G. A. HUGHES.

ELECTRICAL HEATING DEVICE.

APPLICATION FILED JULY 11, 1912.

1,068,658.

Patented July 29, 1913.

2 SHEETS—SHEET 1.

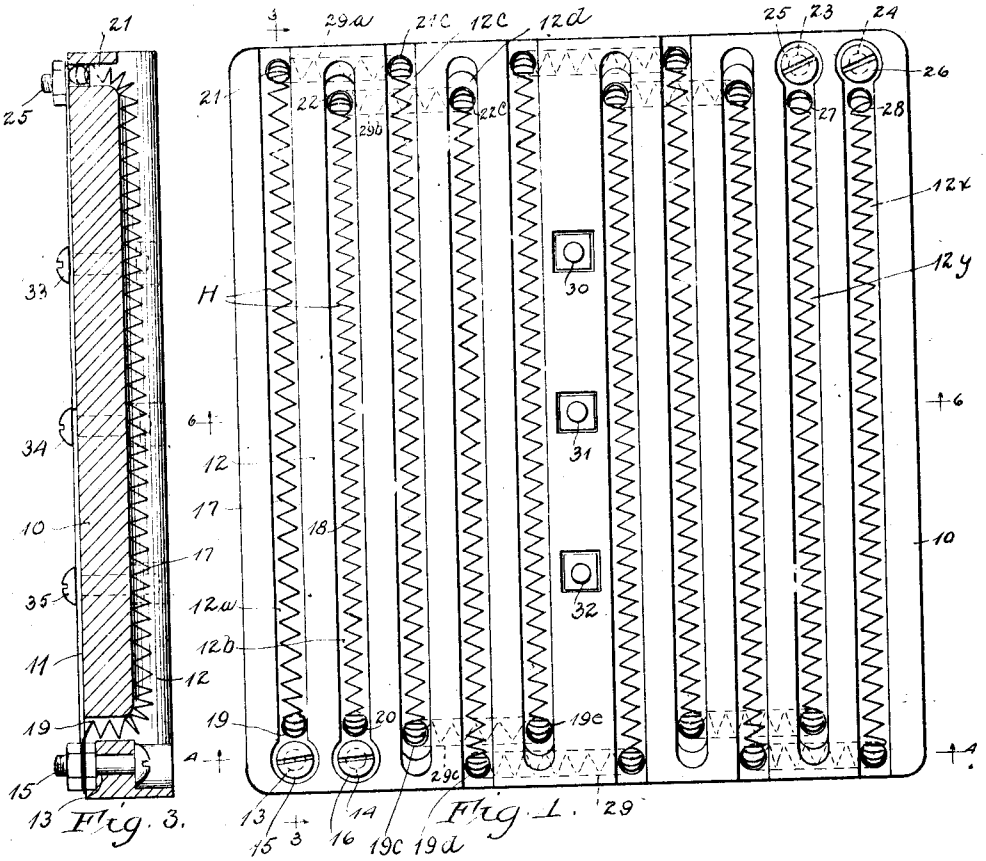


Fig. 3. Fig. 1.

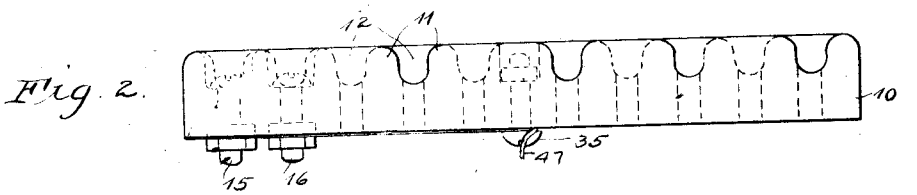


Fig. 2.

