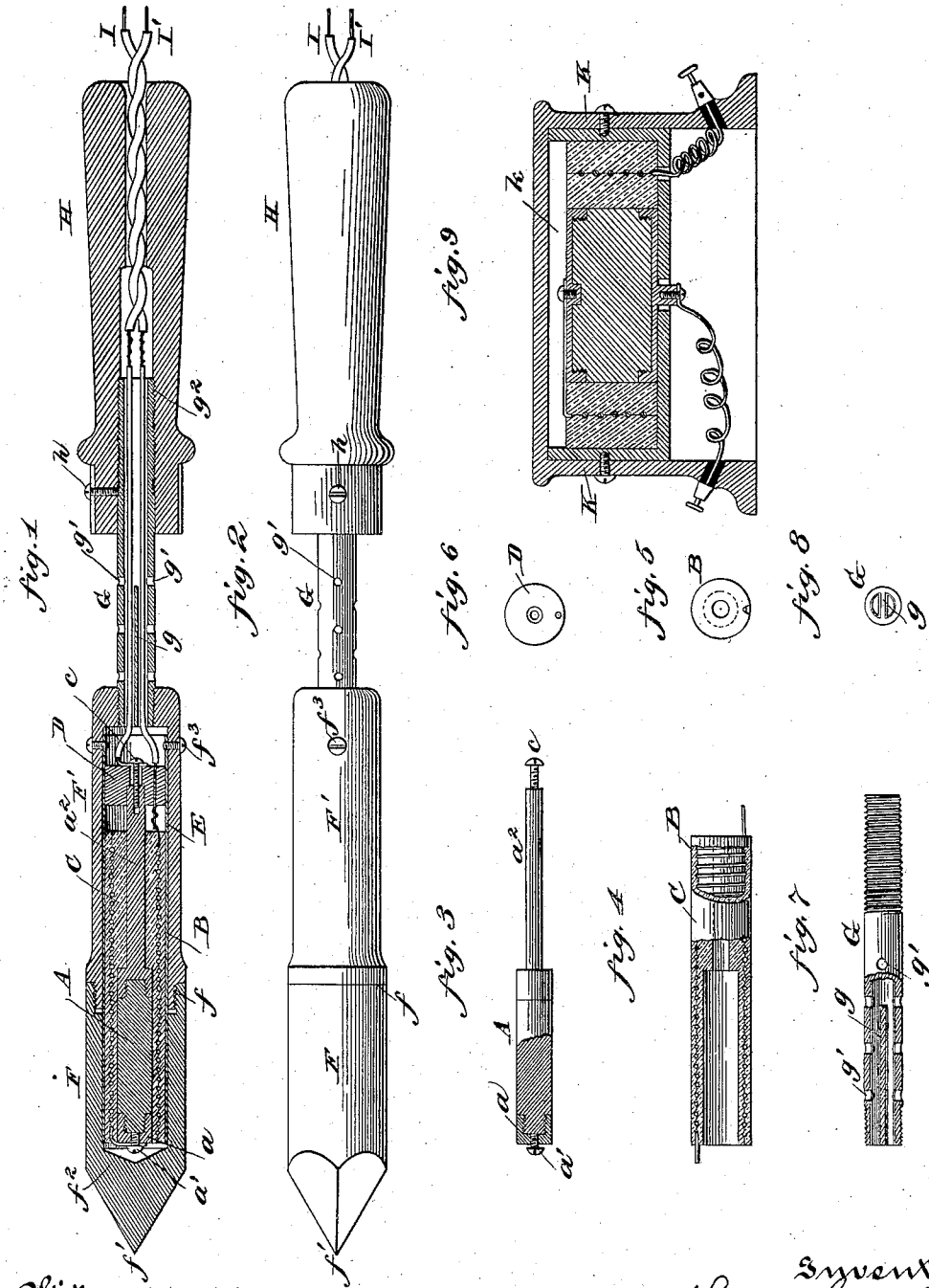
(No Model.)

T. GRUTTING.

ELECTRIC HEATER.

No. 563,715. Patented July 7, 1896.



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UNITED STATES PATENT OFFICE.

THEODORE GRUTTING, OF ST. PAUL, MINNESOTA.

ELECTRIC HEATER.

SPECIFICATION forming part of Letters Patent No. 563,715, dated July 7, 1896.

Application filed September 9, 1893. Renewed January 5, 1895. Serial No. 533,975. (No model.)

