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ELECTRICAL HEATING ELEMENT OF
LARGE SURFACE FOR LOW TEM-
PERATURES

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The electrical heating elements in use up to now consist in most cases of resistance-bodies, such as wires wound helically, gauze, wire cloth, bars of resistance material and the like, which in operation are brought to incandescence or at least to high temperatures.

In heating a dwelling room, assembly hall or the like, such a high temperature is undesirable, because the radiating heat is very unpleasant, the dust particles present in the air are burnt on the heating elements, not to mention other disadvantages. A considerable disadvantage consists in the fact that the radiating surface is small and on account thereof a very unfavourable distribution of the heat results.

For this reason, endeavours have already been made, particularly in connection with the heating of rooms, but also for other purposes, to manufacture electrical heating elements, which distribute the heat over generated large surfaces and, by making use of a low temperature, avoid the drawbacks mentioned.

The best result is obtained in the following manner: a thin layer of the material, causing electric resistance, is deposited on a body which is made of electrically non-conductive material. Such heating elements of small size have already been manufactured, the metal to be applied being precipitated chemically and burnt in to firmly adhere.

Apart from the fact that it is not possible to obtain a heating body with a large surface by these means, because the layer of metal has not sufficiently uniform thickness, the following disadvantage still remains. The metal becomes too coarse-grained and it is not possible to make the layers as thin as desirable in order to avoid the necessity of providing on the heating element conductors of a greater length than convenient for practical use.

The invention relates to a heating element, on which the metal employed to set up resistance is applied in a very thin layer obtained however by other than chemical means. A metal covering of very great uniformity is obtained by applying the metal in vacuum by means of cathodic dispersion or by means of thermal evaporation of the metal. It is also possible to obtain thin precipitations of metal on non-conductive bodies, by galvanic means, provided that these bodies are previously made electrically conductive by coating them with an extremely thin layer of metal by applying the latter in vacuum by means of cathodic dispersion or by means of the evaporation of the metal.

Such heating elements can be manufactured in any desired size, notably with surfaces up to several square meters and it is perfectly possible to apply extremely thin layers of metal, which, thus produced, can be made of absolutely uniform thickness. By these means it is possible to bring the thickness of the layer of metal to correspond to the desired rate of load and particularly into accordance with the usual voltage available, without having to make the conductor of greater length than convenient for practical purposes, measured in the direction of the current.

It is therefore possible to employ heating surfaces on which a very considerable amount of resistance is provided, which accordingly allow a relatively low amount of current to pass and which owing to their large surfaces emit heat at low temperatures.

By way of example may be mentioned a glass plate having a surface of 1 x 1 m., being provided with a dull surface on one of its sides and coated with platinum by means of cathodic dispersion or by thermal-evaporation of the metal, at a given voltage of 230 volts which carries a current of 2 amps. The energy absorption therefore amounts to 460 watts and 390 calories are emitted per hour at a temperature of about 40° C.

Another example is a slate plate of 1.3 sq. metres surface, which is made electrically conductive on one of its sides by means of a thin layer of silver applied by means of cathodic dispersion. On this layer, another layer of nickel of such thickness as to make a current of 3.3 amps. pass at a voltage of 230 volts, is applied by precipitation. This plate emits about 630 calories per hour at a temperature of about 75°. The layer of nickel applied in the manner described at the same time also protects the layer of silver against oxidation.

In the described manner it is possible to manufacture heating elements for all temperatures from the lowest up to a temperature of incandescence. In the heating of rooms, these heating elements possess the special advantage of providing the low temperature which hereby is desirable in this connection as well as the uniform distribution of the heat over a large surface.

In view of the fact that the layers of metal are so extremely thin (a practical figure is about 6 millimicron) the required quantity of metal is so small as to enable precious metals such as platinum and gold, to be employed without difficulty, thus enabling these heating elements to be used also in cases, where a layer of ordinary

metal would be exposed to the chemical action of gases, acid fumes, etc.

It has, moreover, been found that it is quite possible to make the layer so thin that it remains transparent and on account thereof may be employed for very special purposes. By way of example may be mentioned the heating of a portion of the front window panes of motor-cars and other vehicles in order to prevent the panes becoming dimmed by snow, rain, haze, etc. A very thin plate of mirror glass covered with gold used as heating element generates about 100 calories per hour with a current of 10 amps. passing through it at a voltage of 12 volts. In the case of heating elements of this kind it will generally be desirable to arrange the layer of metal between two glass plates.

At certain places as for instance where the current enters and leaves the heating element, it is possible to make the layer of greater thickness either by applying a greater quantity of metal, possibly also a different kind of metal at these places, or by applying the metal by galvanic means.

For special purposes it is also possible to ap-

ply on the heating surface coats of other materials as well, producing a catalytic or an emitting action.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An electrical heating element, comprising a cathode sputtered conducting layer of uniform thickness of not over one micron on an insulating support.
2. An electrical heating element, comprising a cathode sputtered conducting layer of uniform thickness of not over one micron on an insulating support, said layer being produced in vacuo.
3. An electrical heating element, comprising a cathode sputtered conducting layer of uniform thickness of not over one micron on an insulating support, said support being transparent.
4. An electrical heating element, comprising a cathode sputtered conducting layer of uniform thickness of not over one micron on an insulating support, said layer and support being transparent.

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