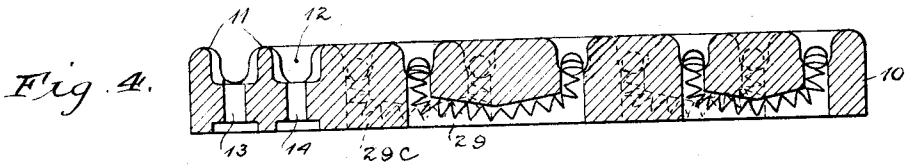


Fig. 4.

Witnesses:
C. J. Schmidt.
Carline Bullwinkel

Inventor:
George A. Hughes
By Offield, Towle, Graves & Offield
Att'ys

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2 SHEETS—SHEET 2.

Fig. 5.

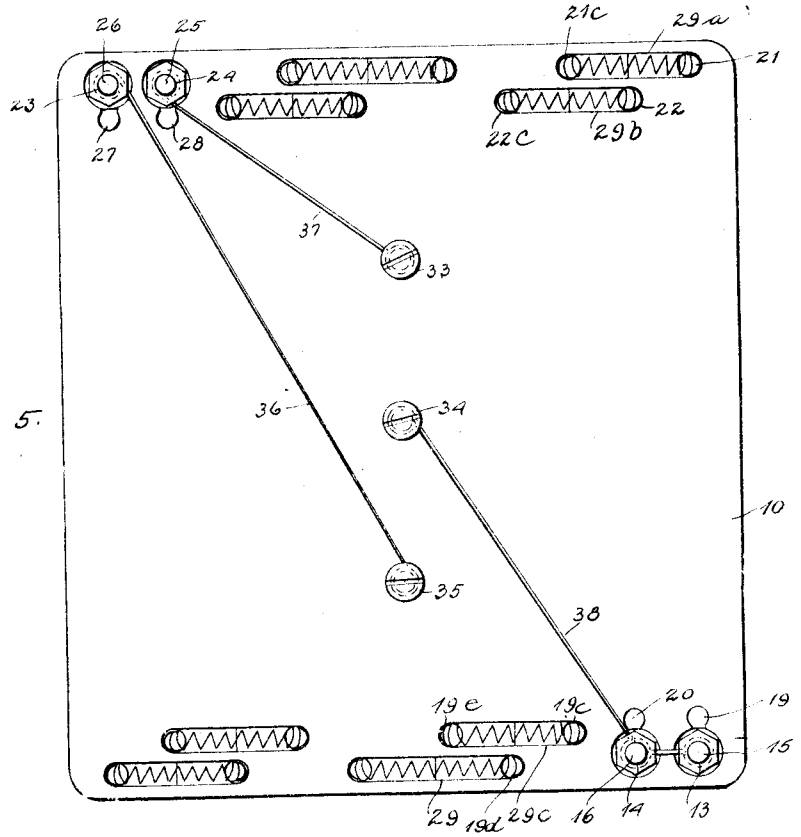
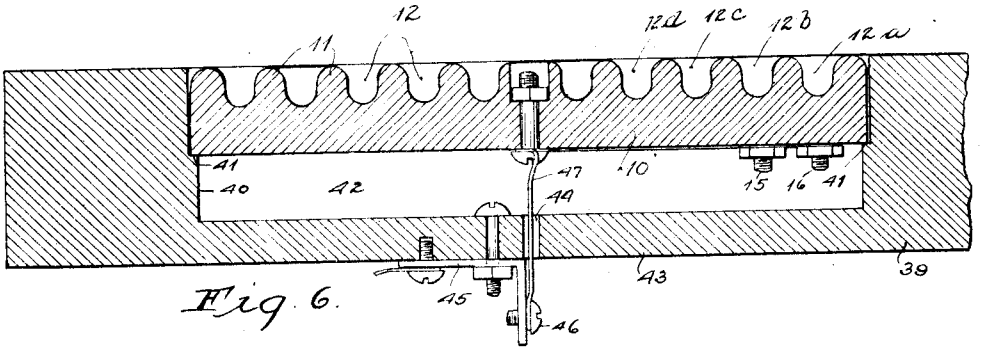


Fig. 6.