To all whom it may concern:

Be it known that I, THEODORE GRUTTING, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Electrical Heaters; and I do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable those skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in electric heaters, particularly soldering-irons and similar tools, its object being to provide a tool of convenient form, in which the temperature is automatically regulated and made practically uniform, and limited, so as to prevent injury to the tool or any of its parts from overheating.

To this end my invention consists of an electrode comprising a heating resistance of large area and low conductivity connected in series with a controlling resistance. The block of heating resistance is surrounded by the controlling resistance, preferably a spirally-wound wire, it being insulated from the heating resistance by a refractory material which surrounds the heating material on all sides but one, that from which the heat is to be radiated to the body to be heated. The heating resistance is of a material the conductivity of which increases with increase of temperature, and the most efficient and satisfactory material which I have found for this purpose is graphite so manipulated in manufacturing as to be of high resistance. On the other hand, the controlling resistance is of a material the conductivity of which decreases with increase of temperature, so as to offer greater resistance to the current. The object of the relative arrangement of these resistances is to raise the temperature of the controlling resistance mainly by means of the thermal influence of the heating resistance. In other words, I do not rely upon the heating effect of the current in passing through the controlling resistance, because that is so slight and so much less in degree, as the resistances are proportioned, than the heat generated in the heating resistance, that a destructive temperature would be reached in the latter before it could possibly be checked by the controlling resistance.

My invention further consists in the features hereinafter more particularly described and claimed.

In the accompanying drawings, forming part of this specification, Figure 1 is a longitudinal central section of a soldering-iron embodying my invention. Fig. 2 is an elevation of the same. Fig. 3 is an elevation of the heating resistance or heater-rod. Fig. 4 is a section, partly in elevation, showing the spool and controlling resistance or rheostat. Fig. 5 is an end elevation of the same. Fig. 6 is an elevation of the insulating-collar. Fig. 7 is a section, partly in elevation, of the shank. Fig. 8 is an end elevation of the same, and Fig. 9 is a vertical sectional view of another form of heating device embodying my invention.

As shown in Figs. 1 to 8 of the drawings, representing a soldering-iron, A is the heating resistance consisting of a cylindrical bar or core of graphite, to the inner end of which is attached the metallic cap a, provided with a binding-screw a' and having a metallic stem a^2 secured to its opposite end. Surrounding the bar and stem is the insulating-spool C of some suitable refractory material, such as fire-clay or porcelain. Embedded in the spool C is the controlling resistance B, consisting of a wire spiral, the coils of which are insulated from each other by the mass of the spool. One end of the wire is attached to the exposed terminal of the bar A by means of the binding-screw a', while the other end projects through a hole in the insulating-collar D, which also is of porcelain or other suitable material. This collar surrounds the projecting stem a^2, and is secured to the latter by the binding-screw c. Surrounding and inclosing the spool and the heating and controlling resistances is the casing E, preferably of thin sheet metal open at each end. This casing is inserted in a head composed, preferably, of two parts F and F', united at f by a screw-joint, the part F having a cone tip or point f', constituting the body to be heated, and provided also with a conical recess f^2 inside, which serves as an air-space between

the exposed terminal end of the heater-rod A and the head F, the casing being held in place by the set-screws f^3.

Secured to the rear end of the head is the hollow cylindrical shank G, which is provided with a central longitudinal partition g and a series of holes g' to secure proper ventilation. This shank is preferably enameled on the inside, and is secured at its other end to the wooden handle H, preferably by threading, as at g^2, and by means of a screw h. This handle is hollow, as shown, and the conducting-wires I and I′ are led through it, and thence through the shank, one on each side of the partition, and connected one to the binding-screw c and the other to the terminal of the controlling resistance.

When the current is switched on through the wires I and I′, the heating resistance is gradually heated, and the heat thus generated is radiated from its exposed end through the air-space to the head F, so as to heat its point. Owing to the character of the material of which the heating-bar is composed, as the temperature rises its conductivity also increases, thereby decreasing its resistance and permitting an increased flow of current. This in turn serves to increase its temperature at a greater ratio than when the current was first applied. Consequently the heating resistance would soon reach a destructively high temperature, unless the current-flow were checked. This is automatically done by means of the controlling resistance. The heat generated in the heating-bar is also conducted quickly through the refractory insulation to the wire of the controlling resistance, thereby raising its temperature almost as rapidly and almost as high as that of the heating-bar. The effect of this heating of the controlling resistance is to proportionately increase its resistance, and consequently decrease its conductivity, thus automatically checking the current-flow.

