E. H. RUCKLE.

ELECTRICAL HEATING ELEMENT.

APPLICATION FILED DEC. 23, 1914.

1,165,451.

Patented Dec. 28, 1915.

2 SHEETS—SHEET 1.

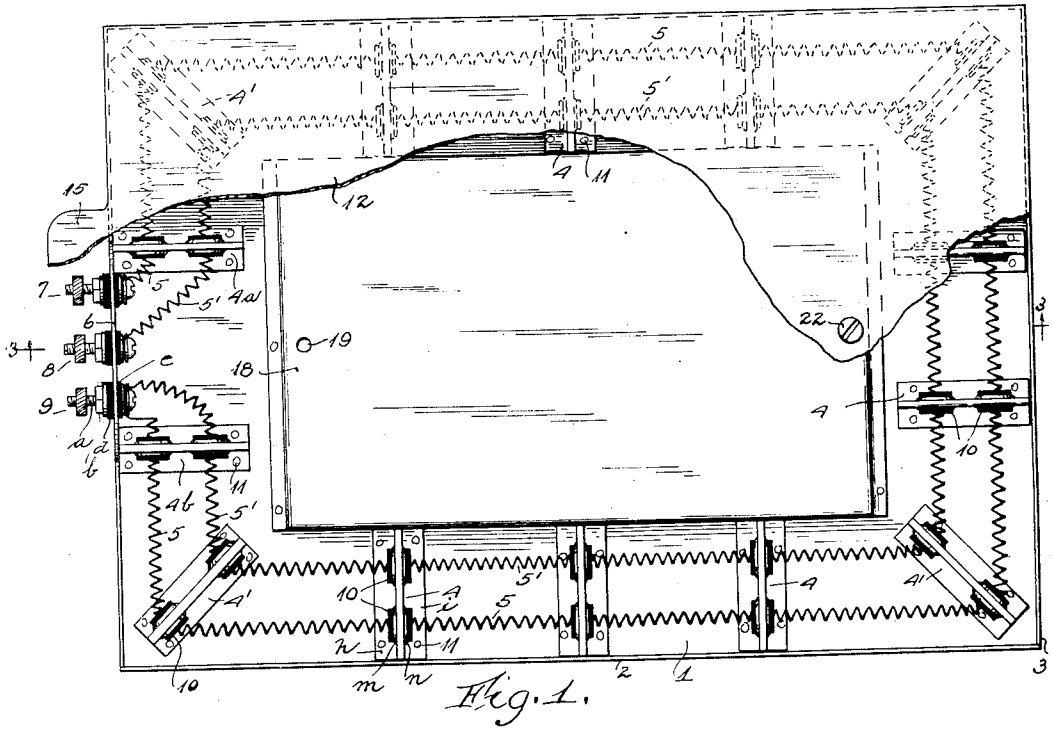


Fig. 1.

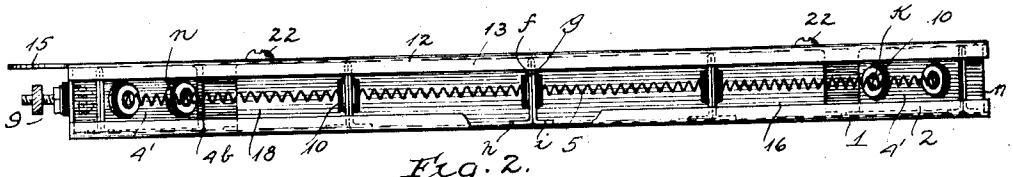


Fig. 2.

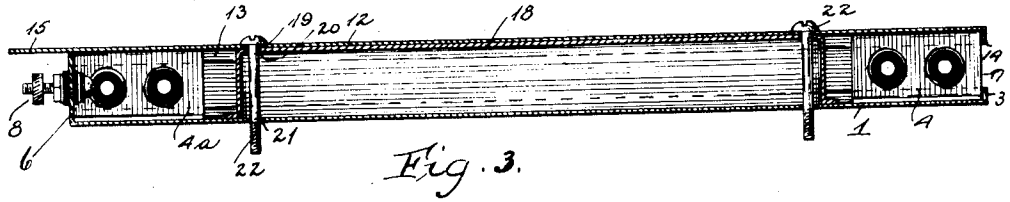


Fig. 3.

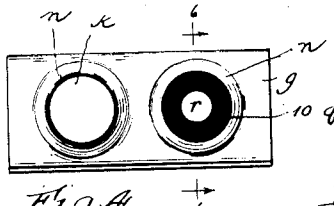


Fig. 4.