Witnesses:
C. J. Schmidt
Lurline Bullwinkel

Inventor:
George A. Hughes
By Offield, Towle, Graves & Offield
Attys.

UNITED STATES PATENT OFFICE.

GEORGE A. HUGHES, OF CHICAGO, ILLINOIS, ASSIGNOR TO HUGHES ELECTRIC HEATING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

ELECTRICAL HEATING DEVICE.

1,068,658. Specification of Letters Patent. Patented July 29, 1913.

Application filed July 11, 1912. Serial No. 708,847.

To all whom it may concern:

Be it known that I, GEORGE A. HUGHES, a resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Electrical Heating Devices, of which the following is a specification.

My invention relates to electrical heating devices and contemplates various improvements in construction and arrangement.

My invention concerns particularly heating devices in which heating units are provided with heating conductor sections adapted for connection in electrical cuits.

In the co-pending application of myself and Trevor M. Caven, Serial No. 566,298, is shown an arrangement in which a heating unit has applied thereto a plurality of lengths of heating conductors or spirals, each conductor at its end being secured by means of terminal bolts, and these bolts are connected on the back of the supporting plate and contact terminals are provided for connection with terminal sockets provided in the supporting base. In such constructions where a great number of metallic fastening and terminal members are provided considerable attention is required, as these members, owing to expansion and contraction under great temperature variations soon loosen up and cause imperfect contacts or open circuits. The manufacture of such units involving separate heating conductors and many terminal members requires considerable time and is quite expensive.

One of the important objects of my invention is therefore to provide construction and arrangement for overcoming such undesirable features and which will greatly decrease the cost of manufacture and maintenance and which will greatly increase the efficiency. Instead of having a plurality of such heating conductors, I provide a plurality of heating conductors sections by applying to a suitable plate a continuous heating conductor or spiral and I securely anchor the end of the heating sections to the plate without the use of separate bolts, screws, or other fastening or terminal means. A number of such heating conductors or spirals, preferably two, are applied so that various connections with the electrical circuit may be made to produce varying degrees of heat.

Another object of the invention is to provide terminals for the unit outside of the intense heat zone so that connections with a supply circuit can be more readily made. The unit is placed in a supporting block and main terminal conductors extend therefrom through openings in said supporting block to connect with terminals mounted at the outside of the block and well away from the heat of the unit. At the same time arrangement is made so that upon disconnection of the unit terminals from the supply circuit terminals the unit can be readily lifted from its supporting block for inspection or repairs.

The various features of my invention are clearly shown on the accompanying drawings in which—

Figure 1 is a plan view of the unit, Fig. 2 is an end view, Fig. 3 is a sectional view taken on plane 3—3 Fig. 1, Fig. 4 is a sectional view taken on plane 4—4 Fig. 1, Fig. 5 is a view of the bottom of the unit, and Fig. 6 is a sectional view taken on plan 6—6 Fig. 1 and showing in addition and in section the supporting block for the unit.

The unit comprises a plate 10 of refractory material preferably of high heat conductivity, this plate having a plurality of parallel ridges 11 extending upwardly to provide the parallel grooves 12 for receiving the heating conductor sections. The unit may be of any desired contour. The unit shown is rectangular and arranged for receiving two continuous heat producing conductors to form a multiplicity of heat conductor sections. At one corner the plate has two holes 13 and 14 for receiving terminal bolts 15 and 16 whose nuts engage at the under side of the plate to secure thereto the end of the heating conductor lengths 17 and 18. These bolts are at the ends of the end grooves 12^a and 12^b and immediately adjacent thereto bolt holes 19 and 20 are provided through which the ends of the heating conductor lengths pass for engagement with the terminal bolts at the under side of the plate. At the opposite ends of the grooves 12^a and 12^b holes 21 and 22 are provided, hole 21 being adjacent the edge of the plate and hole 22 being a