The heating and controlling resistances are relatively so proportioned that when they have reached the maximum temperature desired the current-flow is so far checked as to maintain a substantially uniform temperature. When the temperature of the head is lowered by radiation or use, the temperature of the inclosed resistances is also quickly lowered by conduction, thus permitting an increased flow of current and a repetition of the action above described. It is therefore possible to so proportion the resistances as to absolutely and automatically limit the temperature to any degree desired, and practically all of the heat generated by the current is utilized, since the two resistances are so positioned as to be in close proximity to the part to be heated.

The shank G, being perforated, is kept cool by the circulation of air, and, as the interior of it is provided with a partition and is enameled, the wires I and I′ are prevented from short-circuiting in case their insulation should be abraded by wear.

In Fig. 9 is shown a heater adapted for other purposes, yet embodying the principles of my invention. In this case the graphite heating resistance is made in the shape of a disk, and is surrounded by a spool and controlling resistance or rheostat. Around the two resistances and spool is placed a casing K, which is flat on top, to serve as a stand on which may be placed any article to be heated, an air-space k being formed between the inside of the casing and the top of the heating resistance. The operation of this apparatus is functionally the same as that of the other above described.

I claim—

1. In an electric heater, in combination the heating-conductor whose conductivity increases with increase of temperature, and a controlling-conductor whose conductivity decreases with increase of temperature in series therewith and subject to its thermal influence.

2. In an electric heater, in combination with the mass to be heated, the heating-conductor whose conductivity increases with increase of temperature, the insulating-envelop covering the same, except the part adjacent said mass, and the controlling-conductor whose conductivity decreases with increase of temperature, in series with said heating-conductor and embedded in said envelop.

3. In an electric heater, the combination of the heating-conductor, whose conductivity increases with increase of temperature, a part thereof being exposed and the remainder insulated, the mass to be heated subject to heat-radiation of said exposed part, and the controlling-conductor whose conductivity decreases with increase of temperature embedded in the insulating material.

4. In an electric heater, the combination of the heating-conductor of large sectional area, whose conductivity increases with increase of temperature, the mass to be heated adjacent and subject to the heat radiated from one side or face of said conductor, and the controlling-conductor whose conductivity decreases with increase of temperature, in series with and adjacent the other side of the heating-conductor, and subject to the heat from said heating-conductor.

5. In an electric heating device, the combination with a heating resistance composed of material whose conductivity increases as its temperature rises, of an insulating-spool encircling the same, and a controlling resistance whose conductivity decreases as its temperature rises, embedded in the spool and connected in series with the heating resistance, substantially as set forth.

6. In an electrically-heated soldering-iron, the combination with a hollow head, and a

hollow handle, of a hollow shank connecting the handle and head and provided with a central partition, a heating resistance within the hollow head, and a pair of conductors connected to the heating resistance and passing through the hollow handle and shank, one on each side of the central partition, substantially as set forth.

7. In an electrically-heated soldering-iron, the combination with a hollow jointed head, a hollow handle, and a hollow shank connecting the head and handle and provided with a central partition and air-inlets, of a graphite heater-bar within the head, a metallic cap at one end of the heater-bar provided with a binding-screw, a metallic stem at the other end of the heater-bar, a spool of refractory insulating material surrounding the heater-bar except at the end provided with the metallic cap, a coil of wire embedded in the spool and having one end connected to the binding-screw on the metallic cap, an insulating-collar around the end of the metallic stem and secured by a binding-screw, a tubular casing inclosing the spool, heater-bar and collar, and held in the hollow head by a screw, and a pair of conductors passing through the hollow handle and shank, one on each side of the partition, one conductor connecting to the other end of the coil of wire, the other conductor being connected to the binding-screw in the metallic cap, substantially as set forth.

8. In a tool of the class described, the combination with the mass to be heated, of the connected cylindrical shell, the cylindrical heating-conductor core arranged therein with its inner end adjacent the part to be heated the conductivity of which increases with increase of temperature, the heat-conducting insulation interposed between said core and said shell but leaving the end of said core exposed, the controlling-conductor whose conductivity decreases with increase of temperature, embedded in said insulation and electrically connected to the inner end of said core, the other ends of both said conductors being connected to the respective terminals, whereby the heat generated by the current in the heating-conductor is conducted to the controlling-conductor so as to coöperate with the current in increasing its temperature and enhancing its controlling effect upon the heating-conductor.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

THEODORE GRUTTING.

Witnesses:
LOUIS FEESER, Jr.,
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