F. BÖLLING.

APPARATUS FOR ELECTRIC HEATING DEVICES.

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917,241.

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Fig. 1,

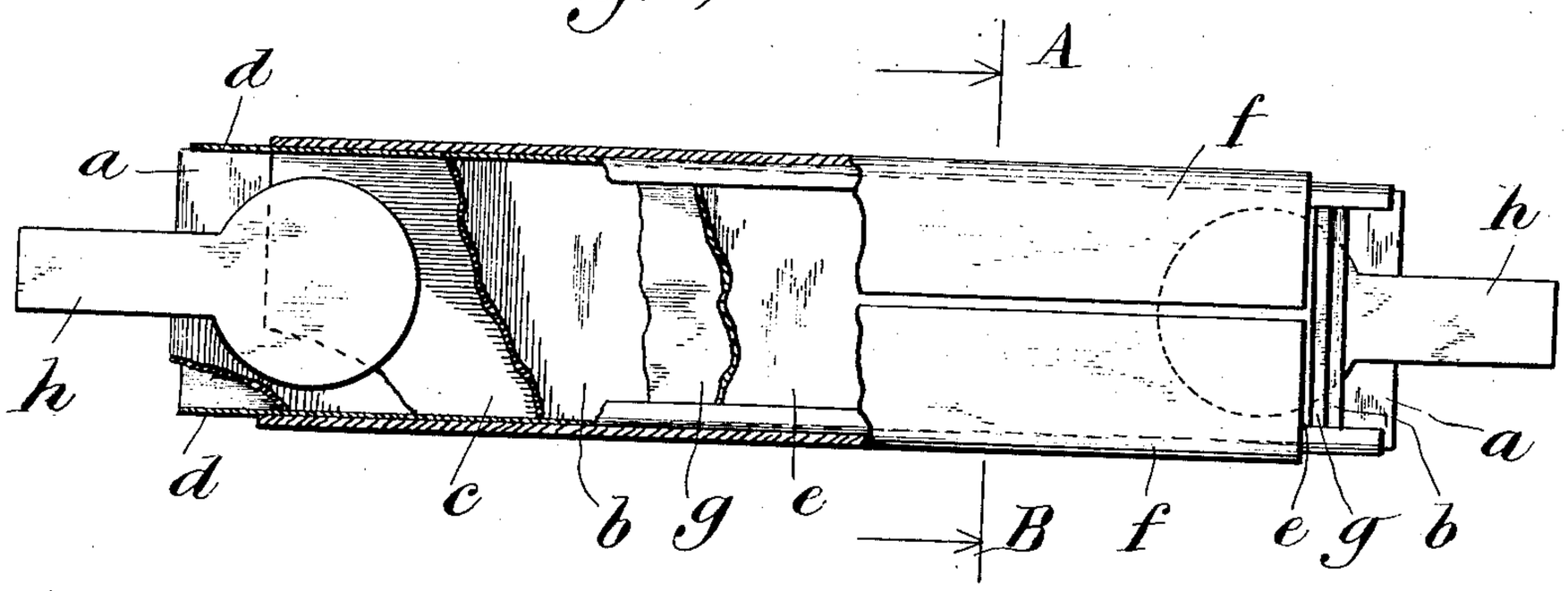
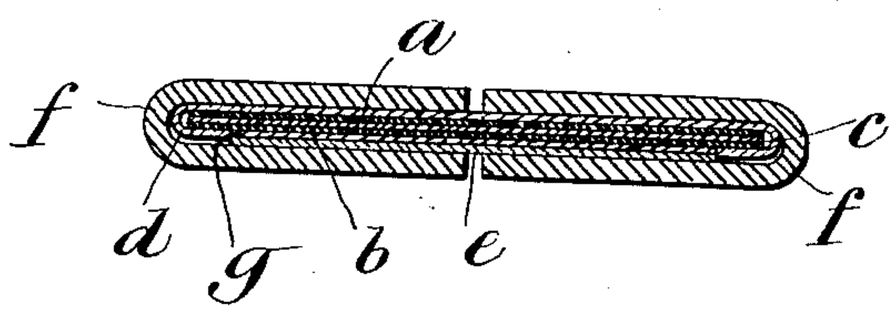


Fig. 2,



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APPARATUS FOR ELECTRIC HEATING DEVICES.

