TANGIBLY

Provisional Patent Analysis

US11879644B2

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Executive Summary

Key New Claim Scope

Direct temperature measurement of heating element
Thermostat thermally isolated from other heat sources
Computer-controlled temperature regulation
Positioning thermostat within heating element region

How Different Are the Changes in the New Claims

Focus shifts from mechanical aspects to temperature measurement and control
Emphasis on direct temperature sensing of heating element
Introduction of computer control and thermal isolation concepts
More detailed temperature regulation methods proposed

New Areas to Expand Into

Computer-controlled heating systems
Precision temperature measurement in heating applications
Thermally isolated temperature sensing
Integration of heating and control systems

Key Potential Trade Secrets

Thermostat design for direct heating element contact
Thermal isolation of thermostat
Positioning of thermostat within heating element
Computer algorithms for temperature control

Expanding the Claim Scope

Potential Continuation Claims With Support in Specification

Claim Candidate 1

Potential Continuation Claim Candidate 1

A heating apparatus, comprising:
- a heating element;
- a thermostat positioned within a region of the heating element, the thermostat comprising:
  - a temperature sensor in direct contact with the heating element;
  - wherein the temperature sensor is configured to provide a direct measurement of the temperature of the heating element;
- wherein the thermostat is thermally isolated from heat sources other than the heating element;
- a first terminal and a second terminal;
- wherein the thermostat is operatively connected in series between the first terminal and the second terminal;
- and a switch configured to control current flow through the heating element based on the direct measurement of the temperature of the heating element.

See spec mapping in page 16

Claim Candidate 2

Potential Continuation Claim Candidate 2

A method for regulating temperature in a heating element, comprising:
- measuring a temperature of the heating element using a thermostat in direct contact with the heating element;
- comparing the measured temperature to a predetermined temperature limit;
- and regulating current flow through the heating element based on the comparison;
  - wherein the thermostat is thermally isolated from heat sources other than the heating element;
  - wherein regulating current flow comprises at least one of:
    - reducing the current flow when the measured temperature approaches the predetermined temperature limit;
    - or stopping the current flow when the measured temperature reaches or exceeds the predetermined temperature limit.

See spec mapping in page 21

Potential Claims With No Support in Specification

Claim Candidate 3

An apparatus, comprising:

an urging element providing an upward force to cause a contact surface to contact an object placed on the apparatus, the urging element comprising:

an urging portion providing the upward force; and

a deformable portion operatively connected to the urging portion and that mechanically deforms to cause the upward force in response to a downward force applied from the object to the contact surface, the deformable portion comprising a plurality of planar sections;

wherein the upward force applied through the deformable portion is a restorative force;

wherein the plurality of planar sections are connected at angles; and

wherein the restorative force urges the deformable portion to restore the angles between the planar sections.

Potential Claims With No Support in Specification

Claim Candidate 4

An apparatus for protecting a switch, comprising:
a capsule enclosing the switch;
wherein the capsule is configured to provide physical protection to the switch;
wherein the capsule comprises:
an outer shell;
an inner cavity housing the switch;
and at least one access point for electrical connections to the switch;
and wherein the capsule is made of a material resistant to environmental factors.

Technology Taxonomy

1. Temperature Sensing and Control
2. Heating Element Design
3. Mechanical Components
4. Electrical Systems
5. Thermal Management
6. Safety Mechanisms

Comparing Parent Claims and Suggested Claims

Temperature Sensing and Control

Claims from Original Patent	Potential Claims With Support in Specification	Potential Claims With No Support in Specification	Relationship Analysis
Claims 1,4,8 & 18: Switch to prevent current based on temperature	**Claims 1-2:** Direct temperature measurement, computer control, thermal isolation	**Claims 3-4:** Temperature-based current control in heating element	New claims significantly expand temperature sensing and control capabilities, introducing direct measurement and computer control

Summary of the Scope of the Claims

Original Patent Claims: Focused on mechanical aspects of heating apparatus with basic temperature control

Potential Claims With Support in Specification: Emphasize direct temperature measurement, thermal isolation, and computer-controlled regulation

Potential Claims With No Support in Specification: Introduce concepts like urging elements and protective capsules not directly related to temperature control

Category Descriptions and Relationships

1. **Temperature Sensing and Control**
   New claims focus on direct temperature measurement and computer-controlled regulation, expanding on original mechanical temperature control
2. **Heating Element Design**
   Original claims detail heating element structure; new claims relate to temperature measurement within the element
3. **Mechanical Components**
   Original claims emphasize mechanical aspects like urging elements; new claims de-emphasize these
4. **Electrical Systems**
   Both sets of claims involve electrical heating systems, with new claims adding computer control
5. **Thermal Management**
   New claims introduce thermal isolation concepts not present in original claims
6. **Safety Mechanisms**
   Both sets include safety features, with original focusing on mechanical and new on precise temperature control

