April 21, 1953 C. H. SPARKLIN ET AL 2,636,106

HEATING ELEMENT

Filed Dec. 31, 1948 2 SHEETS—SHEET 1

Fig. 1.

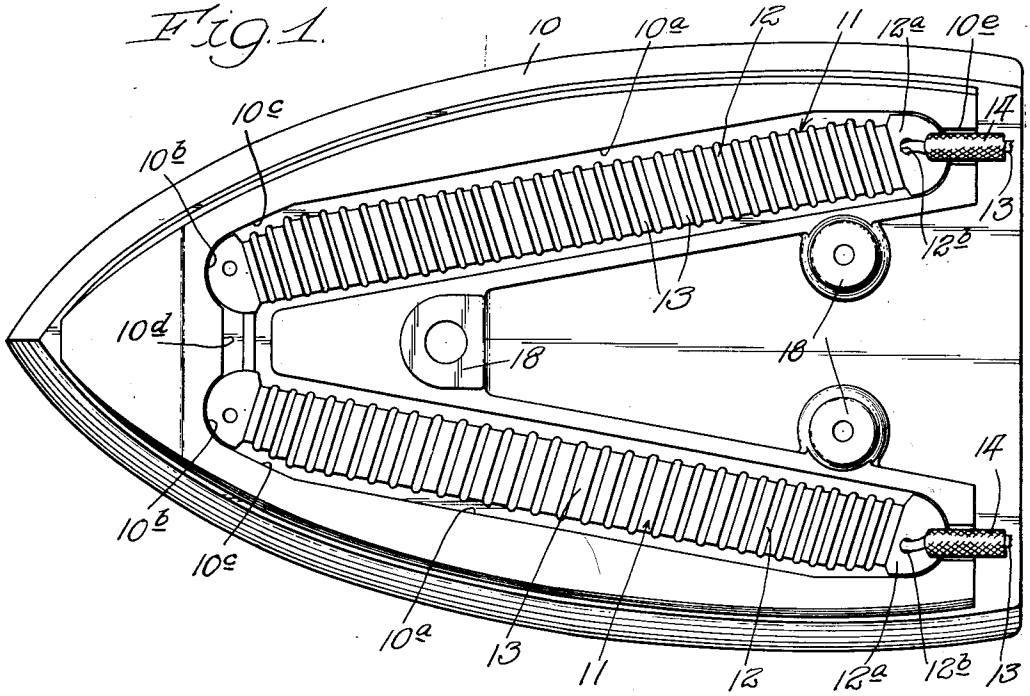
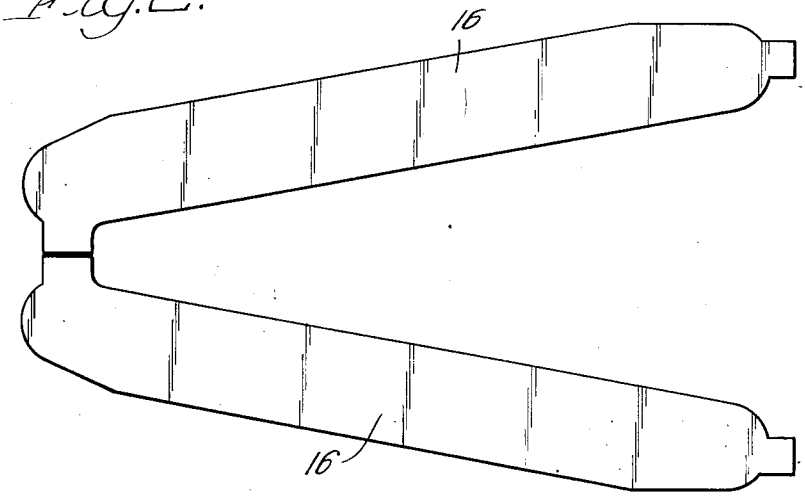


Fig. 2.



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Fig. 3.

