March 24, 1953 A. J. HUCK ET AL 2,632,833

HEATING ELEMENT WITH INTERNAL RETURN LEAD

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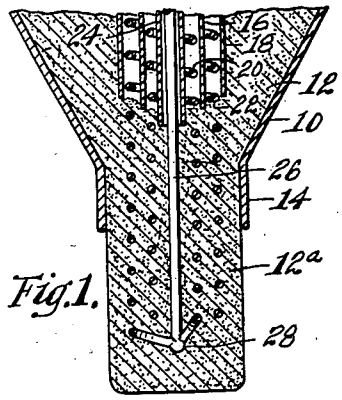


Fig. 1.

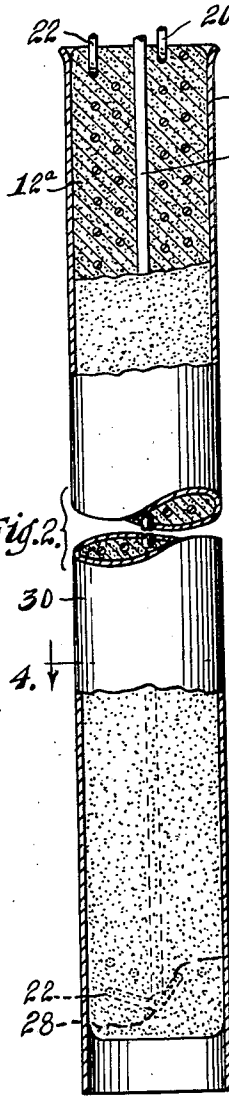


Fig. 2.

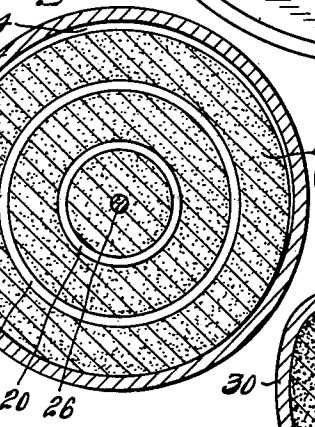


Fig. 4.

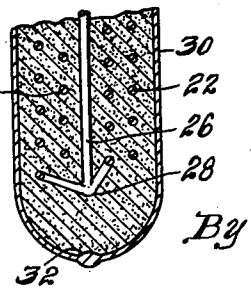


Fig. 3.

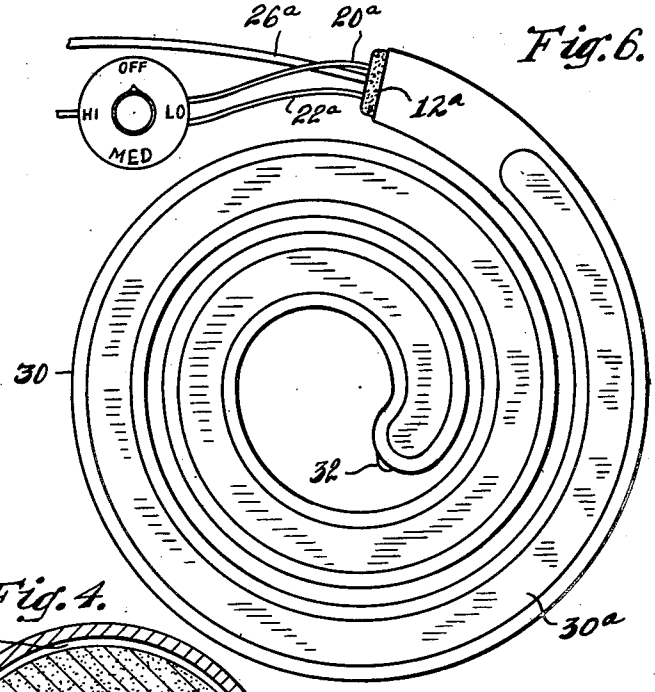


Fig. 6.

