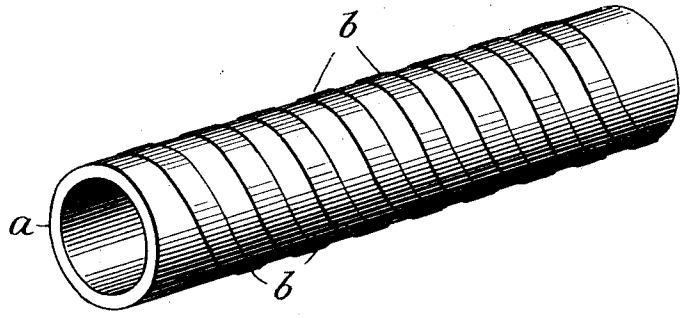
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R. KÜCH.

ELECTRIC HEATING APPARATUS.

APPLICATION FILED NOV. 7, 1902.

NO MODEL.



Witnesses

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UNITED STATES PATENT OFFICE.

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ELECTRIC HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 749,204, dated January 12, 1904.

Application filed November 7, 1902. Serial No. 130,446. (No model.)

To all whom it may concern:

Be it known that I, RICHARD KÜCH, a subject of the German Emperor, and a resident of Hanau, Germany, (having my post-office address at 10 Uferstrasse Hanau,) have invented certain new and useful Improvements in Electric Heating Apparatus, of which the following is a specification.

The present invention relates to an apparatus for heating by means of electrical resistance. Various methods have hitherto been used for this purpose. In some cases, for instance, the metal which is to form the resistance to the heating-current has been baked in the form of a thin layer (metallic mirror) on the walls of the article to be heated. High temperatures could not, however, be obtained by this method, and various difficulties arose from the rigid connection between the thin metal layer and the article to be heated and the different coefficients of expansion of the materials. In other cases very thin metal layers have been used as resistances by cutting strips of so-called "metal" paper and laying or pressing these strips onto the article to be heated or by pressing so-called "beaten" or "leaf" metal on layers of asbestos or the like in the manner of bookbinders' gold-leaf and using the layers thus united as resistances. The printed asbestos paper was in this case also fastened or pressed onto the article to be heated. In all cases in which high temperatures were required—for instance, in laboratory-furnaces, muffles for reducing organic substances to ash, and the like—platinum wire or nickel wire or strips of sheet-platinum or sheet-nickel were wound round the body to be heated—such as the porcelain tube, muffle, or the like—and the separate convolutions were held in position by special devices provided on the said body or were embedded in a fire-brick paste or the like. When platinum was used, as was necessary for very high temperatures, the cost of the method was so considerable that furnaces of the kind referred to could only be used to a very limited extent. Whereas, therefore, on the one hand, the thinnest producible metal layers, metallic mirrors, and beaten gold-skin and, on the other hand, sheet metal and wire have been used, it had hitherto not occurred to anybody to use for electric heating purposes that which unites the most important properties of both these articles as far as the purpose in question is concerned—namely, actual metal foil.

By "platinum-foil," which alone comes into question in this invention, I mean, as is well known, the thinnest sheets which can be produced by rolling. Apart from the method of manufacture, the foil differs also from the beaten or leaf metals in thickness. The thickness of the latter (one seven-thousandth to one ten-thousandth millimeter) being less than that of the foil, the beaten or leaf metals cannot be produced by rolling, but have to be hammered out by special complicated processes. From sheet metal the foil essentially differs by the fact that it has no tendency whatever to preserve an even or straight surface and can be easily made to adapt itself to the shape and unevenness of the surface underneath—for instance, by smoothing or by light tapping with a brush or the like. Over leaf metal it therefore has the advantage of possessing sufficient strength to require no special support, and it can be laid on the article to be heated without such support. Over wire and sheet metal it has the advantage that the first time it is applied to the surface of the article to be heated it fits closely to the said surface. By tapping it with a brush, for instance, it can be made to practically adhere to the surface of a porous body without the use of an adhesive substance, and when placed loosely round the article to be heated the foil is not caused to stand away from the latter by the expansion produced by heating, but, so to say, "collapses" and remains in contact with the said article. These properties are only possessed by foil the thickness of which lies approximately between one one-thousandth and one one-hundredth millimeter, and the use of this foil in electric heating apparatus is the subject-matter of this invention. The described behavior of platinum-foil produces a number of technological effects which were unobtainable by the methods hitherto used. In the first place, is the possibility of obtain-

ing very high temperatures in a very short time and of instantaneously controlling the said temperatures. As an example may be taken a porcelain tube, such as is frequently used for experiments in chemical and physical laboratories. Round a tube of this kind a strip of foil is simply helically wound, and the said tube can then be heated by means of an electric current to within a few degrees of the melting-point of platinum. Owing to the ideal fit of the foil on the tube-surface, which ideal fit is not substantially altered by the heating, all the heat developed by the current is directly transmitted to the tube, and the foil therefore does not become substantially hotter than the tube. With wire or sheet metal the wire or strip stands away from the tube when heated, so that space exists at all points between the tube and the metal, and the latter becomes heated considerably more than the tube. It is therefore obvious that with the aid of foil temperatures can be obtained which are unobtainable with wire or sheet-metal coils. Wire and sheet-metal coils cannot be applied without means for holding the helix in position, since otherwise the expansion is liable to cause the convolutions of the metal to short-circuit each other. The fastening devices, however, form a ballast which must also be heated and by storing heat renders impossible so instantaneous a control of the temperature as is possible with foil. Finally, the use of foil involves only a small expenditure of platinum, and therefore small cost.

In the accompanying drawing there is illustrated one embodiment of my invention, in which—

a represents a tube of refractory material, and *b* the thin strip of platinum, shown as wound in spirals around the tube. In practice the strip is so thin that it can be pressed by hand into the irregularities of the surface of the tube, and it can be applied without an adhesive vehicle without breakage.

When plates or the like are to be heated by means of platinum-foil, strips of the foil must be applied in helical, spiral, or zigzag lines and pressed against the body by means of another plate. If, for instance, a smoothly-planed iron plate is to be heated, it is sufficient to provide it with a thin electrically-insulating coating or to cover it with a thin sheet of mica, to then lay on the strip or strips of foil, whereupon another similarly-treated plate is screwed to the first plate. In this case the characteristic property of the foil, owing to which it has no tendency to remain in a certain plane, has the advantage that the foil adapts itself to the flat surface or the smallest irregularities of the insulating-surface in the easiest manner and where necessary forms small folds and the like, and thus comes at all points into intimate contact with the article to be heated. The result of this is that in use the foil itself becomes only approximately 10° to 20° centigrade hotter than the article heated. In consequence of this the foil is practically indestructible, however long it is used, since at the temperatures used with the apparatus in question (sad-irons, soldering-irons, and the like) platinum undergoes no change whatever. Experience has shown that in heating with platinum wire in the manner hitherto usual, with the wire mounted on a special support, the wire must be so considerably overheated that its life is a limited one.

What I claim is—

Electric heating apparatus comprising a body to be heated and a heating resistance of platinum-foil of .001 to .01 millimeter in thickness in intimate contact with the body and having the characteristics substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RICHARD KÜCH.

Witnesses:
FRANZ HASSLACHER,
MICHAEL POLK.