

T. VAN ALLER.
ELECTRIC HEATING DEVICE.
APPLICATION FILED JUNE 7, 1912.

1,101,821.

Patented June 30, 1914.

Fig.1.

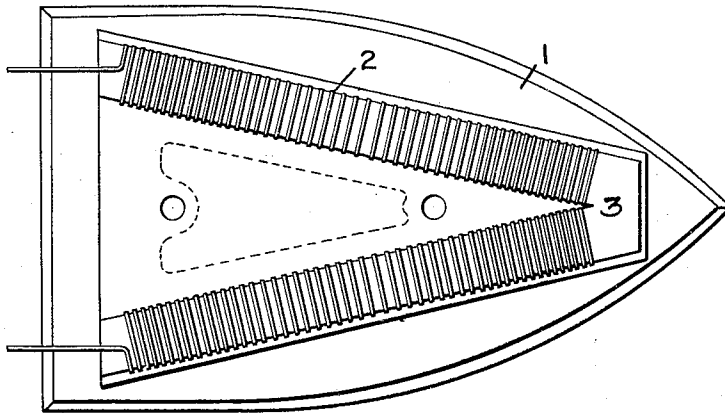
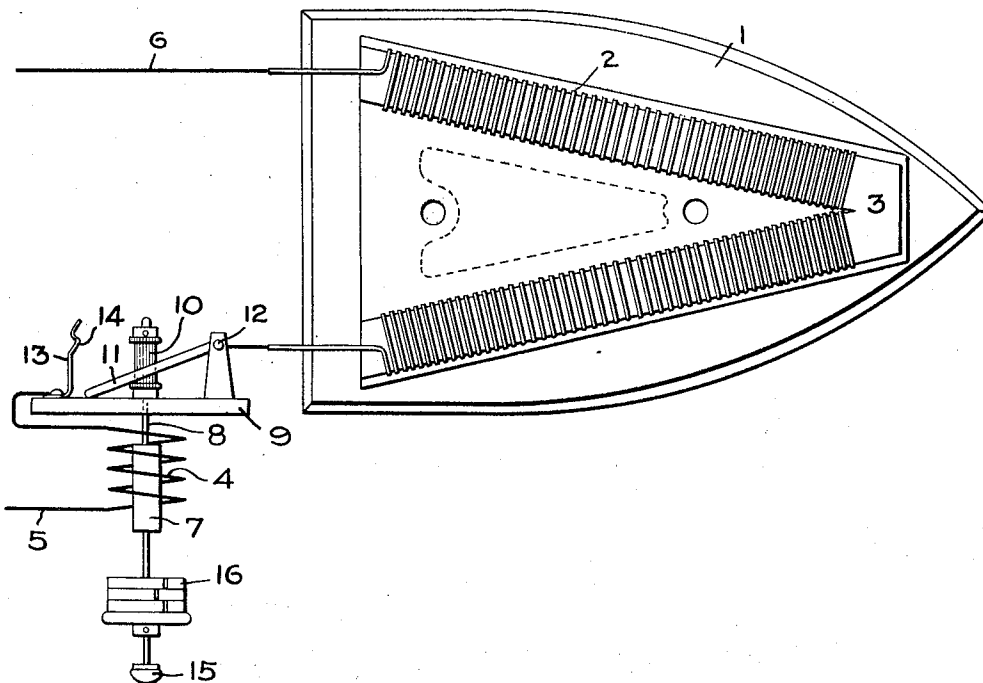


Fig.2.



WITNESSES:

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UNITED STATES PATENT OFFICE.

TYCHO VAN ALLER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC HEATING DEVICE.

1,101,821.

Specification of Letters Patent.

Patented June 30, 1914.

Application filed June 7, 1912. Serial No. 702,158.

To all whom it may concern:

Be it known that I, TYCHO VAN ALLER, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Electric Heating Devices, of which the following is a specification.

This invention relates to electric heating devices, one of the objects of my invention being to provide means whereby a device of this character may be automatically controlled in a reliable, simple and efficient manner.

In the use of such electric heating devices as flat-irons and the like, it is desirable that the heat generated should be varied to a considerable extent. In the case of a flat-iron, for instance, the amount of heat required will depend upon the nature of the work done. If the iron is being used on heavy, damp material, a relatively large amount of heat must be generated, otherwise the iron will become too cool to operate effectively. On the other hand, if the iron is being used on thin material which is relatively dry, a small amount of heat should be furnished, in order that the iron shall not become overheated. In other words, it is desirable that the supply of heat be automatically regulated to the demand.

One of the objects of my invention is to provide an electrically heated device of the character in which the demand for heat is variable, with a heating unit which of itself will regulate the amount of current supplied at any particular time to the demand at that time.