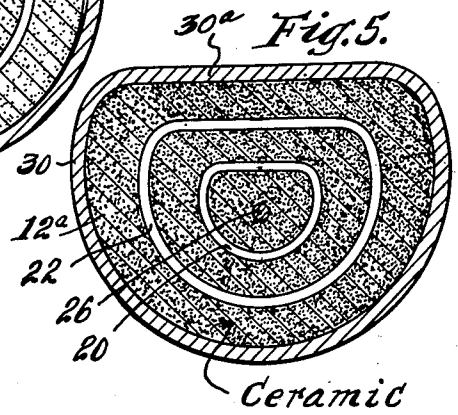


Fig. 5.

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HEATING ELEMENT WITH INTERNAL RETURN LEAD

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Application June 3, 1950, Serial No. 165,892

1 Claim. (Cl. 201—67)

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This invention relates to an extruded type of sheathed heating element of the type shown in our copending applications Serial No. 168,744, filed June 17, 1950, and Serial No. 171,712, filed July 1, 1950, the present application disclosing particularly a return lead that is arranged internally of the coil of resistance wire in the core of the heating element.

One object of the invention is to provide an arrangement in which a return lead for one or more resistance coils is concentrically located in one of the resistance coils and thus eliminates the necessity of having two ends for a sheathed heater with which electric connections must be made.

Another object is to provide a sheathed heating element with only one end for connection to the electric circuits accomplished by providing an internal return lead which eliminates the necessity of connections at the second end of the sheath which end may accordingly be welded closed.

A further object is to provide a single-end sheathed heating element which is accordingly better adapted for formation in spiral shape or any desired shape, and better adapted as an immersion type heater which type preferably has one end closed and the electric connections made only at the other end.

Still a further object is to provide a return-lead type of imbedded, extruded heating element of the sheathed type which is particularly adaptable for forming by the extrusion process in accordance with Smith Patents No. 1,951,176 of March 13, 1934, and No. 1,987,915 of January 15, 1935.

With these and other objects in view, our invention consists in the constructions, arrangement and combination of the various parts of our heating element with internal return lead whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in our claim and illustrated in the accompanying drawings, wherein:

Figure 1 is a sectional view through part of a heating element forming machine of the extrusion type shown in the Smith patents above mentioned for forming heating elements of the imbedded type wherein a coil of resistance wire is filled with and imbedded in a solid cylinder of argillous material. This figure illustrates the first step in the process of forming the heating element.

Figure 2 illustrates the second step which consists of inserting the imbedded resistance coil in a metallic sheath.

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Figure 3 illustrates a third step wherein one end of the sheath is welded closed.

Figure 4 is an enlarged sectional view on the line 4—4 of Figure 2 showing the shape of the parts after the imbedded resistance coil has been inserted in the sheath.

Figure 5 is a similar sectional view showing the parts of the heating element after the sheath has been flattened; and

Figure 6 is a plan view of one of the finished heating elements formed to a spiral shape so that it is suitable as a heating plate for electric stoves, hot plates, and the like.

On the accompanying drawing we have used the reference numeral 10 to indicate a hopper for argillous material 12 which hopper has a discharge nozzle 14. The agrillous material is under pressure so that it is extruded from the nozzle 14.

Depending within the hopper 10 is a pair of guide tubes 16 and 18 for coils of resistance wire 20 and 22 respectively. The guide tubes are concentric so as to guide the coils 20 and 22 concentrically with respect to each other and with respect to the nozzle 14. Inside the tube 16 is a third guide tube 24 for a return lead 26. It likewise is concentric with relation to the tubes 16 and 18 and the nozzle 14.

The lower ends of the coils 20 and 22 and the return lead 26 are welded together as at 28 to form an electrical connection at this point. The argillous material 12 fills the coils 20 and 22 and imbeds them and the return wire 26 in a core 12*a* of the argillous material 12 which core is formed by extrusion from the nozzle 14. The extrusion movement also serves to draw the resistance coils 20 and 22 and the return lead 26 downwardly through the tubes 16, 18 and 24.

While we have illustrated two of the coils 20 and 22, obviously a single coil such as 20 may be extruded along with the return lead 26 from a smaller nozzle 14 as shown in Figure 1 of our copending application, Serial No. 168,744, or three or more coils may be concentrically extruded along with the core 12*a* in an obvious manner. The return lead feature of our present invention is thus adaptable for single or multiple heating element construction and our claims are not to be construed as limited to only a single heating coil arrangement.