Trade Secret Analysis

Trade Secrets by Subject

Subject	Potential Trade Secrets
Contact Heating	The specific design and configuration of the apparatus: this includes details about the heating element, contact surface, switch, urging element, and housing.
	The design and function of the urging element: the way the urging element provides an upward force to make the contact surface contact an object placed on the apparatus could be proprietary information.
	The use of a medallion positioned below the top surface of the heating element: this may offer a unique solution for making physical contact with the object.
	Materials used in the construction of the apparatus: the specific materials chosen for the heating element, contact surface, switch, and other components could offer superior performance, durability, or cost efficiency.
Terminal	The connection of the heating element to the first terminal and the second terminal: if these connections are located below the heating element, this can provide a competitive advantage.
Heating Implementations	The design and configuration of the heating elements, including how they are shaped and arranged to form a generally planar surface, and how they are positioned within the apparatus.
	The inclusion of an inner end heater and an outer end heater in connection with the terminals, the thermostat, and the heating element.
	The unique shape of the medallion, including its position relative to the heating element and the top surface of the medallion.
Temperature Heating	The positioning of the thermostat within the region of the heating element and its method of direct measurement of the temperature of the heating element.
	The mechanism used to open or close the switch based on the temperature of the heating element or the object.
Heating Thermostat	The specific configuration and placement of the thermostat's contact surface, especially how it can make direct physical contact with an object placed on the heating element.
	The method of using the switch to prevent current from conducting through the heating element when the thermostat's contact surface reaches a certain temperature.
Current Heating	The process of measuring and regulating the times or amount of current going through the heating element based on a measurement of an object in contact with the thermostat.
Others	The use of the capsule to enclose the switch: this could be a unique design feature that adds protection to the switch.

Mapping of Trade Secret Categories to Patent Claims

Trade Secret Category	Related Original Patent Claims	Related Potential Claims With Support	Related Potential Claims With No Support
Temperature Sensing	Claims 1,4,8 & 18: Temperature-based current control	Claims 1-2: Direct temperature measurement of heating element	Claim 3: Temperature-based current control
Others	None	None	Claim 4: Switch protection

Detailed Analysis

1. Temperature Sensing

Original Patent Claims:

Claims 1,4,8 & 18: Uses switch to control current based on temperature, specific implementation not detailed

Potential Claims With Support:

Claims 1-2: Direct contact temperature sensor, thermal isolation, positioning within heating element region

Potential Claims Without Support:

Appendix

Claim Support Mapping

Potential Continuation Candidate 1

The positioning of the thermostat within the region of the heating element and its method of direct measurement of the temperature of the heating element.

Candidate #1

Spec Mapping 1

In some implementations, a thermostat 105 can be positioned within a region of the heating element 100 and operatively connected in series between the first terminal 110 and the second terminal 115. The thermostat 105 can measure, regulate, or limit a temperature of the heating element 100. The thermostat 105 can include a temperature sensor that is in direct contact with the heating element 100 to provide a direct measurement of the temperature of the heating element 100. To make a direct measurement of the temperature of the heating element 100, the thermostat 105 can be thermally isolated or insulated from other heat sources such that other heat sources provide little or no contribution to the measurement by the thermostat 105. For example, when a cooler object is placed in contact with the heating element 100, the heating element 100 and the cooler object can have different temperatures. However, the isolated thermostat 105, by virtue of being in direct contact with only the heating element 100, measures the instantaneous temperature of the heating element 100 essentially independently of any heat provided by the object.

Potential Continuation Candidate 1

The positioning of the thermostat within the region of the heating element and its method of direct measurement of the temperature of the heating element.

Spec Mapping 2

By providing a direct measurement of the temperature of the heating element, an overheat condition can be detected. The current to the heating element can then be reduced or stopped in order to avoid the overheating condition. Various implementations of the current subject matter described herein address this problem.

Candidate #1

Potential Continuation Candidate 1

The positioning of the thermostat within the region of the heating element and its method of direct measurement of the temperature of the heating element.

Spec Mapping 3

In other implementations, the thermostat 105 can measure and regulate the times or amount of current going through the heating element 100 based on a measurement of an object in contact with the thermostat 105 and resting on the heating element 100. Such implementations are described in further detail with regard to FIGS. 5-11 .

Candidate #1

Potential Continuation Candidate 1

The positioning of the thermostat within the region of the heating element and its method of direct measurement of the temperature of the heating element.

