(No Model.)

W. S. HADAWAY, Jr.

ELECTRIC HEATER.

No. 563,032. Patented June 30, 1896.

Fig. 2.

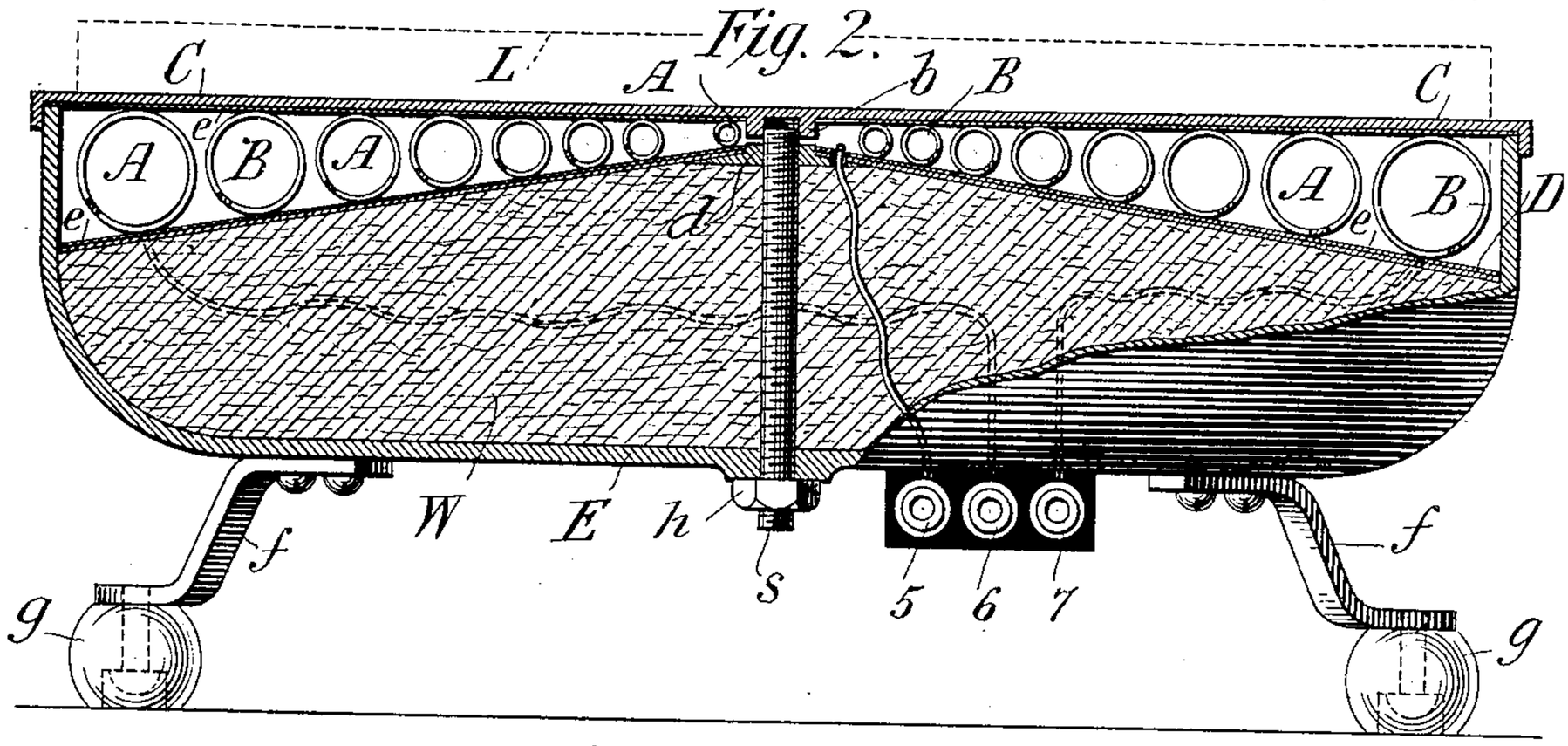
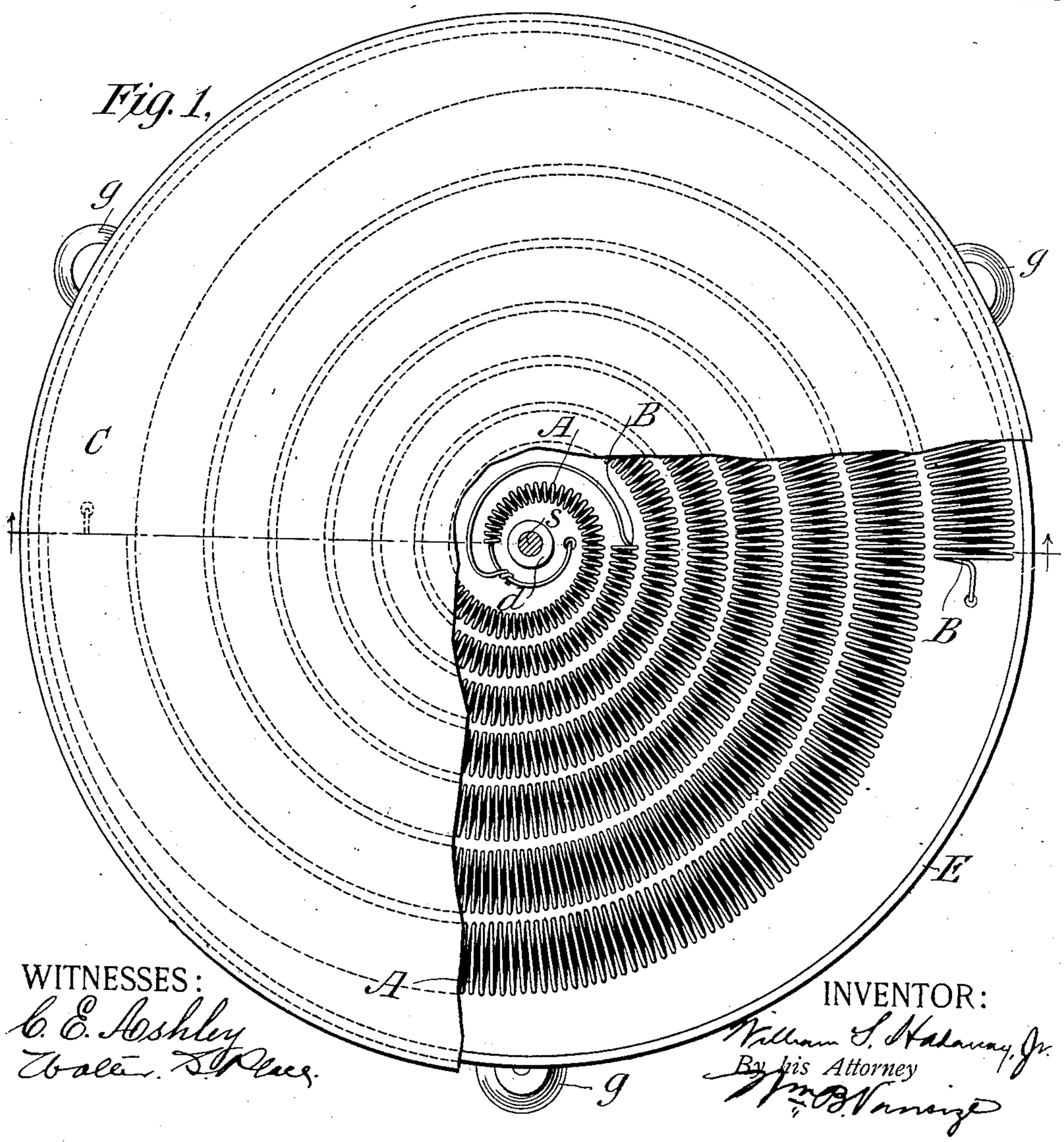


