramic. The liquid aerosol-forming substrate may be retained in the porous carrier material prior to use of the electrically heated smoking system or alternatively, the liquid aerosol forming substrate material may be released into the porous carrier material during, or immediately prior to use. For example, the liquid aerosol-forming substrate may be provided in a capsule. The shell of the capsule preferably melts upon heating and releases the liquid aerosol-forming substrate into the porous carrier material. The capsule may optionally contain a solid in combination with the liquid.

If the aerosol-forming substrate is a liquid aerosol-forming substrate, the electrically heated smoking system may further comprise means for heating a small amount of liquid at a time. The means for heating a small amount of liquid at a time may include, for example, a liquid passageway in communication with the liquid substrate. The liquid aerosol-forming substrate is typically forced into the liquid passageway by capillary force. The at least one heater is preferably arranged such that during use, only the small amount of liquid aerosol-forming substrate within the liquid passageway, and not the liquid within the container, is heated and volatilised.

Alternatively, or in addition, if the aerosol-forming substrate is a liquid aerosol-forming substrate, the electrically heated smoking system may further comprise an atomiser in contact with the liquid aerosol-forming substrate source and including the at least one heater. In addition to the heater, the atomiser may include one or more electromechanical elements such as piezoelectric elements. Additionally or alternatively, the atomiser may also include elements that use electrostatic, electromagnetic or pneumatic effects. The electrically heated smoking system may still further comprise a condensation chamber.

In ~~both~~the above aspects of the invention, the aerosol-forming substrate may alternatively be any other sort of aerosol-forming substrate, for example, a gas aerosol-forming substrate, or any combination of the various types of aerosol-forming substrate.

In ~~both~~the above aspects of the invention, during operation, the aerosol-forming substrate may be completely contained within the electrically heated smoking system. In that case, a user may puff

on a mouthpiece of the electrically heated smoking system. Alternatively, during operation, the aerosol-forming substrate may be partially contained within the electrically heated smoking system. In that case, the aerosol-forming substrate may form part of a separate article and the user may puff directly on the separate article.

In ~~both~~the above aspects of the invention, the electrically heated smoking system may further comprise a sensor to detect air flow indicative of a user taking a puff. In that embodiment, preferably, the sensor is connected to the power supply and the system is arranged to energise the at least one heater when the sensor senses a user taking a puff. Alternatively, the system may further comprise a manually operable switch, for a user to initiate a puff.

In ~~both~~the above aspects of the invention preferably, the electrically heated smoking system further comprises a housing for receiving the aerosol-forming substrate and designed to be grasped by a user. The housing preferably houses the at least one heater, the power supply and any other components required for the system, such as electronic circuitry. In one embodiment, the housing comprises a shell and a replaceable mouthpiece.

In ~~both~~the above aspects of the invention, in one preferred embodiment, the power supply is a DC voltage source. In one embodiment, the power supply is a Lithium-ion battery. Alternatively, the power supply may be a Nickel-metal hydride battery, a Nickel cadmium battery or a Lithium Phosphate battery.

Features described in relation to one aspect of the invention may also be applicable to another aspect of the invention. In particular, features and advantages of the one or more electrically conductive tracks acting as both a resistive heater and as a temperature sensor described in relation to the first aspect of the invention may also be applicable to the second aspect of the invention. Features and advantages of the thermally insulating material described in relation to the second aspect of the invention may also be applicable to the first aspect of the invention.

The invention will be further described, by way of example only, with reference to the accompanying drawings, in which:

Figures 1a to 1d show a first embodiment of a method for forming a heater for an electrical smoking system;

Figures 2a to 2e show a second embodiment of a method for forming a heater for an electrical smoking system;

Figures 3a to 3f show a third embodiment of a method for forming a heater for an electrical smoking system;

Figure 4 shows a first embodiment of a heater for use in an electrically heated smoking system; and

CLAIMS

1. An electrically heated smoking system for receiving an aerosol-forming substrate, the system comprising:

at least one heater for heating the substrate to form the aerosol, and

a power supply for supplying power to the at least one heater,

wherein the at least one heater comprises a plurality of electrically conductive tracks on an electrically insulating substrate, wherein the electrically insulating substrate is rigid and is arranged to be inserted into the aerosol-forming substrate, the plurality of electrically conductive tracks having temperature coefficient of resistance characteristics such that the plurality of electrically conductive tracks can act as both a resistive heater and as a temperature sensor.

2. An electrically heated smoking system according to claim 1, wherein the power supply supplies power to the at least one heater in dependence upon the temperature sensed by the plurality of electrically conductive tracks and a desired temperature.

3. An electrically heated smoking system according to claim 2, wherein the desired temperature is a temperature at which the heater heats, but does not burn, the aerosol-forming substrate.