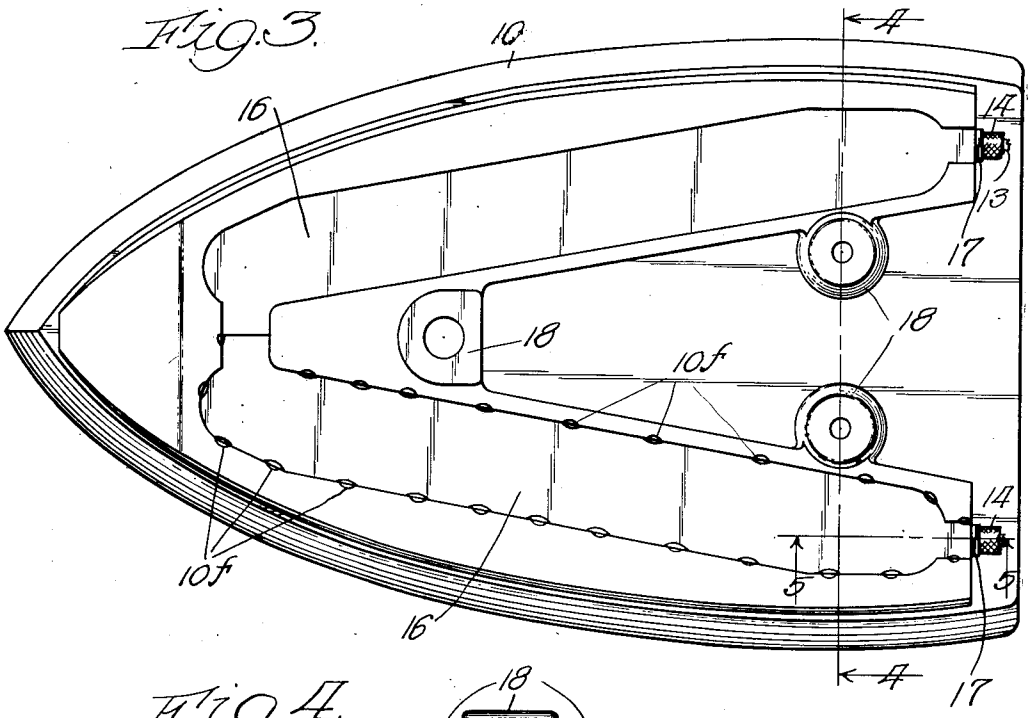


Fig. 4.

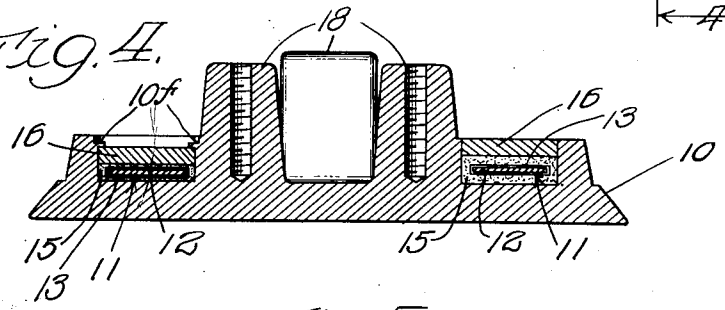


Fig. 5.

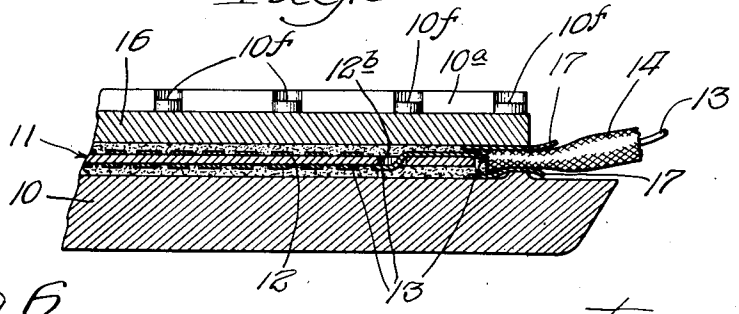
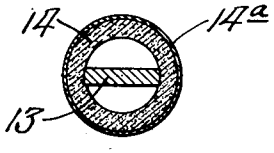


Fig. 6.



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2,636,106

UNITED STATES PATENT OFFICE

2,636,106

HEATING ELEMENT

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Application December 31, 1948, Serial No. 68,588

8 Claims. (Cl. 219—25)

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This invention relates to a heating element, and relates particularly to a heating element for electric irons.

Electric irons employ a sole plate having a heating element associated therewith. This heating element ordinarily comprises a resistance element comprising a strip of resistance metal located adjacent the sole plate and insulated therefrom. It has been discovered that the effective life of the iron is dependent upon the efficiency of the insulating material and the rigid sealing of the resistance element within the insulating material.