distance inward therefrom. The second set of grooves 12^c and 12^d have at their ends holes 19^c, 19^d, and 21^c, 22^c. At the opposite corner of the plate the grooves 12^x and 12^y have the holes 23 and 24 for receiving the terminal bolts 25 and 26 for receiving at the lower side of the plate the other terminals of the heating conductor lengths 17 and 18. Immediately in front of these holes are the holes 27 and 28 through which the ends of these conductors pass from the top of the plate. The first groove 12^a and alternate grooves thereafter are serially connected together at their ends by the holes at the ends of said grooves and grooves 29 in the bottom of the block. As shown, the upper end of the first groove 12^a communicates through hole 21, groove 29^a, and hole 21^c with the top of the third groove, and the lower end of this third groove communicates through hole 19^c, groove 29^c and hole 19^e with the lower end of the fifth groove, and so on, so that a continuous groove is formed for the heating conductor length 17 from its terminal 15 to the terminal 25. In like manner the ends of the second, fourth, sixth, etc., grooves on the face of the plate are connected together by cross grooves to form a substantially continuous groove for conductor 18 from its terminal 16 to terminal 26. In order that these cross grooves will not interfere, the end holes of the even number grooves are offset longitudinally from the holes of the odd number grooves, as is plainly indicated.

When a plate is formed the one set of ends of the conductor lengths 17 and 18 is inserted through holes 19 and 20 and secured at the bottom of the plate to the terminal bolts 15 and 16. The respective conductors are then laid in the first set of grooves 12^a and 12^b, then passed through the holes 21 and 22 and through the corresponding cross grooves 29^a and 29^b to the holes 21^c and 22^c, thence upwardly through these holes and in the grooves 12^c and 12^d then are again passed to the bottom of the plate through holes 19^c and 19^d and through the corresponding cross grooves and holes to the face of the plate and in the fifth and sixth grooves, and so on until the other ends of the conductor lengths are passed downwardly through holes 27 and 28 and connected with the terminal bolts 25 and 26 at the opposite corner of the plate. The conductor lengths are thus securely anchored at their bends to the plate and are entirely protected in the longitudinal grooves and cross grooves without the necessity of any additional fastening members. The conductor lengths are preferably in the form of continuous spirals of high resistance wire and after application of these lengths to the plate as just described, the various heating sections H are securely held on the face of the block in the longitudinal grooves or channels and protected by the ridges 11.

The terminal screws 15, 16 and 25, 26 may be connected directly with current supply conductors of which a preferred arrangement is as shown in Figs. 5 and 6. Along the central longitudinal line of the plate holes 30, 31 and 32 are provided for receiving terminal screws 33, 34 and 35, and on the bottom of the plate these terminal screws are connected by suitable current conductors with the heating section terminals. As shown, the conductor 36 connects terminal screw 35 with screw 26 and a conductor 37 connects terminal screw 33 with screw 25, while the conductor 38 connects terminal screw 34 with both terminal screws 15 and 16 on the heating sections.

Referring to Fig. 6 each heating plate is supported by a block 39 having a rectangular pocket 40 whose opposite walls have supporting ledges 41 for receiving the plate, the plate when applied having the upper ends of its ridges 11 substantially flush with the top surface of the supporting block and having its lower surface separated by the air space 42 from the base 43 of the block. Along the central longitudinal line of this base, holes 44 are provided to register with the terminal screws 33, 34 and 35 of the plate and adjacent each of the holes 44 a terminal bracket 45 is secured in the under side of the block, and each bracket carries a binding screw 46 for connection by a conductor 47 with the corresponding terminal screw on the plate. When the plate is applied to the block these conductors 47 pass through the holes 44 and are secured to the various terminal brackets, and upon withdrawal of binding screws 46 the plate with conductors 47 can be readily removed from the block. The terminal brackets may connect through suitable switch mechanism with the current supply conductors so that various heating combinations may be adjusted for, as for example, serial inclusion of both the heating conductor lengths 17 and 18, or parallel inclusion of such conductors in circuit, or inclusion of only one thereof in circuit. As the supporting block is of material highly non-conductive to heat the terminal brackets are protected from the intense heat adjacent the plate and are kept comparatively cool so that the circuit connections can be readily made or changed at any time, or disconnection of the plate effected.