Fig. 1.



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ELECTRIC HEATER.

SPECIFICATION forming part of Letters Patent No. 563,032, dated June 30, 1896.

Application filed February 27, 1896. Serial No. 580,981. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM S. HADAWAY, Jr., a citizen of the United States, residing in the city of New York, county and State of New York, have made certain new and useful Improvements in Electric Heaters, of which the following is a specification.

My invention is an improvement in electric heating-devices and apparatus.

The object of my invention is to secure a uniform distribution of heat at all points of a heat-radiating surface and to secure a compact, light, adjustable apparatus for providing artificial heat that is susceptible of easy repair.

Great difficulty has been experienced in securing a uniform distribution of heat at different radial points or at different points from a center of heat in stoves and similar electric heaters, and it has been the common practice to place small coils or convolutions of wire on a radiating-surface at separated points. It resulted from this that more heat was generated or developed at the center than at any given radial distance from the center, and the distribution of heat could be graphically represented by an outline in the form of a cone, the apex representing the maximum heat.

My improved arrangement for a heating-conductor completely and uniformly remedies or obviates this objectionable feature in electric heating apparatus. I take a conductor of uniform diameter and wind it on a tapering mandrel, so that it presents the form of a graduated helix; that is, the successive convolutions of wire forming a helical coil gradually and uniformly increase in diameter. I then dispose this graduated helix in the form of a spiral, beginning with the smaller end of the helix for the center of the spiral, so that the convolutions of the helix and the convolutions of the spiral both increase in diameter at the same time or together, the comparison being made at points on any radial line. It will thus be seen that a unit in length, measured on the major axis of the helix at the outer end, will include a greater length of wire, and therefore greater electrical resistance, than a similar length taken at any other point on said axis where the diameter of a helical convolution is less, and I have discovered that when a conductor of uniform diameter is laid up in the form of a graduated helix and disposed upon a circular radiating-surface in the form of a spiral the distribution of heat is practically uniform. I provide two metal plates, and I coat the contact-surface of each plate with a vitreous enamel, such as is employed in numerous domestic cooking utensils. Between these plates I clamp the spiral convoluted conductor, one plate being preferably a plane surface and one being a conical surface to conform to the outline of the conductor, as described. I prefer to use two sections of conductor and arrange both in the helical form described, the diameter of a helical convolution of one being slightly greater than the diameter of the same or a corresponding convolution in the other, and these two separate graduated helices I lay side by side in alternating spiral coils, and I provide means for connecting either one in circuit or both in parallel circuit.