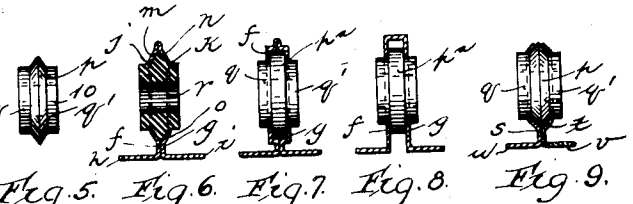


Fig. 5. Fig. 6. Fig. 7. Fig. 8. Fig. 9.

WITNESSES:

L. Bullwinkel.

C. J. Schmitt.

INVENTOR.

Edward H. Ruckle.

BY Offield, Towle, Graves & Offield

ATTORNEYS.

E. H. RUCKLE.

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2 SHEETS—SHEET 2.

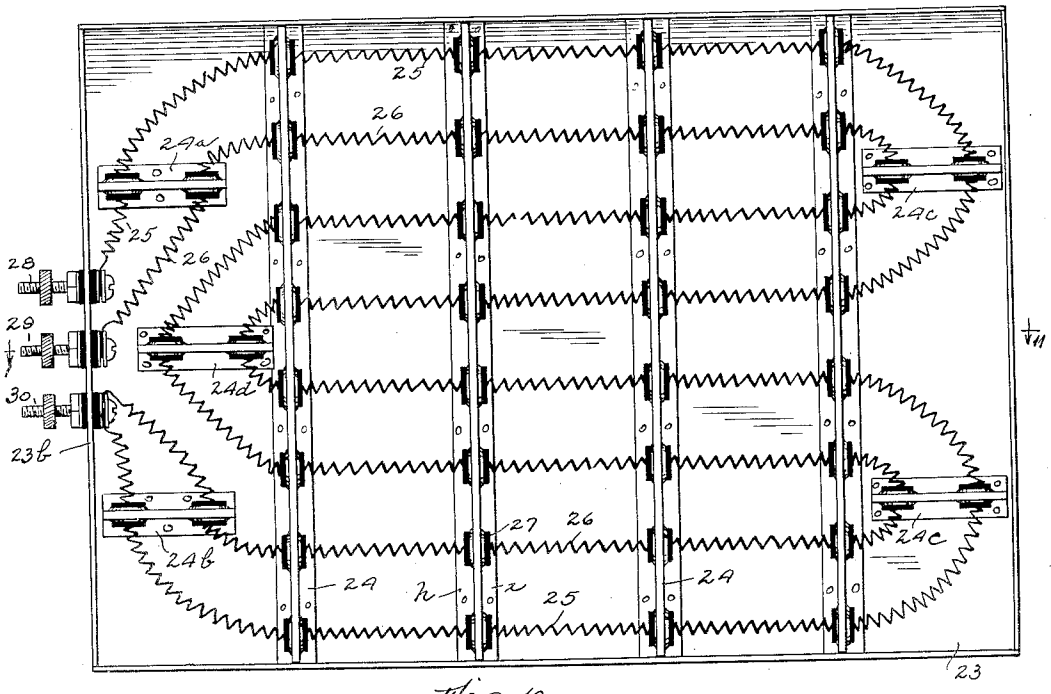


Fig. 10.

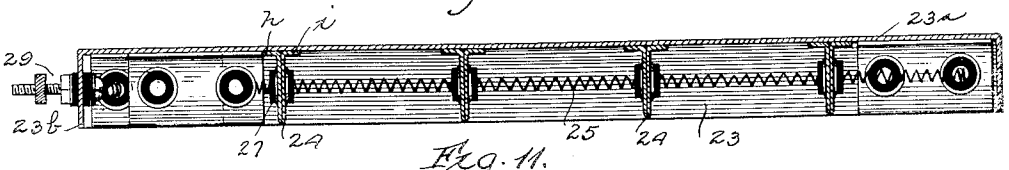


Fig. 11.