Another object of my invention is to provide improved means whereby, in case the heat supplied is not being used, the current will be cut off so as to save current and in some cases to prevent serious scorching or perhaps fire, as for instance where the iron is accidentally left in contact with the work for a considerable time.

In carrying out the first object of my invention, I employ as a heating element a material having a positive temperature coefficient, *i. e.*, one in which the specific resistance will increase with the temperature and rely upon the heating element for the resistance variation. It has been heretofore proposed to use a resistance element of this character, but since the range of variation

of resistance with the arrangement suggested was small, a resistance material having a positive temperature coefficient was merely employed as an auxiliary or separate resistance for reducing the current, the change in the specific resistance being taken advantage of to cause a relay to operate and vary the amount of extra resistance in circuit. I have found that certain metals, such, for instance, as iron, having a positive temperature coefficient, may be employed in such a way that the resistance element itself will furnish sufficient variation of resistance upon change of temperature to regulate the supply of current to the demand within the limits of practical requirements. I have found, for instance, that by using iron as the resistance element and causing it to operate efficiently throughout a wide range of temperature that practically perfect regulation can be obtained. To this end, I preferably, though not always necessarily, provide some means for preventing oxidation of the iron or other resistance metal, and therefore make it possible to operate the metal efficiently at a higher temperature than could otherwise be used. One method of accomplishing this result is by treating the metal by the process disclosed in my previous application, Serial No. 652,756. This process consists, broadly speaking, in treating the metal in the presence of powdered aluminum and other material at a high temperature to cause the materials to act upon and combine with the iron to render it non-oxidizing even at a high temperature. When treated in this way the resistance wire may be operated at a high temperature, at which it would otherwise quickly oxidize, without any noticeable oxidation, so that a wide range of temperature and therefore a wide range of current values may be employed.

In carrying out the second object of my invention, I provide means whereby, in case the specific resistance of the resistance element is increased to a predetermined extent by the increase in temperature, the decrease of current flow incident thereto will cause the circuit to be opened and the flat-iron or similar device permanently cut out of circuit. Assuming the case of a flat-iron accidentally left by the operator in contact with a piece of cotton material, the heat not being carried away by contact with damp or

cool articles, the temperature will rise, and as the temperature rises, the specific resistance of the resistance material rises. There being no means for radiating the heat like there would be, for instance, if the flat-iron were left on an iron stand, the temperature may continue to rise and the current to decrease. Just before the temperature is reached which would cause a fire or perhaps just before the temperature is reached which would cause the material to be scorched, I cause the circuit to be opened and cut out the flat-iron entirely. This is preferably accomplished by the opening of an underload cutout switch which can only be closed by hand after the temperature has dropped to a safe value.

Other objects and purposes of my invention will appear in the course of the following specification, in which I have shown my invention embodied in concrete form for purposes of illustration.

In the accompanying drawings illustrating my invention embodied in concrete form, Figure 1 is a plan view of a flat-iron with the upper plate removed to show the heating unit; and Fig. 2 is a similar view showing the flat-iron provided with an automatic cutout.

Referring to the drawing, 1 represents the base of a flat-iron having a resistance element 2 mounted in heat conductive relation therewith. For purposes of illustration, I have shown the unit as consisting of a metal ribbon 2 wound upon a flat V-shaped support of insulating material 3, such as mica or the like, although any suitable arrangement or construction of the unit may be employed without departing from the spirit of my invention. The material of the ribbon 2 is preferably of iron or other metal having a high positive temperature coefficient of resistance. The unit is placed in good thermal relation with the iron base so that any change in temperature of the base will be quickly communicated to the heating unit and the heat from the unit will be quickly communicated to the iron. This good thermal relationship between the unit and the iron is exceedingly important. The metal of the resistance ribbon having a positive temperature coefficient will cause the current supplied to the iron base and hence the heat supplied thereto to automatically regulate itself to the demand. If, for instance, the iron base is placed in contact with heavy damp material, the iron base will, of course, be quickly cooled. Owing to the good thermal relationship between the iron and the unit, this decrease of temperature will cause heat to be quickly extracted from the heating unit and the temperature of the heating unit to drop. This decrease of temperature causes the specific resistance of the resistance metal to be decreased and

consequently a proportional increase in current flow. Since more current will now flow through the resistance material, the temperature of the unit will be increased and this increase in temperature will be immediately communicated to the iron base. The net result is, that while the iron base will be cooled for an instant, an additional supply of heat will immediately become available and the iron will promptly rise to the proper temperature. In this way, the temperature of the flat-iron may be kept substantially uniform and the amount of current used varied with the requirements. In other words, when work is being done which requires only a small amount of heat, then only a small amount of heat is generated and a small amount of current consumed, whereas when the work requires more heat the heat needed will be automatically supplied.

