219-436

No. 819,650. PATENTED MAY 1, 1906.

J. HÄRDÉN.

ELECTRIC HEATER.

APPLICATION FILED MAR. 27, 1905.

FIG. 1

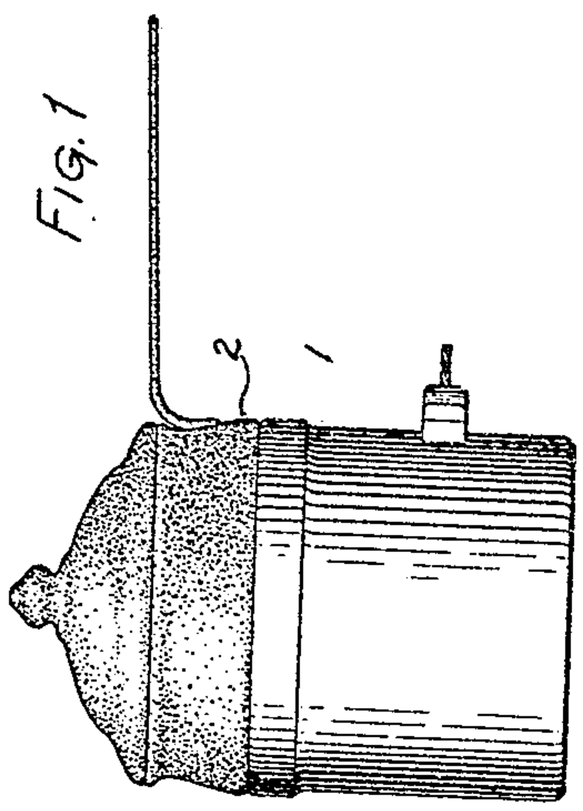