As shown below the nozzle 14 in Figure 1, the final result of the extrusion process is a solid argillous cylinder having the outer diameter of the core 12*a* and having the resistance coil or coils and the return lead completely imbedded

therein with the argillous material extending somewhat below the weld 28.

After the imbedded heating element is formed, the argillous core 12a is moist and in plastic condition as disclosed in the Smith patents, whereupon drying is permitted just long enough to permit handling and subsequent insertion of the core into a metallic sheath 30 as shown in Figure 2. The sheath is usually straight and thus permits free entry of the core, the resistance coils and the return lead, the inside diameter of the sheath being slightly greater than the outer diameter of the core 12a to permit ready assembly.

The core 12a when inserted in the sheath 30 is extended to approximately the position shown at the lower end of Figure 2. The lower end of the sheath is then welded closed as at 32 in Figure 3 with the argillous material insulating the weld 28 from the closed end of the sheath.

A cross section of the sheathed heating element is shown in Figure 4 before the core is fired or reduced to a ceramic by heating as disclosed in our application, Serial No. 171,712. Before heating or firing there is a space indicated at 34 representing the difference in diameters between the core 12a and the sheath 30. After firing this space is even greater because of shrinkage of the argillous material during the firing process.

After firing the sheathed heating element may be bent to any suitable shape such, for instance, as shown in Figure 6 in case the heating element is to be used for a hot plate or electric stove. Subsequently the sheathed heating element is flattened as to the shape shown in Figure 5 to eliminate the space at 34 in Figure 4, compact the ceramic 12a and thus render it a better conductor for the heat from the resistance coils to the sheath, all as disclosed in our copending application, Serial No. 171,712.

During the flattening process, the coils 20 and 22 are also flattened proportionally as illustrated so as to provide substantially equal spacing between them and the sheath and between the inner one and the return lead 26 without any danger of contact. By reducing the argillous material to ceramic by firing before the forming and flattening operations, we find that the above is accomplished whereas any flattening before firing would not effect deformation of the resistance coils as desired and in the proportional manner necessary.

With our internally located return lead arrangement, single-end electrical connections can be made to the sheathed heating element as through the insulator 34 in Figure 6, the extending ends of the resistance coils and the return lead being indicated at 20a, 22a and 26a respectively. It is therefore unnecessary to bring the second end of the sheathed heating element out

to a suitable point for other electrical connections, bending it to pass under some of the coils of the spiral as in our application Serial No. 171,712. This is a decided improvement and is one that is particularly adapted to an imbedded and extruded type of sheathed heating element when provided with an internal return lead as herein disclosed.

Some changes may be made in the construction and arrangements of the parts of our heating element with internal return lead without departing from the real spirit and purpose of our invention, and it is our intention to cover by our claim any modified forms of structure or use of mechanical equivalents which may be reasonably included within its scope.

We claim as our invention:

In a heating element construction of the character disclosed, a single piece tubular sheath having one end constricted and closed, inner and outer coiled resistance elements and a return lead positioned in said sheath, said return lead being concentrically located within said inner resistance coil, said inner resistance coil being concentrically located within said outer resistance coil and said outer resistance coil being concentrically located within said sheath, said coils and return lead entering the open end of said sheath, extending throughout the length thereof and terminating adjacent the closed end thereof, said return lead at its inner end only being electrically connected with both of the inner ends of said coils adjacent said closed end of said sheath but spaced therefrom and each at the other end extending from the open end of said sheath opposite said closed end thereof for circuit connections, and fired ceramic insulating material filling both of said coils and surrounding said return lead to span the distance between it and the inner coil and the distance between the inner coil and the outer coil, and surrounding said outer coil to span the distance between it and said sheath, said fired ceramic insulating material substantially equally spacing physically and electrically said outer coil from the walls of said sheath, said coils from each other and said inner coil from said return lead.

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The following references are of record in the file of this patent:

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