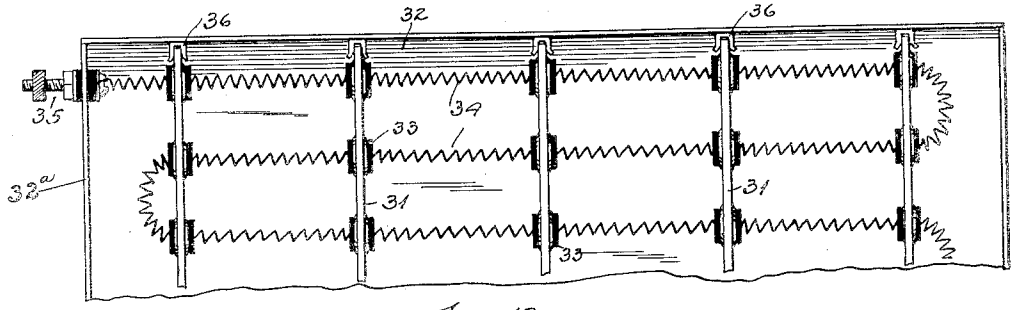


Fig. 12.



Fig. 13.



Fig. 14.

WITNESSES:

L. Bullwinkel

C. J. Schmidt.

INVENTOR.

Edward H. Ruckle

BY

Offield, Towle, Graves & Offield.

ATTORNEYS.

UNITED STATES PATENT OFFICE.

EDWARD H. RUCKLE, OF CHICAGO, ILLINOIS, ASSIGNOR TO HUGHES ELECTRIC HEATING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

ELECTRICAL HEATING ELEMENT.

1,165,451. Specification of Letters Patent. Patented Dec. 28, 1915.

Application filed December 23, 1914. Serial No. 878,656.

To all whom it may concern:

Be it known that I, EDWARD H. RUCKLE, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electrical Heating Elements, of which the following is a specification.

My invention relates to electrical heating elements and covers improved construction and arrangement which will make such devices more efficient.

The invention concerns particularly heating elements to be used in bake ovens, broiling ovens, toasters and the like. Such elements usually comprise a supporting frame on which a heating wire or coil passes back and forth to give the desired heating capacity and various means have been provided for supporting the wire and insulating sections thereof from each other.

One of the important objects of my invention is to provide improved supporting and insulating construction and arrangement for the heating wire sections. My improved supporting means are in the form of holders or frames in which pockets are provided for securely holding and retaining bushings of suitable insulating material through which the heating wire passes, the construction and arrangement being such that even though the bushings should crack or break they would still be retained within their supporting frames and insulating of the heating wire is assured.

Another object of the invention is to provide improved arrangement particularly adaptable for oven heating units, the arrangement involving improved means for preventing concentration of heat at the center of the heating element and for effecting lateral and upward flow of the generated heat to be deflected by the oven walls downwardly against the material to be baked, my improved construction eliminating the necessity of heat baffling or directing mechanism or parts.

Another object is to provide simple and efficient construction of the element as a whole and of the various wire holding and other parts thereof in order to provide a strong and efficient yet inexpensive element.

In the drawings which show various adaptations of my invention Figure 1 is a plan view of an oven heating element with part of the top thereof broken away; Fig. 2 is a side view; Fig. 3 is a sectional view on plane 3—3, Fig. 1; Fig. 4 is an enlarged side elevational view of one of the heating wire supporting structures; Fig. 5 is a side elevational view of one form of insulating bushing that may be used with the frames; Fig. 6 is a sectional view on plane 6—6, Fig. 4; Fig. 7 is a similar sectional view but showing a different form of bushing; Fig. 8 is a similar sectional view showing the same form of bushing as Fig. 7 but showing a modified form of frame; Fig. 9 is a similar sectional view as Fig. 6 but showing a different form of supporting frame structure; Fig. 10 is a view of the under side of a broiler oven heating element; Fig. 11 is a sectional view on plane 11—11, Fig. 10; Fig. 12 is a plan view of a fraction of a toaster element showing modified arrangement for supporting the heating wire supporting strips or frames; Fig. 13 is an end view of one of the wire supporting frames shown in Fig. 12; and Fig. 14 is an end view of a modified form of wire supporting frame.

Referring to Figs. 1 to 6, the oven heating element comprises a base 1 preferably formed of sheet metal with the side and end edge sections 2 and 3 bent upwardly to stiffen and strengthen the base. Extending inwardly a distance from the sides and ends of the base and secured thereto in vertical position are frames 4 for supporting the heating wire circuits of which two, 5 and 5′, are shown. The frames 4′ at the corners of the base extend diagonally as indicated, and at one end of the base a section of the sheet metal of which the base is formed is prolonged upwardly to form a wall 6 for supporting the circuit terminals 7, 8 and 9, these terminals being of any suitable construction, comprising as shown the screws *a* secured to the wall by suitable nuts *b*, the screws and the nuts being insulated from the wall by suitable insulating washers *d* and *e*.