No. 917,241. Specification of Letters Patent. Patented April 6, 1909.

Application filed November 5, 1908. Serial No. 461,146.

To all whom it may concern:

Be it known that I, FRIEDRICH BÖLLING, a subject of the Emperor of Germany, residing at Frankfort-on-the-Main, Bockenheim, Germany, have invented a certain new and useful Apparatus for Electric Heating Devices, of which the following is a specification.

The present invention has reference to resistances for heating and cooking devices and other purposes, with particular reference to resistances of the general type shown in United States Patent No. 617,375 to Voight and Haeffner, wherein resistances comprising thin strips of fine metal are painted on an insulating support, and then fired.

Mica has been mostly used recently for the insulating support. These resistances are further preferably provided with a protecting mica insulating strip and are folded into sheet metal, so that the strip of fine metal cannot be damaged mechanically. For instance, two kinds of resistances are used, first; such resistances, which radiate heat freely, *e. g.* for stoves, and secondly; such resistances which are pressed upon a support capable of absorbing heat. The former can be loaded with about 1.5 to 2 watts per square centimeter, whereas with the latter a load up to 12 watts per square centimeter is admissible, provided that care is always taken that sufficient heat is consumed. The pressing of the resistances against the heat absorbing support is effected by pressure plates and screws. Between the pressure plates and the heat radiating element a layer of asbestos is interposed, to prevent the heat from being too strongly conducted to the pressure plates and to obtain a uniform distribution of the pressure against the support. The load capacity of these resistance elements further depends on the condition of the body intended to absorb the heat. If the surface is plane and made exactly true, and also the pressure plate, which must be pressed against the support by means of as many screws as possible, the load capacity is very large, in any case it is double that of other plates which are not plane and which are made of cast iron and have not been smoothly finished. Instead of using screws, the pressing can be effected by first pressing the parts of the element together with a pressure plate which presses firmly against the heat furnishing body, a layer of asbestos being interposed, after which the pressure plate is soldered to the heat furnishing body. This method is used with cooking vessels, since the temperature of the heat absorbing body does not run so high, that the pressure plate will melt off.

In using the so-called open, *i. e.* free radiating, elements, for stoves, a disadvantage lies in the fact that on account of the small load capacity comparatively many elements are required to do a certain amount of work, whereby a correspondingly larger construction becomes necessary for the stove. Moreover, in the use of elements which are pressed onto the heat absorbing support, the cost of manufacturing and selling becomes very great on account of the cumbersome, time consuming and, consequently, expensive manipulations referred to. In order to avoid said disadvantages in the use of the elements known heretofore, the present invention provides for the pressing by means avoiding the use of screws or soldering and a resistance is made, which contains in itself the pressing. The well-known heating element, after the insertion of a filler-sheet of metal into the fold of the sheet metal surrounding the resistance, is laid into two sheet metal strips, closely embracing the heating element nearly for its entire length and width and made conveniently of iron sheet metal having a thickness of 1 to 1½ mm. The element thus made up is pressed by means of a suitable press and with the use of a sufficiently high pressure of 350 to 500 kg. per square centimeter, in such a manner, that the two sheet metal strips are firmly pressed against the element inclosed within them, and are combined with it, to form a single body. By using the filler sheet metal and the sheet metal strips closely surrounding the elements, the radiating capacity of the elements is essentially increased and thereby also the load capacity of the heating body. An element pressed in such a manner, of a size of, for instance, 150x30 mm. can be loaded with 100 watts, instead of 50, without the element resting on a heat absorbing surface. Such an element can freely radiate the heat into the air. Moreover, by subjecting the element to the pressure of a press, or the like, a perfectly uniform pressing and, consequently, a smooth uniform bearing of the elements at all places is effected, whereby the giving off of the

heat of the heat resistance through the mica becomes very intensive. A further considerable advantage of the element made according to the present invention is this, that it can, without the requirement of a pressure plate, be easily and closely connected, by a few screws or by solder, with the surface to be heated. The time-consuming and expensive manipulations used heretofore in pressing the element against the heat absorbing surface become unnecessary. The cost of manufacturing, and the sales-price, of cooking and heating devices are also essentially reduced. A further reduction in cost is effected on account of the increased load capacity of the heating elements as for a heating or cooking apparatus of a certain efficiency, a considerably smaller number of elements is required than has hitherto been required. If, for instance, a freely radiating element made in accordance with the present invention, is loaded with a double load, *e. g.* with 4 watts, instead of with two, only half of the radiating surface in comparison with the old art, is required, which means a corresponding considerable decrease of the construction material which serves as a covering for the stoves, and, consequently, a considerable reduction of the manufacturing cost of stoves of the same efficiency.