In the present invention there is provided an improved heating element comprising a metal plate having an elongated groove therein with this groove having a reduced and extended end. The resistance element is provided in this groove with a terminal portion thereof extending out of the reduced end. Insulating material is arranged within the groove and surrounding the resistance element and a tube comprising woven fiber glass is arranged around this end of the resistance element. A cover plate extends between the sides of the groove and contacts the insulating material, and serves to hold the tube in place. This tube of fiber glass is held tightly in position and serves to insulate the resistance element from the surrounding structure. The fiber glass tube is not only important for its insulating value, but it is also very simple to slip the tube over the end of the resistance element in the manufacturing operation. In the preferred construction there are provided thin sheets of separate insulating material, such as mica, in contact with the top and bottom surfaces of the fiber glass tube. These sheets provide additional insulating structures and are so arranged that the bottom sheet rests on the bottom of the extended end of the groove, while the top sheet is pressed down by the cover plate.

The insulating material in the groove is preferably, but not necessarily, a powdered zirconium silicate that is tightly compressed by the cover plate. This combination of insulating material, resistance element, hollow fiber glass tube and cover plate provides a rigid structure that prevents shifting of the resistance element and results in an extremely long life for the heating element.

In the preferred construction, where the heating element is used in an electric iron, there is provided an elongated groove having rounded ends thereon together with a resistance element within the groove comprising an elongated resistance metal strip, either a tape or a wire,

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wound around a solid core. This core is provided with rounded ends that are shaped to bear against the rounded ends of the groove and locate the resistance element within the groove. This core has the sides thereof between the rounded ends spaced inwardly, with the resistance metal strip being wound around this portion of the core. In a preferred construction, each end of the resistance metal strip extends beyond the core and through a hole or opening in one of the rounded ends. This construction aids in maintaining the strip tightly wound around the core.

In the usual embodiment of the invention for use in electric irons the metal plate is provided with a pair of converging elongated grooves, with a short groove connecting the converging ends of the grooves. There is provided a pair of resistance elements in the grooves with the resistance metal strip extending through the short groove. The cover plates are shaped so that a portion of each extends into and covers a part of the short groove. Each cover plate is made so that it is interchangeable for the other by merely turning it over. This is an important element of the invention as it permits stamping cover plates of a single size and shape so that any pair of these plates can be used in any of the heating elements. Each cover plate is also provided with a reduced and extended end portion adapted to be located between the sides of the reduced and extended ends of the groove and hold the hollow fiber glass tube in place. In the preferred construction the outer vertical side of each elongated groove is provided with a flattened portion at each end thereof and at an acute angle to the remainder of the vertical side to assist in the proper location of the cover plate. Each cover plate is, of course, similarly shaped.

The above features of construction of the new heating element result in an element that is relatively simple and inexpensive to build and that has an extremely long life in use. All the electrical conducting portions of the heating elements are completely insulated and the entire assembly is compact and rigid so that the element has an extremely long life.

In actual production it has been discovered that the handling of the fiber glass tubes sometimes causes the fibers to break and to become unraveled. It is, therefore, preferred that at least the outer portions of each be impregnated with a binder. This binder may be an organic or inorganic material and may be one that remains permanently in place or may be one that

burns off at the first application of heat. Excellent results have been achieved by using a starch solution for impregnating the woven fiber glass. When heating is applied, the starch of course burns off leaving only the fiber glass and a small amount of carbon. This is not detrimental as the heat is not applied until after the manufacturing is complete. Another impregnating material that has been used is any of various silicone resins. These resins being inorganic compounds are not burned off but remain on the fiber glass. The invention will be described as related to the embodiment shown in the accompanying drawings. Of the drawings:

Fig. 1 is a plan view of an electric iron sole plate with the resistance elements in place, but omitting the insulating materials and the cover plates; Fig. 2 is a plan view of a pair of cover plates used in closing the grooves in the sole plate shown in Fig. 1; Fig. 3 is a plan view of a sole plate having the cover plates applied thereto with one cover plate being staked in position and the other cover plate being merely pressed into the groove; Fig. 4 is a vertical section taken substantially along line 4—4 of Fig. 3; Fig. 5 is an enlarged fragmentary vertical section taken substantially along line 5—5 of Fig. 3; and Fig. 6 is an enlarged cross section taken through one of the fiber glass tubes and showing a resistance metal strip in place.