4. An electrically heated smoking system according to any preceding claim, further comprising a thermally insulating material for insulating the at least one heater.

5. An electrically heated smoking system for receiving an aerosol-forming substrate, the system comprising:

at least one heater for heating the substrate to form the aerosol, the at least one heater comprising a plurality of electrically conductive tracks on an electrically insulating substrate, wherein the electrically insulating substrate is rigid and is arranged to be inserted into the aerosol-forming substrate;

a power supply for supplying power to the at least one heater; and

a thermally insulating material for insulating the at least one heater.

~~6. An electrically heated smoking system according to claim 5, wherein the~~

plurality of electrically conductive tracks have temperature coefficient of resistance characteristics such that the plurality of electrically conductive tracks can act as resistive heaters and as a temperature sensor.

7. An electrically heated smoking system according to any preceding claim, wherein the plurality of electrically conductive tracks comprise a plurality of portions, each portion being separately connectable to the power supply.

8. An electrically heated smoking system according to any preceding claim, wherein the at least one heater comprises an end heater for heating the end of the aerosol-forming substrate, the end heater comprising one or more electrically conductive tracks on an electrically insulating substrate.

9. An electrically heated smoking system according to any preceding claim, wherein at least one of:

the electrically conductive tracks comprise one or more of: silver, platinum, copper, nickel and palladium,

the electrically conductive tracks are plated with one or more of: gold, nickel and glass, and

the electrically insulating substrate comprises one or more of: paper, glass, ceramic, anodized metal, coated metal and Polyimide.

~~10. A heater for use in an electrically heated smoking system, the heater comprising~~

a plurality of electrically conductive tracks on an electrically insulating substrate, wherein the electrically insulating substrate is rigid and is arranged to be inserted into an aerosol-forming substrate, the plurality of electrically conductive tracks having temperature coefficient of resistance characteristics such that the plurality of electrically conductive tracks can act as both a resistive heater and as a temperature sensor.

11. Use of a heater in an electrically heated smoking system, the heater comprising a plurality of electrically conductive tracks on an electrically insulating substrate, wherein the electrically insulating substrate is rigid and is arranged to be inserted into an aerosol-forming substrate, the plurality of electrically conductive tracks having temperature coefficient of resistance characteristics such that the plurality of electrically conductive tracks can act as both a resistive heater and as a temperature sensor.

CLAIMS

1. An electrically heated smoking system for receiving an aerosol-forming substrate the system comprising:

at least one heater for heating the substrate to form the aerosol, and

a power supply for supplying power to the at least one heater,

characterised in that the at least one heater comprises a plurality of electrically conductive tracks on an electrically insulating substrate, wherein the electrically insulating substrate is rigid and is arranged to be inserted into the aerosol-forming substrate, the electrically conductive tracks having temperature coefficient of resistance characteristics such that the electrically conductive tracks can act as both a resistive heater and as a temperature sensor.

2. An electrically heated smoking system according to claim 1, wherein the power supply supplies power to the at least one heater in dependence upon the temperature sensed by the electrically conductive tracks and a desired temperature.

3. An electrically heated smoking system according to claim 2, wherein the desired temperature is a temperature at which the heater heats, but does not burn, the aerosol-forming substrate.

4. An electrically heated smoking system according to any preceding claim, further comprising a thermally insulating material for insulating the at least one heater.

5. An electrically heated smoking system according to any preceding claim, wherein the electrically conductive tracks comprise a plurality of portions, each portion being separately connectable to the power supply.

6. An electrically heated smoking system according to any preceding claim, wherein the at least one heater comprises an end heater for heating the end of the aerosol-forming substrate, the end heater comprising one or more electrically conductive tracks on an electrically insulating substrate.

7. An electrically heated smoking system according to any preceding claim, wherein at least one of:

the electrically conductive tracks comprise one or more of: silver, platinum, copper,

nickel and palladium,

the electrically conductive tracks are plated with one or more of: gold, nickel and glass, and

the electrically insulating substrate comprises one or more of: paper, glass, ceramic, anodized metal, coated metal and Polyimide.

8. A heater for use in an electrically heated smoking system, characterised by the heater comprising a plurality of electrically conductive tracks on an electrically insulating substrate, wherein the electrically insulating substrate is rigid and is arranged to be inserted into an aerosol-forming substrate, the one or more electrically conductive tracks having temperature coefficient of resistance characteristics such that the one or more electrically conductive tracks can act as both a resistive heater and as a temperature sensor.

9. Use of a heater in an electrically heated smoking system, characterised by the heater comprising a plurality of electrically conductive tracks on an electrically insulating substrate, wherein the electrically insulating substrate is rigid and is arranged to be inserted into an aerosol-forming substrate, the one or more electrically conductive tracks having temperature coefficient of resistance characteristics such that the one or more electrically conductive tracks can act as both a resistive heater and as a temperature sensor.