F. BÖLLING.

ELECTRIC RESISTANCE.

APPLICATION FILED JUNE 20, 1912.

**1,050,912.** Patented Jan. 21, 1913.

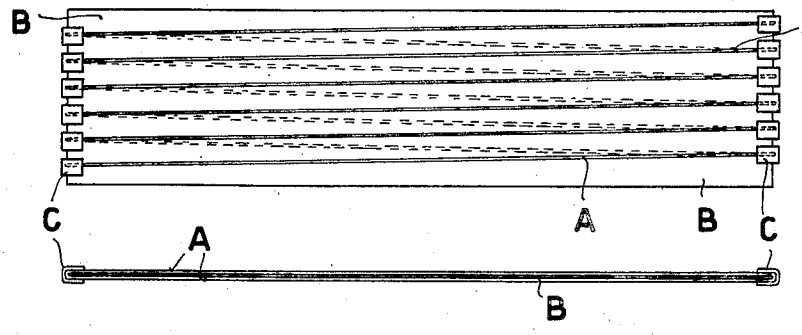


FIG.1.

FIG.2.

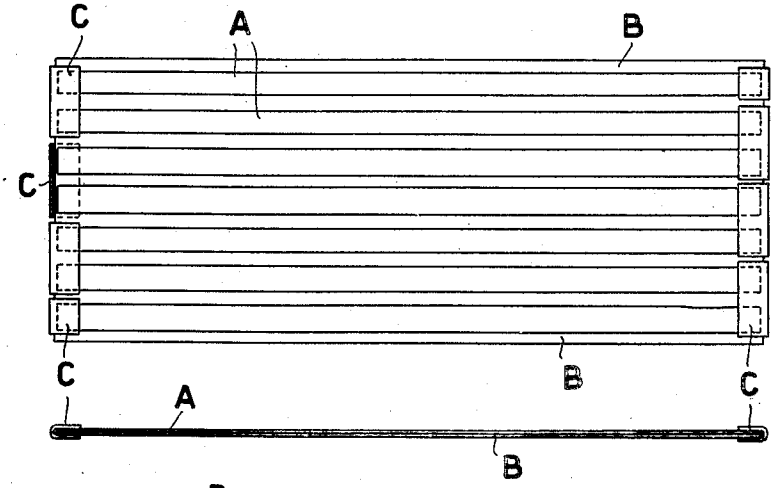


FIG.3.

FIG.4.

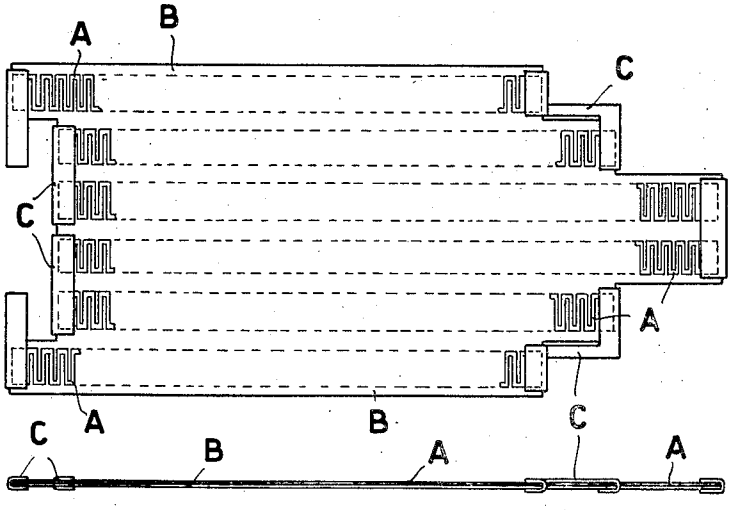


FIG.5.

FIG.6.

Witnesses:
Arthur Roche
C. Everett Lancaster.

Inventor:
Friedrich Bölling
by B. Singer Atty

# UNITED STATES PATENT OFFICE.

FRIEDRICH BÖLLING, OF FRANKFORT-ON-THE-MAIN, GERMANY.

## ELECTRIC RESISTANCE.

1,050,912. Specification of Letters Patent. Patented Jan. 21, 1913.

Application filed June 20, 1912. Serial No. 704,873.

*To all whom it may concern:*

Be it known that I, FRIEDRICH BÖLLING, a citizen of Germany, residing at Frankfort-on-the-Main, Germany, have invented new and useful Improvements in Electric Resistances, of which the following is a specification.