The heating element shown in the accompanying drawings comprises a sole plate 10 having a pair of converging elongated grooves 10*a* therein. Each end 10*b* is rounded and the outer vertical side of each groove is provided with a flattened portion 10c adjacent the end of the groove and arranged at an acute angle to the remainder of said side.

The converging ends of the groove 10*a* are connected by a short groove 10*d* while the diverging end of each groove is provided with a reduced and extended portion 10*e*.

Located within the converging grooves 10*a* are a pair of resistance elements 11 each comprising a flattened insulating core 12. Each end of each core is provided in a rounded configuration, as indicated at 12*a*, adapted to fit closely within the rounded end 10*b* of the groove. These rounded portions assist in locating the core 12. The sides of the core between the rounded ends 12*a* are spaced inwardly as shown in Fig. 1. Each core 12 is wound with an elongated resistance metal strip 13, here shown as flattened tape. A single strip is used with a portion thereof being wound around one core 12 and another portion being wound around the other core. An intermediate portion of the strip is located within the short groove 10*d*. Each outer end of the metal strip extends through a hole or opening 12*b* in the corresponding rounded end 12*a* of the core. This arrangement aids in maintaining the coils around the core. As shown in Fig. 1, each end of each core is provided with an opening 12*b* so that either end of the core may be located within the diverging end of the groove.

The end of the resistance metal strip extending beyond the core 12 is in the extended portion 10*e* of the groove and is provided with a hollow tube 14 of woven fiber glass. The end of the strip extends within the interior of the tube and this tube serves to insulate the strip from the surrounding metal structure.

In order to prevent the outer fibers of the hollow tube 14 becoming broken and separated during the manufacturing operation, it is preferred that at least the outer portion of the tube be impregnated with a binder. This binder may be either an organic or an inorganic material and may be adapted to be either permanently associated with the tube or be burned off during the first heating of the iron. This binder, which is indicated at 14*a* in Fig. 6, is ordinarily applied in the form of a solution. Excellent results have been obtained when the binder was starch applied in the form of a solution. This starch, of course, immediately burned off when the resistance strip became first heated. Another binder that has been used has been made of any of the well known silicone resins. Such a silicone resin, of course, remains permanently associated with the tube.

The resistance element 11, including that portion of the resistance metal strip located within the short groove 10*d*, is surrounded with an insulating material 15 which is preferably, but not necessarily, powdered zirconium silicate. The tops of the grooves including the short groove 10*d* and the extended and reduced end portions 10*e* are closed by means of cover plates 16. As shown in Figs. 2 and 3, each cover plate is adapted to close approximately one-half of the groove. The cover plates are so shaped that either plate may be used in either groove depending upon which surface of the cover plate is arranged as the top surface. Each cover plate is shaped similarly to a groove 10*a*, one-half of the short groove 10*b* and an extended portion 10*e*.

In assembling the irons with the resistance elements and the insulating material in place, the cover plates are arranged across the top of the grooves and a considerable pressure is applied to each cover plate. This pressure, which is preferably between 25 to 40 thousand pounds per square inch, serves to compress tightly the insulating material and produce what is in effect an integral structure. In Fig. 4, the cover plate at the left hand side of the figure has been pressed down and locked in place by displacing the small portions of metal 10*f* so that these portions extend over the sides of the cover plate. The cover plate on the right hand side of Fig. 4 has not yet been pressed down.

As shown in Fig. 5 the cover plate 16 compresses the inner portion of the hollow fiber glass tube 14 so that it assumes an oval shape. This serves to lock the tube in position. In a preferred construction additional insulating means are provided in the form of thin sheets 17 of a separate insulating material. In the preferred construction these thin sheets are mica. As shown, one sheet 17 is located on top of the tube 14, while the other sheet is located at the bottom thereof.

The cover plate 10 may be made of a cast metal such as aluminum or steel. When made from such a cast metal it is preferably provided with upstanding internally threaded posts 18 for use in attaching other portions of the completed iron to the sole plate structure.

Having described our invention as related to the embodiment shown in the accompanying drawings, it is our intention that the invention be not limited by any of the details of this description unless otherwise specified, but rather be construed broadly within its spirit and scope as set forth in the accompanying claims.