Spec Mapping 4

In some implementations, the thermostat 105 can be positioned in the region 120. As used herein, the term “region” 120 can refer to a volume above or below that indicated by the dashed line shown in FIG. 1 . The region 120 generally refers to a centrally located region of the apparatus that is not used for heating, but can include other hardware. For example, the region 120 can include the thermostat 105, switches, portions of the heating element 100, electrical connections, housings, or the like.

Candidate #1

Potential Continuation Candidate 1

The positioning of the thermostat within the region of the heating element and its method of direct measurement of the temperature of the heating element.

Spec Mapping 5

The opening or closing of the switch can be controlled by a computer, for example by converting the electrical measurement signals from a temperature sensor in the thermostat 105 to a temperature and comparing this temperature to the temperature limit. Temperature sensors can include, for example, a thermocouple, thermometer, optical sensor, or the like. The computer, or other integrated circuit, can be included in the thermostat 105, or can be at an external location. In other implementations, the opening or closing of the switch can be based on a mechanical configuration of the switch responding to changes in the temperature of the heating element 100. For example, a switch in thermal contact with the heating element 100 can move, deflect, or the like due to thermal expansion or contraction of the materials in the switch. In other implementations, the switch can be located outside the thermostat 105. For example, the switch can be at the power supply for the heating element 100, elsewhere in the appliance containing the heating element 100, or the like.

Candidate #1

Potential Continuation Candidate 2

The process of measuring and regulating the times or amount of current going through the heating element based on a measurement of an object in contact with the thermostat.

Candidate #2

Spec Mapping 1

In other implementations, the thermostat 105 can measure and regulate the times or amount of current going through the heating element 100 based on a measurement of an object in contact with the thermostat 105 and resting on the heating element 100. Such implementations are described in further detail with regard to FIGS. 5-11 .

Potential Continuation Candidate 2

The process of measuring and regulating the times or amount of current going through the heating element based on a measurement of an object in contact with the thermostat.

Spec Mapping 2

By providing a direct measurement of the temperature of the heating element, an overheat condition can be detected. The current to the heating element can then be reduced or stopped in order to avoid the overheating condition. Various implementations of the current subject matter described herein address this problem.

Candidate #2

Potential Continuation Candidate 2

The process of measuring and regulating the times or amount of current going through the heating element based on a measurement of an object in contact with the thermostat.

Spec Mapping 3

In some implementations, a thermostat 105 can be positioned within a region of the heating element 100 and operatively connected in series between the first terminal 110 and the second terminal 115. The thermostat 105 can measure, regulate, or limit a temperature of the heating element 100. The thermostat 105 can include a temperature sensor that is in direct contact with the heating element 100 to provide a direct measurement of the temperature of the heating element 100. To make a direct measurement of the temperature of the heating element 100, the thermostat 105 can be thermally isolated or insulated from other heat sources such that other heat sources provide little or no contribution to the measurement by the thermostat 105. For example, when a cooler object is placed in contact with the heating element 100, the heating element 100 and the cooler object can have different temperatures. However, the isolated thermostat 105, by virtue of being in direct contact with only the heating element 100, measures the instantaneous temperature of the heating element 100 essentially independently of any heat provided by the object.

Candidate #2

Potential Continuation Candidate 2

The process of measuring and regulating the times or amount of current going through the heating element based on a measurement of an object in contact with the thermostat.

Spec Mapping 4

The opening or closing of the switch can be controlled by a computer, for example by converting the electrical measurement signals from a temperature sensor in the thermostat 105 to a temperature and comparing this temperature to the temperature limit. Temperature sensors can include, for example, a thermocouple, thermometer, optical sensor, or the like. The computer, or other integrated circuit, can be included in the thermostat 105, or can be at an external location. In other implementations, the opening or closing of the switch can be based on a mechanical configuration of the switch responding to changes in the temperature of the heating element 100. For example, a switch in thermal contact with the heating element 100 can move, deflect, or the like due to thermal expansion or contraction of the materials in the switch. In other implementations, the switch can be located outside the thermostat 105. For example, the switch can be at the power supply for the heating element 100, elsewhere in the appliance containing the heating element 100, or the like.

Candidate #2

Potential Continuation Candidate 2

The process of measuring and regulating the times or amount of current going through the heating element based on a measurement of an object in contact with the thermostat.

Spec Mapping 5

An electrical current passed through the heating element can cause resistive heating of the heating element. The direction of current flow through any of the elements described herein is arbitrary and can go in any direction consistent with the applied power source. The steady-state temperature of the heating element can be based on achievement of thermal equilibrium between the power dissipated during the resistive heating and the power radiated or conducted away by the objects or the medium in contact with the heating element. During the heating process, the temperature of the heating element increases until thermal equilibrium is reached. Because an object, for example, a pan with water, can act as a substantial heat sink, the heating element can obtain a different final temperature than it would in the absence of an object being heated.

Candidate #2