In the following I have described, in connection with the accompanying drawings, one form of device illustrating my invention, the features thereof being more fully set forth hereinafter in the claims.

In the drawings Figure 1 is a plan view and Fig. 2 a section along the line A—B in Fig. 1.

The resistance, as shown, is made of a strip of metal *c*, which is painted on the mica strip *a* and then fired. On the outside, the strip *c* is covered by the mica strip *b*. The two mica strips *a* and *b* are surrounded by sheet metal *d* for nearly their entire lengths. The sheet metal *d* extends only a short distance over the sides of the strip *b* as shown in the drawings. Between the two bent over side edges of the sheet metal piece *d*, a flat piece of sheet metal *g* is inserted substantially covering the mica strip *b*, and a layer of asbestos *e* placed over the metal strip. The metal sheet *g* might be placed between resistance *c* and mica strip *b* and the asbestos strip *e* placed directly over the mica strip *b* but I prefer the arrangement of parts first described. Two U-shaped pieces of thick sheet metal *f* are placed over the said parts in such a manner that they nearly touch each other on their longitudinal edges, *i. e.* they embrace the said parts like clamps. The sheet metal pieces *f* bear, as soon as they are subjected to a pressure of about 350 kg. per square centemeter, perfectly firmly against the parts inclosed by them and form with them a single whole. With the strip of resistance *c* are electrically connected the caps or conductors *h* adapted to conduct the current to the resistance. One or the other of the two pieces of sheet metal covering *f* is, in certain cases, extended beyond the heating element, in order to transmit the heat to a still larger surface. The pieces *f* may in that case be provided with holes or the like, which permit the heating resistances to be easily screwed, or otherwise fastened, onto a surface.

Where heating elements are concerned in which, instead of a resistance of fine metal painted onto the mica, a wire or the like, is wound upon mica or a strip of asbestos, to be used as resistance, such a heating element, after having been inclosed in the above-described manner in the sheet metal covering, is pressed together and thus intimately connects the parts, so that such elements may be used in the same way as those referred to.

It is obvious that the exact arrangement of parts disclosed is not material to the invention and that parts, such as the asbestos strip or the overlaying metal strip, may be omitted without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:—

1. An apparatus for electric heating devices comprising a mica strip, a resistance layer fixed thereon, a conducting covering, a non-conductor inserted between said resistance layer and the conducting covering, and a second conducting covering composed of U-shaped pieces of like construction substantially surrounding the aforesaid parts and pressed together upon these parts so as to form the whole into a unitary structure.

2. An apparatus for electric heating devices comprising an insulated resistance strip, a heat conducting covering partially inclosing the same, a sheet metal strip resting on said insulated resistance between the edges of said heat conducting covering, and a second heat conducting covering substantially inclosing the aforesaid parts, the whole combined as a unitary structure by pressing the second heat conducting covering thereon.

3. An apparatus for electric heating devices comprising an insulated resistance strip, a heat conducting covering partially inclosing the same, a sheet metal strip adjacent to the uncovered portion of said insulated resistance, an asbestos covering on one side of said insulating strip, and a second heat conducting covering of two like U-shaped pieces substantially inclosing the aforesaid parts and pressed down upon them to form a unitary structure.

4. An apparatus for electric heating devices comprising a mica strip, a metallic

resistance fired thereon, a second mica strip protecting said resistance, a sheet metal strip substantially covering said last named mica strip, a sheet metal covering inclosing the first-named mica strip and having its edges adjacent to the edges of said sheet metal strip, an asbestos strip superimposed on said sheet metal strip, and a second sheet metal covering of like U-shaped pieces applied to these parts edgewise and substantially inclosing them and the whole combined to form a unitary structure by pressing the second covering down thereon.

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

FRIEDRICH BÖLLING.

Witnesses:
JEAN GRUND,
CARL GRUND.