The construction of the wire supporting members is best shown in Figs. 4, 5 and 6. The members there shown each comprise the vertical upright sections *f* and *g* which abut against each other, and the horizontal base or flange sections *h* and *i*. The

upright sections f and g have the registering openings j and k therein, the edge sections m and n of which are deflected outwardly to an angle in order to produce the annular V-shaped pocket o. The insulating bushing 10 shown in Figs. 4, 5 and 6 comprises the central section p whose annular surface is V-shaped to snugly fit in the pocket o of the supporting frame and extending in opposite directions from the central sections p are the cylindrical ends q and q', these ends being of a length to extend a distance beyond the deflected edges j and k of the support. Each frame is first stamped from sheet metal, the holes k and j with their deflected edge sections being formed during the stamping operation. Either during or after the stamping operation the flanges h and i are formed, but before bending the stamping to form the upright sections f and g the bushing or bushings are inserted into the hole or holes of one of the sections and the blank then bent along a median line and the other section thus formed brought against the first section and receiving in its holes the corresponding ends of the bushings. After completion of the frame the bushings will be securely clamped and locked in position. Each bushing has a longitudinal passageway r through which a heating wire or spiral may pass. The frames may be secured in any desired manner to the base 1. Preferably they are secured by spot welding their flanges h and i to the base as indicated at 11. In the diagonally extending corner frames 4′ the bushings are spaced farther apart than in the other frames in order that the wires passing therethrough may retain parallelism.

In the arrangement shown in Fig. 1, the wire for circuit 5 starts from terminal 7 and passes then through the outer bushing of the frame 4^a which extends inwardly from the end of the wall 6, the wire then passing adjacent the outer edge of the base through the outer bushings of the various supporting frames and passes eventually through the outer bushing of the frame 4^b extending from the other end of the wall 6, and being secured then to the terminal 9. The conductor for the circuit 5′ extends from the terminal 8 through the inner bushing of frame 4^a, then parallelly with the outer conductor 5 through the inner bushings of the supporting frames and finally through the inner bushing of frame 4^b to terminal 9. Suitable switch mechanism, (not shown) will in practice be connected with the current supply circuit leading to the terminals for effecting separate or parallel or serial connection of the heating circuits 5 and 5′ with the main circuit. The heating conductors are protected by a cover 12 which is preferably stamped from sheet metal and made rigid and strong by deflecting its side and end edge sections 13 and 14 downwardly, the cover resting on the tops of the conductor supporting frames. In order to also protect the terminals the section 15 integral with the cover projects from the end thereof to overhang the terminals.

The opposed stiffening edges of the base and cover do not meet but are short in order to leave the side and end outlets 16 and 17 for the generated heat. The element is placed in the bottom of a baking oven and the banking utensils may be set right on top of the element or on grids placed in the oven over the element, the heat issuing from the outlets 16 and 17 flowing upwardly and being deflected by the oven walls downwardly against the material to be baked. It has been found necessary, to effect efficient baking, to prevent concentration of heat at the center of the element, that is, to prevent excessive upward radiation of heat from the central part of the element to the under side of the baking utensils. In prior arrangements special baffle plates or structures were placed over the heating element to laterally deflect away such excessive heat. In my arrangement such heat concentration at the center of the element is efficiently prevented by a rectangular frame or box 18 interposed between the base and cover of the element. This frame is preferably stamped integral of sheet metal and is secured to the base by being spot welded thereto. The frame 18 is preferably the same height as the heating conductor supporting members 4 so that the cover 12 will rest intimately against the top thereof, and this frame together with the inclosed air space will then form an efficient barrier or insulator against the inward flow and concentration of heat generated by the heating conductors, and the generated heat must therefore flow laterally through the outlets 16 and 17 to be carried upwardly and be deflected against the top of the baking utensils, only sufficient heat being radiated directly upwardly from the central section of the element to effect efficient baking together with the heat deflected downwardly. In the cover 12, insulating frame 18, and base 1 are the holes 19, 20 and 21 respectively through which screws 22 may pass to thread in the oven bottom or in a suitable support provided in the oven for the element, these bolts besides securing the element in place in the oven also securing the cover in place. Other means could of course be provided for holding the cover in place on the element or for securing the element in the oven.