My invention relates to the well known type of electric resistances, especially used for heating purposes, in which a conductor formed by a metal wire or band is arranged on a sheet of insulating material capable of withstanding high temperatures. Such resistances have, however, the drawback, that the conductor at the points where it is bent or folded is very liable to burn out and that further its different portions are easily displaced, thus coming in contact and forming short circuits. In order to avoid these difficulties I employ clamps, which are clasped about the bending points of the conductor, so that they protect the latter against burning out and secure it on the insulating sheet. Such clamps may further be employed for greatly facilitating the building up of such electric resistances, which contain a metal band, especially if it is stamped out in zig-zag form.

Further improvements will be readily understood from the following specification and the accompanying drawing, in which—

Figures 1 and 2, 3 and 4, 5 and 6 show three constructional forms each in top and side view respectively.

In the first example (Figs. 1, 2) the conductor is a wire A wound around a sheet B of suitable insulating material, for instance mica. If a current flows through the wire A, it becomes hot and its strength lessens. Also the sheet B is heated and tries to stretch itself. Thus partly by the heating of the wire A, partly by the stretching of the sheet B, the bending points of the conductor are subjected to a heavy mechanical stress, so that they very easily break or tear, if they are not protected in any suitable manner. This is now done by the clamps C, which are clasped about the bending points of the wire and the edges of the insulating sheet. The clamps further prevent the single pieces of the wire A from becoming displaced. Instead of a wire, a metal band could also be employed as the conductor and wound around the sheet B.

In the second example (Figs. 3, 4) the conductor is a thin metal band A, which is cut into pieces. The clamps C not only mechanically secure these pieces on the insulating sheet B, but form also their electric connections. This construction has the further advantage, that it is not necessary to first fold a comparatively long metal band before it is secured on the insulating sheet.

If the ohmic value of resistances with a metal band as conductor is to be high, without decreasing its thickness too much, the band is usually stamped out in zig-zag form, as shown in Fig. 5. Such a band can, however, not be wound around an insulating sheet without certain precautions, as otherwise the drawbacks set out above would result. On the other hand, if such stamped out bands are arranged only on one side of an insulating sheet, great difficulties are encountered in the process of making them, viz: The length of the different pieces must be in accord with the respective purposes, and at both ends of such a piece, a certain length is to be left without stamped slots. Thus the mode of stamping such bands is very complicated, as the stamping machines, which work automatically and also automatically feed or transport the band, are to be regulated for different lengths. All these difficulties are easily overcome by again employing the clamps C (Figs. 5, 6). Now it is possible to stamp out or to slit the band for its whole length without interruptions, and to cut it afterward into pieces of the requisite length. These pieces are arranged on one or both sides of the insulating sheet B and are secured by the clamps C, which also form the electric connections between the ends of the single band pieces. The special advantage of this construction is to be easily recognized from Figs. 5, 6 which show a heating resistance for a flat iron, such as is used for ironing clothes and the like. For such a resistance there were previously employed three different lengths of a band stamped out in zig-zag form, the ends of which were, however, not slotted, while according to my invention the stamped out slots can extend over the whole length of the band.

In the first example (Figs. 1, 2) the conductor could also be arranged on one side of the insulating sheet, and in the other examples (Figs. 3–6) it could be arranged on both sides of it. In the first example the

heat developed radiates from both sides, and in the other forms only from one side of the resistance.

All the constructions shown and described are still to be provided with means for conveying the current and with an insulating cover. These elements are, however, not specified and illustrated, as they do not form parts of my invention and could be constructed in any known or special manner.

I claim:

1. In an electric heating resistance the combination of a thin insulating sheet of refractory material, a thin, flexible metal conductor arranged to form a plurality of windings extending between opposite edges of said sheet, and clamps of sheet metal clasped about the ends of each of said windings and the edges of the sheet, substantially as and for the purpose described.

2. In an electric heating resistance the combination of a thin insulating sheet of refractory material, a thin, flexible metal conductor arranged to form a plurality of windings consisting of separated pieces extending between opposite edges of said sheet, and clamps of sheet metal clasped about the ends of each of said pieces and the edges of the sheet, substantially as and for the purpose described.

3. In an electric heating resistance the combination of a thin insulating sheet of refractory material, a thin, flexible metal band stamped out in zig-zag form on its whole length arranged to form a plurality of windings consisting of separate pieces of the requisite length extending between opposite edges of said sheet, and clamps of sheet metal clasped about the ends of each of said pieces and the edges of the sheet, substantially as and for the purpose described.

In testimony whereof I affix my signature in presence of two witnesses.

FRIEDRICH BÖLLING.

Witnesses:
JEAN GRUND,
CARL GRUND.