Oct. 13, 1925. 1,556,930

H. GRAU

ELECTRICAL HEATER

Filed July 15, 1924

Fig. 1

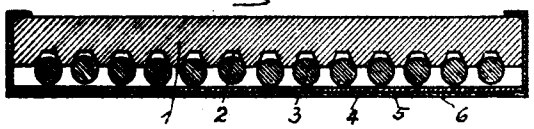


Fig. 2.

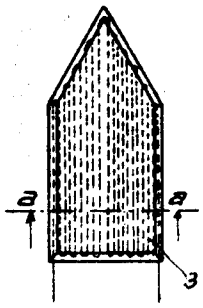


Fig. 3.

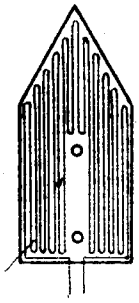


Fig. 4.

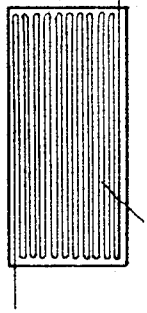


Fig. 5

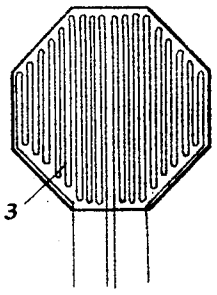


Fig. 6.

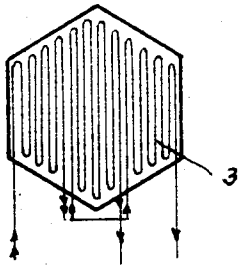


Fig. 7

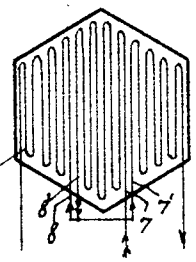


Fig. 8.

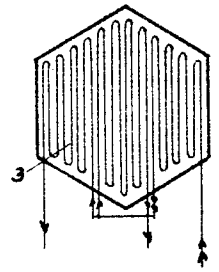


Fig. 9

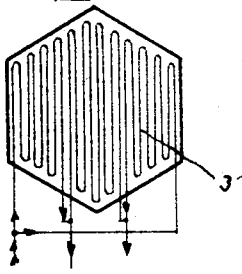


Fig. 10.

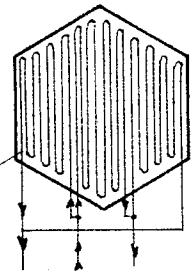


Fig. 11.

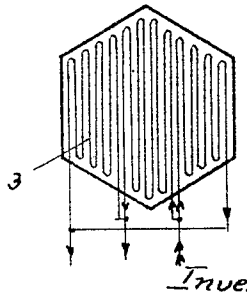
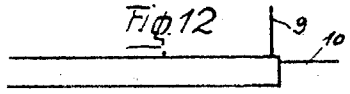


Fig. 12



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By [signature]
Attorney

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UNITED STATES PATENT OFFICE.

HANS GRAU, OF ZURICH, SWITZERLAND.

ELECTRICAL HEATER.

Application filed July 15, 1924. Serial No. 726,129.

To all whom it may concern:

Be it known that I, HANS GRAU, a citizen of Switzerland, and residing at Zurich, Switzerland, have invented certain new and useful Improvements in Electrical Heaters, of which the following is a specification.

The present invention relates to improvements in devices for electrical heaters.

The main object of my invention is to create an electrical heater of simple construction and of high efficiency. According to the invention the electrical heater possesses a non-conducting, heat-proof plate with grooves for the heating wires, whereby the grooves are disposed at a very small distance from one another, a distance limited only by the difference of the tension existing between the wires located in two adjacent grooves.

My invention will be best understood when described in connection with the accompanying drawings in which—

Fig. 1 shows a section according to line *a*—*a* of Fig. 2.

Fig. 2 shows the winding of a glossing iron.

Fig. 3 shows the same as Fig. 2, provided with screw-holes.

Fig. 4 shows a winding for electrical heaters intended for baking and roasting furnaces.

Fig. 5 shows a plate intended for the use of continuous current or one-phase-alternating current.

Figs. 6, 7 and 8 show the star delta-switch in three different phases adapted especially for electrical heaters with alternating current.

Figs. 9, 10 and 11 show a similar star delta switch like Figs. 6, 7 and 8.

Fig. 12 shows a special way of a lead-and-return line of the current.

According to Fig. 1 the electrical heater possesses a non-conducting heat-proof plate 1, provided with grooves 2, receiving the wires which form the electrical resistance. The wire 3 may be loosely located in the groove in which case it is secured by a plate. It can also be connected to the plate with gluing material. The grooves have the form of a "trapeze," and are placed in such a way as to obtain a minimum contact between plate and wire. 4 indicates a second electrically insulating plate between the wires 2 and the heating plate 5, consisting preferably of mica or the like.

In order to keep the whole together the plate 5 is flanged.

Figs. 2 and 3 show the winding for flat-irons, Fig. 4 the winding for different heating devices such as home-baking and roasting-furnaces and Fig. 5 shows a special plate for continuous or one-phase-alternating current.

The Figs. 7 and 9 show special windings for alternating current.

Figs. 6, 7 and 8 demonstrate the star delta switch in three different phases, whereby Fig. 7 indicates the most unfavorable distribution of the current.

According to Fig. 7 the greatest difference of tension exists between the wires 7, 7' calling for a very careful insulating of these wires which may be obtained by the skipping of grooves so as to create a distance between the wires according to the tension of the phase.

Between the wires 8 and 8' the same drop of tension exists as between any other wires thus allowing the placement of the three phases in one electrical heater.

The star delta switch can be disclosed in the heater itself as the condition that the three-phases—the interlinked tension—be directly introduced in it.

The disposition of the star delta switch according to Figs. 9, 10 and 11 presents no difficulty at all, since every groove can take up a wire. The star delta switch can be provided in the heater itself by introducing the three phases of the interlinked current. The heater can also be commutable when grooves are skipped and the winding is disposed in a not interlinked way. The (six) wires can be built as a step-switch, for kitchen heaters as a star delta switch, the heater producing about half of the heat when changed to a star delta switch from the cut off position. On the other hand the heater will produce the maximum when regulated in triangle. The wires can be adjusted to the heater in any way, at the sides, as shown in Fig. 2 or in the centre as shown in Fig. 3 or mixed as shown in Fig.

4, the latter way being advantageous especially for series—and parallel—connection.

What I claim is:

In an electric heater, a non-conducting body having closely arranged groove sections therein, an electrical resistance wire of larger diameter than the width of the groove, said wire having their lower arcs engaged in the groove sufficiently to space the adjacent sections of the wire and thereby leaving the major portions of the wire exposed, an insulating plate covering the wire, and a heating plate overlying the insulating plate and having marginal flanges embracing the non-conducting body and securing the several parts in position.

HANS GRAU.