Figs. 7, 8 and 9 show modified heating conductor supporting structures. In Fig. 7 the bushing shown has the cylindrical central section p^a instead of the conical form

shown in Fig. 5, and the metal sections adjacent the holes for receiving the cylindrical ends of the bushing are deflected to snugly fit the cylindrical section as shown. In Fig. 8 the bushing is the same as shown in Fig. 7 but the supporting frame upright sections *f* and *g* instead of being brought entirely together are left spaced apart a distance equal to the width of the cylindrical bushing section p^a. In the arrangement of Fig. 9 the supporting frame, instead of being an integral piece of sheet metal, is formed by two separate side members *s* and *t* provided with the base flanges *u* and *v* respectively, and any type of bushing can be inserted between the plates. As shown, the arrangement with reference to the bushing is the same as in Fig. 6.

In Figs. 10 and 11 a broiler heating element is shown. The supporting frame for this element is in the form of a shallow, inverted, sheet metal container 23. Extending crosswise of this container is a suitable number of frames or bands 24 for supporting the sections of heating conductors 25 and 26. The supporting frames may be of any of the constructions shown in Figs. 1 to 9 and are secured to the top 23^a by spot welding their flanges *h* and *i* thereto, or in any other suitable manner, the vertical sections of the frames supporting bushings 27 through which the heating conductors pass. On the end wall 23^b suitable terminals 28, 29 and 30 are grouped with which the heating conductors connect. Conductors 25 and 26 connect with terminals 28 and 29 respectively and then pass back and forth in parallel relation through the bushings of the frames 24 and eventually both connect with terminal 30. To guide the conductors to the frames short longitudinally extending frames 24^a and 24^b are secured adjacent the terminals, and to keep the conductors properly spaced at the turns short transverse frames 24^c, 24^d and 24^e are provided as shown in Fig. 10. The heating element 23 is secured with its top 23^a against the top of the oven and the generated heat is deflected downwardly. By suitable switch mechanism controlling the flow of supply current the heating conductors can be connected individually or in series or parallel arrangement with the supply circuit.

In Fig. 12 a heating element is shown adapted for toasting purposes. In the construction shown a row of heating conductor supporting frames 31 are set transversely between the sides of a shallow container or frame 32, these frames supporting rows of alined bushings 33 through which a heating conductor 34 is threaded back and forth with its ends secured to suitable terminals 35 mounted on the end wall 32^a, only one of such terminals being shown. The frames 31 could be of any of the constructions shown in Figs. 1 to 11 and secured to the floor of the container by having their flanges spot welded thereto. However, it may be desirable to have these supporting bands or strips readily detachable. The structure may therefore be as shown in Fig. 13, this being substantially the same structure as shown in Figs. 4 and 6 but with the flanges omitted from the end members *f* and *g* which are brought intimately together after insertion of the bushings. These strips can then be slipped into suitable U-shaped guides 36 secured to the side walls of the container 32, these guides keeping the sections *f* and *g* of the frames together. Additional means may be provided for keeping the sections *f* and *g* together by bending the end *x* of one of the sections around the edge of the other as shown in Fig. 14.

It is evident that the heating conductor arrangement in the toaster element could be the same as that in the broiler element. In other words, the structure shown in Fig. 10 could be used in an oven for broiling or could be inverted and be used outside the oven for toasting, and the structure of Fig. 12 could be inserted into a broiling unit.

The various constructions and arrangements I have shown and described have been found to be very efficient. The sheet metal construction gives strength and rigidity. The heating conductor supporting frames or strips are particularly efficient. The bushings which may be of porcelain or any other suitable insulating material are always rigidly held in place and cannot fall out even though they should crack, efficient insulation being always thus assured. The manner of inserting the bushings in the frames during formation of the frames is unique and very efficient.

I do not of course desire to be limited to the precise constructions and arrangements herein shown, described and referred to as modifications are no doubt possible which would still come within the scope of the invention.

I claim as follows:

1. In an electrical heating element, the combination of a supporting base, heating conductors supported on said base adjacent the outer edge thereof, a top over said base separated therefrom a distance to leave lateral outlets for the heat generated by said conductors, and walls extending between said base and cover for forming a heat insulating space at the middle section of said element for preventing concentration of generated heat at said middle section.

2. In an electrical heating element, the combination of a supporting base, holder members extending inwardly a distance from the edges of said base, heating conductors passing through said holders, a top spaced from said base to leave lateral out-

let for heat generated by said conductors, and walls extending between the base and top and adjacent the inner ends of said holders to form a heat insulating air space at the central section of the element for preventing concentration of heat thereat.

In witness whereof, I hereunto subscribe my name this 21st day of December, A. D. 1914.

EDWARD H. RUCKLE.

Witnesses:
C. J. SCHMIDT,
EDMUND G. INGERSOLL.