FIG. 3

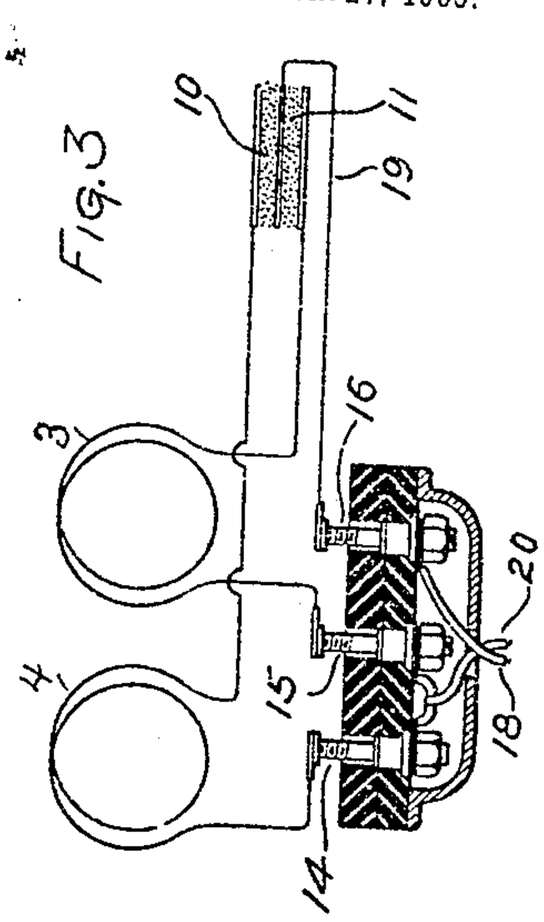


FIG. 4

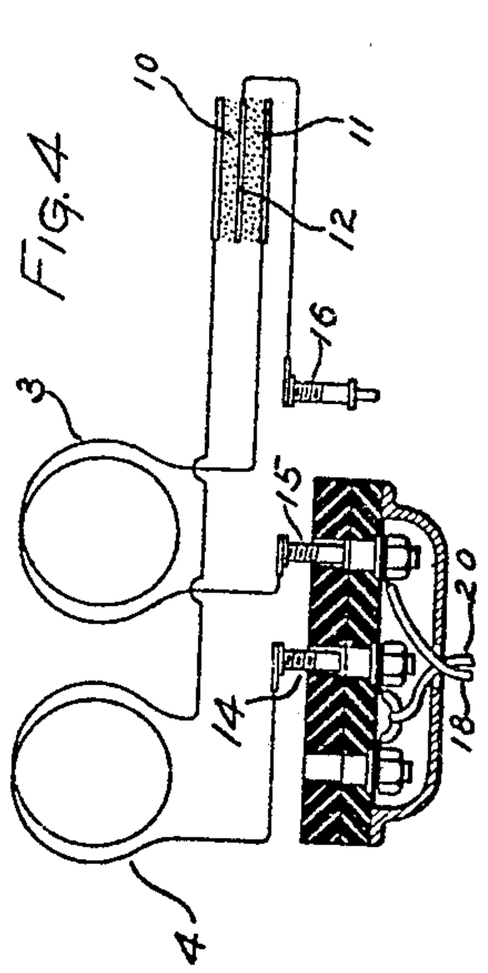
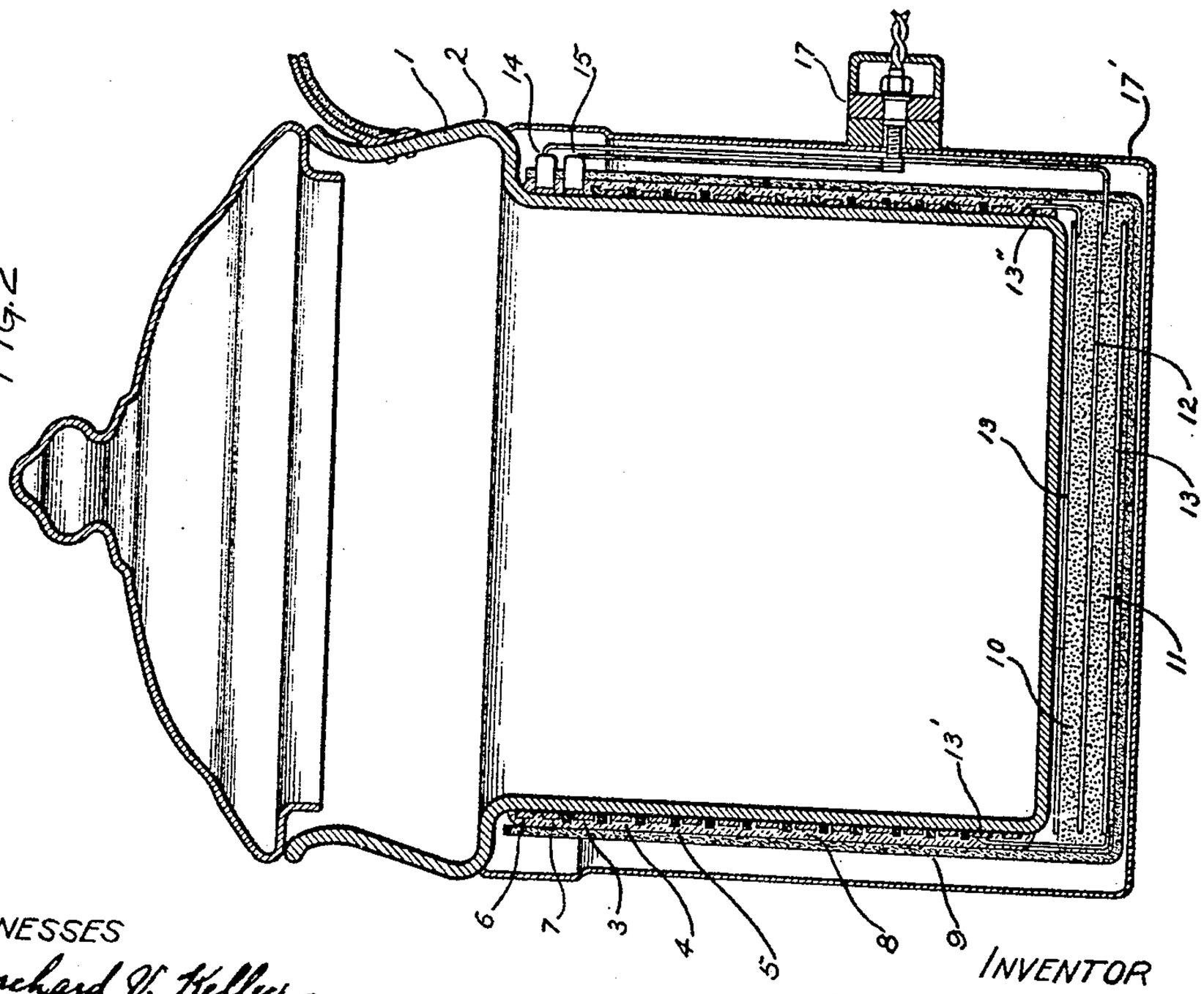


