

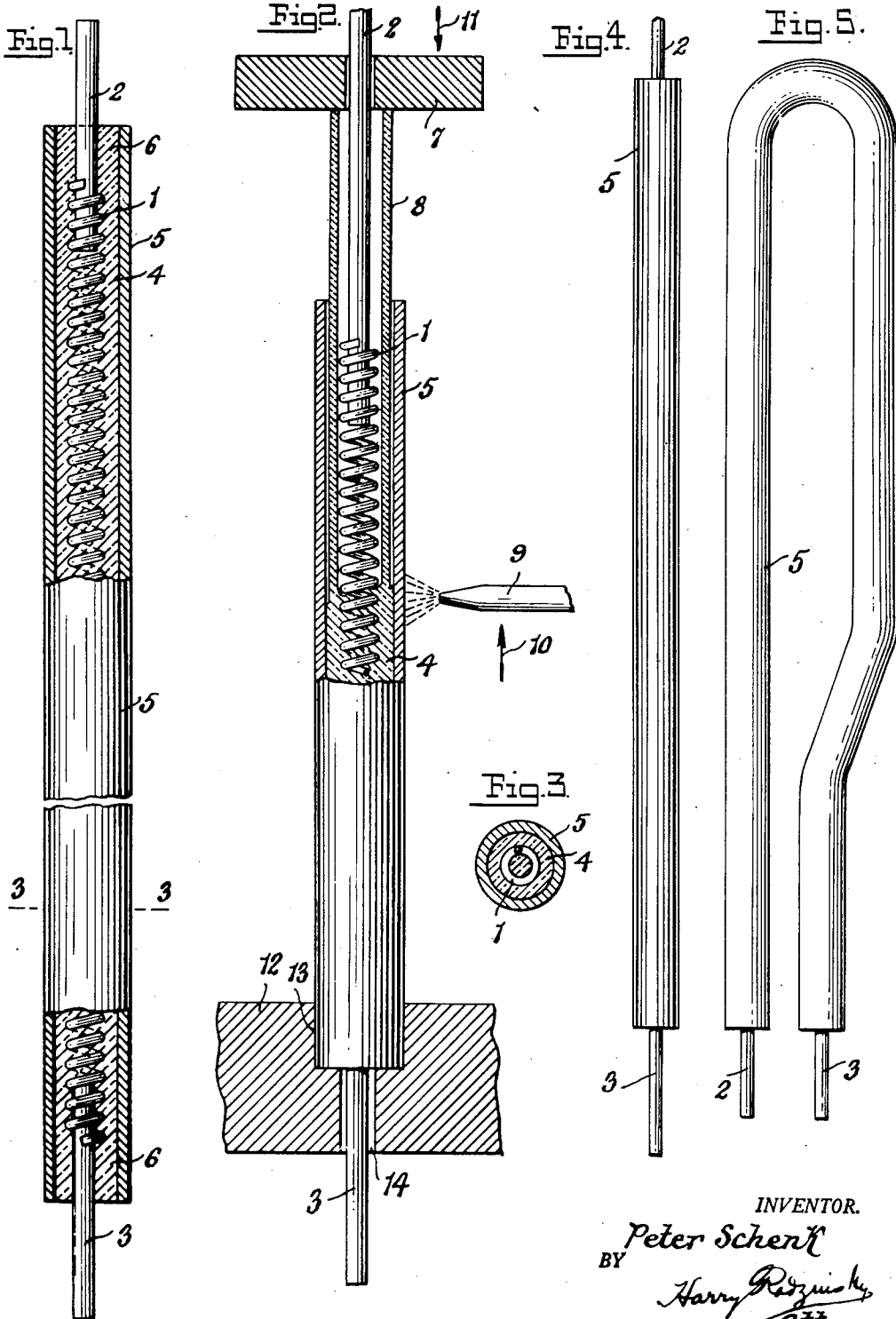
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ELECTRICAL HEATING ELEMENT

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ELECTRICAL HEATING ELEMENT

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This invention relates to electrical heating elements, and particularly to those of rod-like formation, in which a heating filament is enclosed within an outer metallic sleeve and with an interposed insulating and heat conducting material located between the outer sleeve and the filament.

It is an object of the invention to provide an article of this character in which a maximum of protection for the heating filament is provided; in which the filament is so enclosed and protected that contact with air and with resultant oxidation will be prevented and as a result the life of the heating element materially increased.

It is another object of the invention to provide an improved method by which heating elements can be manufactured easily and inexpensively; it is an object of the invention to provide a heating element which can be made in various sizes and shapes to suit different requirements, and one which will stand high temperatures for long periods of use.

More particularly, the invention contemplates the provision of a heating element consisting of a filament surrounded by and spaced from a metallic sleeve, with the space between the sleeve and the filament completely filled with glass, the glass closely surrounding the filament and maintaining it centrally in the sleeve and out of contact with the walls of the sleeve. The invention further contemplates the provision of a method of making such a heating element wherein the filament is surrounded by a glass tube and the glass tube is enclosed in the outer metallic sleeve, and heating means travelling the length of the sleeve applies heat to the glass tube to render the same molten while longitudinal pressure is applied to the glass tube so that as the same is melted by the heat it fills the entire interior of the sleeve and closely surrounds the filament and holds it centrally of the sleeve and free from contact with the inner wall surfaces thereof.

With these and other objects to be hereinafter set forth, in view, I have devised the particular arrangement of parts to be described and more specifically pointed out in the claims appended hereto.