In order that satisfactory regulation may be obtained through automatically increasing resistance of this character, it is necessary that the unit shall operate efficiently throughout a wide range of temperature to afford a sufficient range of resistance. In order to accomplish this, it is necessary that the metal shall in some cases attain a comparatively high temperature. If, for instance, iron is used, this high temperature will cause deterioration of the iron due to oxidation. In order to overcome this difficulty, I treat the metal in such a way as to render it non-oxidizing even at a high temperature. This may be done very effectively, especially in the case of iron resistance material, by treating the iron by the process described in my application above referred to. One method of carrying out this process, which has been found to be very successful in practice, is as follows: Powdered aluminum is thoroughly mixed with a certain percentage of powdered zinc and sal ammoniac and the metal to be treated is placed in an oven surrounded by the powdered mixture. The oven is then completely closed and slowly rotated. A temperature of about 700° C. is maintained in the oven for about two hours. One mixture which has been found to give excellent results contained 60 per cent. aluminum; 10 per cent. sal ammoniac; and 30 per cent. graphite. Iron wire treated by this process has been kept at red heat for over two hundred hours without any apparent oxidation. It is obvious that by using iron wire treated in this way a high temperature can be maintained for a long time without deterioration of the unit, and thus the current supplied may be varied throughout a wide range.

In Fig. 2, I have shown my device in connection with an automatic switch which will cut off the flat-iron when the current decreases to a predetermined value. Any well

known form of underload cutout which is suitably calibrated and adjusted will serve my purpose. As shown in the drawing, the cutout simply consists of a coil 4 which is adapted to be connected in series with the heating wire 2 and with the supply lines 5 and 6. A core 7 operating within the solenoid is weighted at its lower end and connects through a rod 8 extending through a stationary insulating support 9 with an insulating member 10 having a flange at each end. The switch member 11, in the form of a loop, is pivoted at 12 so that its free end engages the spring contact 13 which is provided with a shoulder 14 which latches the switch member in closed position. The flanges on the member 10 engage the switch member to open and close the same. When the current is above a predetermined value, the core will be held in raised position and the switch closed after it has once been closed by means of the knob 15. In this raised position the circuit will be closed through the winding 4, switch arm 11, and the resistance wire 2 of the flat-iron. When the current in the winding 4 falls below a predetermined value, which value may be regulated by regulating the weights 16 upon the core, or in any other well known manner, the switch contacts will be opened by the dropping of the core and the supply of current cut off from the wire 2. This automatic cutout acts as a safety device to cut off the current in case the iron is left in circuit, either accidentally or otherwise, for so long a period and under such conditions as might cause fire. If, for instance, the flat-iron should be accidentally left in contact with inflammable material, the temperature of the unit will rise and the resistance of the unit correspondingly increase. No means being supplied for carrying away the heat, the temperature will continue to rise and the current to decrease until a balance is reached in which the radiation losses will equal the energy input. The underload switch is therefore set so as to open the circuit when the current is reduced to a predetermined value corresponding to a rise in temperature of the flat-iron beyond which it would not be considered safe. If the flat-iron were left upon a stand, the radiating surface would be increased to such an extent that the temperature might not rise to a point at which the cutout will operate, although it can be set to operate at substan-

tially any value. It will be seen that I have provided an electrically heated device in which the current supplied is automatically regulated to the demand solely by means of the heating unit itself and likewise provide automatic means for cutting off the heater if it becomes hot enough to be dangerous, and while I have described my invention as embodied in concrete form and as operating in a specific manner for purposes of illustration, it should be understood that I do not limit myself thereto, since various modifications thereof will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claims.

What I claim as new, and desire to secure by Letters Patent of the United States, is:—

1. An electric heating device comprising a body to be heated and a resistance conductor composed of iron with a non-oxidizable surface and in good thermal relation with said body so as to regulate the heat supplied to said body by the changes of resistance of the iron conductor due to changes of temperature.

2. An electric heating device comprising a body to be heated, a resistance conductor for heating the same having a high positive temperature coefficient and arranged to regulate the heat delivered to the said body by changes of resistance of said conductor due to changes of temperature, and an electroresponsive device for cutting the device out of circuit when the current in said conductor decreases to a predetermined value.

3. An electric heating device comprising a body to be heated, a non-oxidizable resistance conductor for heating the same having a high positive temperature coefficient and arranged to regulate the heat delivered to the said body by changes of resistance of said conductor due to changes of temperature, and an electromagnetic switch having its winding in series with said conductor for cutting the conductor out of circuit when the current therein decreases to a predetermined value.

In witness whereof, I have hereunto set my hand this 6th day of June, 1912.

TYCHO VAN ALLER.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.