FIG. 2



WITNESSES

Burchard V. Kelly

Helen Orford

INVENTOR

JOHANNES HÄRDÉN

BY Albert G. Davis

ATTY.

UNITED STATES PATENT OFFICE.

JOHANNES HÄRDÉN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC HEATER.

No. 819,650. Specification of Letters Patent. Patented May 1, 1906.

Application filed March 27, 1905. Serial No. 252,173.

To all whom it may concern:

Be it known that I, JOHANNES HÄRDÉN, a subject of the King of Sweden and Norway, residing in Schenectady, county of Schenectady, and State of New York, have invented certain new and useful Improvements in Electric Heaters, of which the following is a specification.

This invention relates to electric heaters, and has for its object the provision of a heater of such a character that it may be operated efficiently by either a direct or an alternating current.

Further objects are the provision of improved means for compensating for the rapid increase of resistance with the rise of temperature in iron or other resistance-conductors and producing different heats by varying the relative arrangement of the resistances.

My invention further consists in the details of construction and the combination of elements hereinafter described, and particularly set forth in the claims annexed to and forming a part of this specification.

In the drawings, Figure 1 is an elevation of a receptacle embodying my invention. Fig. 2 is an enlarged sectional view of the same. Fig. 3 is a diagram of the circuits employed, showing the windings arranged in parallel; and Fig. 4 is a similar view showing the windings arranged in series.

Referring to the drawings, 1 is a metallic vessel of a suitable shape preferably covered throughout with insulating material. I prefer to use an iron vessel coated with enamel 2, vessels of enamel-ware being very well known in the art. The shape of the vessel is preferably cylindrical, and upon the cylindrical surface is wound resistance-wire, either of iron or German silver or any of the well-known resistance-conductors. I have shown this resistance as comprising two separate windings 3 and 4, each winding composed of an iron ribbon wound flatwise. The windings are separated from each other by a strip of insulating material 5, the contact-rings 6 and 7 serving as terminals of the said windings. A layer of cement 8 is now formed over and around the wires, the cement preferably containing potassium silicate, calcium sulfate, and some calcium oxid. The particular kind of cement, however, forms no part of my invention, as any good quality of cement or other plastic heat-resisting insulating material will be satisfactory. The cement is now heated until the gases are driven off and it is caused to harden. A porous asbestos cover or casing 9 is now placed over the cement, so as to entirely inclose the winding.

It has been found that the resistance-conductor has a low initial resistance which increases so rapidly with the increase of temperature that a large amount of current is taken at first; but as the temperature rises it is cut down considerably. In order to compensate for this and also in order to have some heat generated in the bottom of the vessel, a mass of powder preferably containing iron-filings and silicon is placed adjacent the bottom of the receptacle. This mixture has an opposite resistance temperature coefficient to that of iron, and a compensating effect is thereby obtained. The powder has a high initial resistance which comes down when it is heated, which is the reverse of the action taking place in the case of the iron wire.

I have divided the powder into two layers 10 and 11, separated by a metallic plate 12 and having similar plates 13 on opposite sides of and in contact with the layers. These plates are primarily for the purpose of making a good contact between the powder and the wires. As shown in the drawings the two outside plates 13 are each connected with one end of the windings 3 and 4 by means of contacts 13′ and 13″, the other end of each winding being connected with the terminals 14 15 through contacts 14′ and 15′. The central plate 12 is connected with another terminal 16. At 17 I have shown a connector-plug having three sockets, with which the terminals 14, 15, and 16 are adapted to engage. These terminals are arranged in a metallic casing or cover 17′, which surrounds the winding and is separated from the asbestos sheet by a small air-space.