I provide a base for a stove or heater of cast aluminium, this metal being preferable for this use on account of the difficulty with which it emits heat. The space below the heating-coil I fill with mineral wool or asbestos.

The accompanying drawings illustrate my invention.

Figure 1 is a plan view of the stove or heater with a section of the top broken away to show the construction and arrangement of the conductor. Fig. 2 is a central cross-section of the heater, showing details.

A and B are two bare conductors, of any suitable material, which have been formed into a graduated helix by winding upon a tapering mandrel. A is about one-eighth inch in diameter at one end and one-half inch at the other end. B is three-sixteenths inch in diameter at one end and nine-sixteenths at the other, these measurements being approximate and here mentioned for clearness of description. Both A and B are arranged in the form of a spiral and placed side by side.

C is a plane plate of iron or steel.

D is a plate of iron or steel thin enough to have a resilient action, conoidal in form or outline, the pitch of the sides being sub-

stantially equal to the line formed by the hypotenuse of a triangle having for its base the outside diameter of any helical convolution. Upon the interior or contact surfaces of plates C and D, I place one or more coats of any suitable insulating-enamel, as *e*, preferably vitreous, and such as is commonly employed for coating culinary ironware.

The plate C is provided with a central screw-threaded boss *b*, and the plate D is provided with a screw-threaded boss *d*. The base E is a casting of aluminium, this metal being preferred because it offers resistance to the emission of heat. Feet *f*, having glass-ball contacts *g*, provide suitable supports for the base E. A screw *s*, having a screw nut or head *h*, passes up through the base and unites the two plates at the center, while the outer edges of the plates are held by the edge of the base and against the interior surface of the base, respectively, by the screw *s* and the nut *h*. The space between the plate D and base E is filled with mineral wool or asbestos W.

In placing the conductors in position in the first instance, or when repairs are necessary, I remove the nut *h* from the screw *s*, said screw still uniting the two plates at their centers and holding them firmly in fixed relation, as shown. I then lay the first coil A between the plates A and B in such a manner that it is caught and held, and when one convolution is in position I place the second coil B in position and so proceed with alternate spiral convolutions of each coil A and B alternately, until both are in position. As the plate D is resilient, care must be taken not to force one spiral convolution of a helical coil in so far that the plate is sprung out beyond the point where a second or succeeding coil will be readily caught and held. When all the spiral convolutions are in position, each one must be and will be independently caught and held by the two plates C and D. The two interior ends of the coils I electrically unite and connect with the plug connection 5 on the base E. The exterior end of coil A is connected with the socket 6, and the exterior end of coil B is connected with the socket 7.

In operation the coils are connected to a suitable source of constant electromotive force, and when the current is finally established and the apparatus heated the radiation of heat will be substantially uniform at all points of the surface, as shown by the dotted line L in Fig. 1. When coil A is in circuit alone, its resistance being the lower of the two, the greater current from a constant electromotive force will yield the greater heat. When the coil B is alone in circuit, its resistance being greater, the lesser current from a constant source will yield the lesser heat; and when both coils are in circuit in parallel the heat will be the maximum of the capacity of the apparatus.

What I claim, and desire to secure by Letters Patent, is—

1. In an electrical heating apparatus the combination of a heat-radiating surface, and an electrical conductor in the form of a graduated helix disposed in spiral form, upon said radiating-surface, but insulated therefrom, substantially as described.

2. In an electrical heating apparatus the combination of a heat-radiating surface and an electrical conductor laid in the form of a helix, the convolutions of which uniformly increase in diameter from one end to the other, said helix being disposed in convolutions increasing in diameter from the center of the heating-surface outward, substantially as described.

3. A coiled conductor for use in electrical heating devices, said conductor being laid up in the form of a graduated helix and disposed in the form of a spiral, substantially as described.

4. In an electrical heating apparatus the combination of a coiled conductor laid up in the form of a graduated helix disposed in the form of a spiral, two plates or surfaces one or both of which conform to the gradually-varying thickness of the spiral convolutions, means for clamping or holding said convolutions in fixed position between said plates and for insulating said conductor from said plates, substantially as described.

5. In an electrical heating apparatus the combination of a conductor in the form of a graduated helix disposed in the form of a spiral, a metal plate having a substantially plane surface coated with a vitreous insulating-enamel against which said conductor is held, a second plate having an enameled surface in the form of a cone, conforming to the outline of the spirally-disposed conductor, and means for clamping or holding said plates against opposite sides of said conductor to maintain all said parts in position, substantially as described.

6. In an electrical heating apparatus the combination of two sections of conductor each in the form of a graduated helix, each disposed in the form of a spiral, the diameter of the helical convolutions of one being greater than the diameter of the helical convolutions of the other, and the spiral convolutions of one alternating with the spiral convolutions of the other, all arranged substantially as and for the purpose described.

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