We claim:

1. A heating element comprising a metal plate having an elongated groove therein having a reduced and extended end, said groove including

the reduced end projecting through the top surface of said metal plate, a resistance element in said groove having a terminal portion extending out of said reduced end, insulating material within said groove surrounding said resistance element, a tube comprising woven fiber glass through which said terminal portion of the resistance element extends, and a cover plate engaging the sides of said groove and said insulating material and having a reduced portion engaging the sides of said reduced end for holding said tube in place.

2. The heating element of claim 1 wherein a thin sheet of a separate insulating material is provided at each of the top and bottom of said tube within said reduced end.

3. The heating element of claim 1 wherein said tube has at least the outer portion thereof impregnated with a binder to prevent separation of the fibers during the manufacture of said element.

4. A heating element comprising a metal plate having an elongated groove therein having a reduced and extended end, said groove including the reduced end projecting through the top surface of said metal plate, a resistance element in said groove having a terminal portion extending out of said reduced end, insulating material within said groove surrounding said resistance element, a tube comprising woven fiber glass through which said terminal portion of the resistance element extends, said hollow tube having at least the outer surface thereof impregnated with a binder to prevent separation of the fibers during the manufacture of said element, a thin sheet of mica at each of the top and bottom of the tube within said reduced end, and a metal cover plate engaging the sides of said groove, said insulating material and the top sheet of mica, said plate serving to compress said tube and retain it tightly in place.

5. A heating element comprising a metal plate having a pair of converging elongated grooves therein with a short groove connecting the adjacent ends of said converging grooves, the outer vertical side of each elongated groove being provided with a flattened portion at each end thereof and at an acute angle to the remainder of said vertical side, and the diverging end of each elongated groove being provided with a reduced and extended end, a pair of resistance elements in said converging grooves including an elongated resistance metal strip located in said elongated grooves and extending through said short groove, insulating material surrounding said resistance elements and said strip within the short groove, and a cover plate in each groove extending between the sides thereof and including an end portion extending into and covering a part of said short groove, each of said cover plates being interchangeable with the other and the pair of cover plates substantially completely sealing all said grooves, and each cover plate being provided with a reduced and extended end portion to cover said reduced and extended end of each elongated groove.

6. A heating element comprising a metal plate having a pair of converging elongated grooves therein with a short groove connecting the converging ends and the diverging ends each being provided with a reduced and extended end, each elongated groove having the ends thereof rounded and the outer vertical side of each groove being provided with a flattened portion at each end thereof at an acute angle to the remainder of said vertical side, a resistance element within each groove comprising an elongated resistance metal strip wound around a solid core, said core having rounded ends shaped to bear against said rounded ends of said groove and locate the resistance element within the groove and said core having the sides thereof between said rounded ends spaced inwardly, said resistance metal strip being wound around that portion of the core between said rounded ends, insulating material surrounding said resistance elements and said strip within the short groove, and a cover plate in each groove extending between the sides thereof and including an end portion extending into and covering a part of said short groove, each of said cover plates being interchangeable with the other and the pair of cover plates substantially completely sealing all said grooves, and each cover plate being provided with a reduced and extended end portion to cover said reduced and extended end of each elongated groove.

7. A heating element comprising a metal plate having an elongated groove therein having a reduced and extended end, said groove including the reduced end projecting through the top surface of said metal plate, a resistance element in said groove having a terminal portion extending out of said reduced end, insulating material within said groove surrounding said resistance element, a flexible insulating tube in said reduced end through which said terminal portion of the resistance element extends, and a cover plate engaging the sides of said groove and said insulating material and having a reduced portion engaging the sides of said reduced end for holding said tube in place.

8. A heating element comprising a metal plate having a pair of converging elongated grooves therein with a short groove connecting the adjacent ends of said converging grooves, a pair of resistance elements in said converging grooves including an elongated resistance metal strip located in said elongated grooves and extending through said short groove, insulating material surrounding said resistance elements and said strip within the short groove, and a cover plate in each groove extending between the sides thereof and including an end portion extending into and covering a part of said short groove, each of said cover plates being interchangeable with the other and the pair of cover plates substantially completely sealing all said grooves, each of said elongated grooves being provided at the diverging end thereof with a reduced and extended end portion and each of said cover plates being provided with a similarly shaped portion for location within said reduced and extended end portion.

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