Referring to Fig. 3, it will be seen that when the connector 17 is in the position in which the three terminals engage the three sockets the direction of the current is as follows: from lead 18 through terminal 16, wire 19, thence through the two layers 10 and 11 and windings 3 and 4 in parallel back to the terminals 14 15 and lead 20. By shifting the connector 17 so that only the terminals 14 15 are in engagement with the sockets, as shown

in Fig. 4, the direction of the current will be as follows: from lead 18 through terminal 15, winding 3, lower plate 13, layers 10 and 11 in series, winding 4, and terminal 14 to lead 20. By this arrangement of windings two different heats may be given to the receptacle by simply reversing the connector. It will thus be seen that I have provided a heater which may be used efficiently with either a direct or an alternating current. I have found that good results have been obtained by so arranging the turns of the resistance-conductor that about eighty per cent. of the heat is generated by the ohmic resistance and about twenty per cent. is generated by the transformer effect. These proportions, however, may be varied somewhat to suit conditions.

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

1. An electric heater, comprising a receptacle, and a resistance for heating the same, one portion of which has a positive and the other a negative resistance temperature coefficient, both portions being in heat-conductive relation with said receptacle.

2. An electric heater, comprising a receptacle, an electric conductor (the resistance of which varies directly as the temperature) wound around the same, and another conductor in circuit therewith and in heat-conductive relation with said receptacle, the resistance of which varies inversely as the temperature.

3. An electric heater, comprising a receptacle, a resistance-conductor wound thereon, and a granular resistance in heat-conductive relation with said receptacle and in circuit with said resistance-conductor.

4. In an electric heater, the combination of an enameled receptacle, a resistance-conductor thereon, and a powdered resistance of negative temperature coefficient in heat-conductive relation with said receptacle and in circuit with said resistance-conductor.

5. In an electric heater, the combination of a receptacle, a plurality of resistances in heat-conductive relation therewith, each comprising a conductor, one portion of which has a positive and the other a negative resistance temperature coefficient, and means whereby the relative arrangement of said conductors may be varied.

6. In an electric heater, the combination of a receptacle, a plurality of resistances in heat-conductive relation therewith, each of which comprises a resistance-wire having a positive temperature coefficient and a granular resistance having a negative coefficient, and means whereby either a series or parallel arrangement of said conductors may be effected.

7. In an electric heater, the combination of an enameled metallic receptacle of good magnetic permeability, a plurality of resistance-conductors having a positive temperature coefficient wound upon said enamel, granular resistances having a negative temperature coefficient in circuit with said conductors and in heat-conductive relation with said receptacle, and means whereby either a series or parallel arrangement of said conductors may be effected.

8. In an electric heater, the combination of an insulated iron receptacle, a resistance-conductor wound thereon, a coating of plastic material surrounding said winding, a casing surrounding the same but separated therefrom, and a granular resistance in circuit with said conductor and adjacent the bottom of said receptacle.

9. In an electric heater, the combination of an insulated metallic receptacle, resistance-conductors wound thereon, layers of powdered resistance containing iron-filings in heat-conductive relation with the bottom of said receptacle and in circuit with said conductors, and means for varying the direction of a current through said resistances.

10. In an electric heater, the combination of an enameled metallic receptacle, a resistance-conductor wound thereon, and a layer of powdered resistance containing iron-filings and silicon in circuit with said conductor and in heat-conductive relation with the bottom of said receptacle.

11. An electric heater comprising a receptacle of good magnetic permeability, a conductor arranged in inductive relation thereto, an ohmic heating-resistance in series with said conductor and in heat-conductive relation with said receptacle whereby the latter may be heated by both a transformer and ohmic effect.

In witness whereof I have hereunto set my hand this 23d day of March, 1905.

JOHANNES HÄRDÉN.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.