Instead of having the plate of rectangular contour it can be of different contour. It might be circular and the heating conductor lengths applied thereto in spiral arrangement and looped through suitable holes at intervals so that the heating conductor sections will be securely held in place on the plate. Other modifications might

also be possible which will still come within the scope of the invention and I do not therefore desire to be limited to the particular construction and arrangement shown and described.

It is apparent that my invention will greatly simplify the construction and decrease the cost of manufacture while at the same time the arrangement is more efficient particularly in view of the fact that no intermediate terminals or connecting members are necessary. The resistance conductor lengths are fully protected throughout their entire lengths in the channels and notches provided therefor.

I claim the following:

1. In an electrical heating unit, the combination of a plate of refractory material, said plate having pairs of holes therethrough at intervals, and a resistance conductor arranged on the face of said plate and looping through the holes of each pair, there being grooves in the under side of said plate connecting the holes of each pair and receiving said conductor.

2. In an electrical heating unit, the combination of a plate of refractory material having parallel channels in its face and holes at the end of each channel at the back of the plate, and a continuous resistance conductor applied in said channels and looping through said holes to the back of the plate, adjacent holes being connected by grooves in the back of the plate for receiving said conductor.

3. In an electrical heating unit, the combination of a plate of insulating material, said plate having in its face a plurality of longitudinal grooves and each groove being connected at each end by a passageway with the back of the plate, transversely extending grooves in the back of said plate connecting with adjacent passageways, said channels, passageways and grooves forming the continuous pocket and a continuous heating conductor applied in said pocket.

4. In an electrical heating unit, the combination of a base of insulating material, said plate having in its face a plurality of longitudinal grooves and each groove being connected at each end by a passageway with the back of the plate, transversely extending grooves in the back of said plate connecting with adjacent passageways, said channels, passageways and grooves forming the continuous pocket and a continuous heating conductor applied in said pocket, and terminal members connected with the ends of said conductor and secured to said plate.

5. In an electrical heating device, the combination of a plate having a plurality of longitudinal channels in its face and each groove being connected at each end with the back of the plate by a passageway, a continuous heating conductor extending serially through said channels and passageways, a plurality of longitudinal channels in the face of said plate interposed between said first mentioned channels and each being connected at its ends with the back of the plate through the passageway, and continuous heating conductor extending serially through said interposed channels and the associated passageways, and terminal members for each conductor secured to said plate.

6. In an electrical heating unit, the combination of a plate of refractory material having a plurality of longitudinal channels in its face, there being holes at the ends of each channel for connecting said channel with the back of the plate, transverse grooves in the back of said plate connecting said adjacent holes and forming with said holes and channels a continuous channel, a heating conductor extending serially through said continuous channel, a plurality of longitudinal channels interposed between said first mentioned channels, each of said interposed channels having holes at its ends through said plate, transversely extending grooves in the back of said plate connecting between adjacent holes of the interposed channels, a continuous heating conductor extending serially through said interposed channels and associated holes and grooves, and terminals for each of said conductors secured to said plate.

7. In an electrical heating unit, the combination of a plate of insulating material having groups of channels in its upper face, said plate having holes therethrough and grooves in its lower face connecting the channels of each group serially together and a continuous heating conductor applied in the channels of each group and extending through the associated holes and grooves.

In witness whereof, I hereunto subscribe my name this 9th day of July, A. D., 1912.

GEORGE A. HUGHES.

Witnesses:
JOYCE M. LOTZ,
C. J. SCHAUER.