In the accompanying drawing, wherein an illustrative embodiment of the invention is disclosed,

Fig. 1 is an elevational view, with parts broken away and other parts in section, of an electrical heating element made according to the invention;

Fig. 2 is a view showing the manner in which the heating element is made;

Fig. 3 is a sectional view taken on the line 3-3 of Fig. 1;

Fig. 4 is a view of one of the heating elements of straight formation; and

Fig. 5 shows a heating element in the form of a loop.

Referring to the drawing, 1 indicates the filament of the heating element, which filament may

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be of Nichrome wire or other suitable material. In the form shown, the filament 1 is spiral or helical and at each of its ends it is attached to the terminals indicated respectively at 2 and 3. These terminals may be metallic rods or wires and may be welded or otherwise securely attached to the opposite ends of the filament coil 1, or may be frictionally held within the spirals of the coil by a tight fit therein.

The outside casing or covering of the heating element consists of a metallic sleeve or tube 5 which has an inside diameter considerably larger than the diameter of the filament coil 1 so that when the filament is inserted within the tube or sleeve 5, an annular space is provided within the tube 5 between the inner wall surface of the said tube and the filament coil 1. This space is filled with glass 6, or other suitable insulating material capable of withstanding heat and becoming plastic under high temperature. This filling 6 is such as to completely fill the interior of the metal tube or sleeve 5 and to extend between the convolutions of the filament coil and thus completely encase the coil as well as surround the inner ends of the terminals 2 and 3.

The method by which the improved heating element is made is clearly shown in Fig. 2. A support or base is shown at 12 and the same is provided with a recess or seat 13 in which one end of the metal tube or sleeve 5 is seated. A glass tube 8 is inserted concentrically within the metal tube 5 and said glass tube has one end resting upon the seat 13. Inserted within the glass tube 8 is the filament 1 having the attached end terminals 2 and 3 which protrude out of the opposite ends of the concentric sleeves 5 and 8, the lower terminal, or that indicated at 3, extending down through the seat 13 and out of the bore 14 leading therefrom.

A weight or other pressure imposing element 7 is placed against the exposed end of the glass tube 8 and the weight 7 exerts pressure downward, or in the direction of the arrow indicated at 11. While such pressure is being exerted against one end of the glass tube 8, a heating device, such as one or more jets projecting gas flames, is directed against the outer tube 5, beginning at the lower end of the same, and is slowly moved upwardly, in the direction of the arrow 10. The heat from the burner 9 will melt the glass tube, causing it to become plastic or molten and completely fill the interior of the metal tube 5 and flow around the filament 1 and enter between the convolutions thereof and thus completely encase the filament and hold it centrally within and spaced from the outer tube 5. The pressure exerted by the weight or pressure means 7, longitudinally of the glass tube 8, while the heat source 9 travels in an opposite direction, causes the glass or filling material 6 to be compacted in the tube 5 and thus caused to fill all

of the space within the tube 5 and completely surround and encase the filament 1.

When the heating element is used, it will be apparent that the glass filling will become plastic or softened by the heat of the filament 1, but the filling material 4 will not become sufficiently molten to flow out of the ends of the tube 5, for the reason that the filament terminates short of the ends of the tube 5 and thus the end portions of the glass filling, indicated at 6, 6 in Fig. 1, do not become hot enough to flow out or permit the passage of the hotter central portion of the glass filling 4. Of course, closure caps might be provided at the opposite ends of the sleeve or tube 5 to hold the glass filling in place should such end-closure means be found desirable.

The resultant heating element, made according to the method above described, can be made in various shapes and forms, the same being shown in the form of a straight rod in Fig. 4 and in loop shape in Fig. 5. The element may be readily bent in various forms, and while the glass filling might break or shatter when the element is so bent, the broken portions will merge together when the element is heated and glass becomes molten or plastic under the heat. Since the glass filling 4 completely surrounds and encases the filament at all times, air cannot reach the filament and thus oxidation is prevented.

One of the difficulties encountered in making heating elements in which a filament is contained within an outer metallic shell and a powdered material is deposited within the shell and about the filament, is the maintenance of the filament centrally and away from the side wall of the outer metallic shell during the filling operation. Such a difficulty is completely obviated with the present structure since the glass tube 8, inserted within the metallic shell 5 and surrounding the filament 1, will hold the filament centrally during the manufacture of the element by the method described.

In describing the method of making the heating element, I have suggested that it be done while the tubes 5 and 8 are maintained vertically, but it will be apparent that this method may be carried out with the tubes arranged horizontally or in other positions. In addition to supporting the tubes 5 and 8 at one end on the seat 13, these tubes may be supported along their length as required, during the application of the heat by the burner 9, and during the simultaneous application of the pressure at one end of the glass tube 8. Also while I have herein shown the filament as being of helical or spiral form, it will be apparent that the same may be straight or otherwise shaped to suit various requirements.

Having described one embodiment of the invention, it is obvious that the same is not to be restricted thereto, but is broad enough to cover all structures coming within the scope of the annexed claims.

What I claim is:

1. The method of making a heating element comprising, the steps of surrounding a filament with a glass tube, encasing the glass tube within a metal tube, applying travelling heat longitudinally along the metal tube to heat the same and thereby melt the glass tube within said metal tube, and applying longitudinal pressure to the glass tube during application of the heat so that

as the glass tube melts the entire interior of the metal tube is filled with molten glass encasing the filament.

2. The method of making a heating element comprising, surrounding a filament with a glass tube, surrounding said glass tube with a metal tube, progressively heating the glass tube to melt the same inside of the metal tube and cause the same to flow around the filament and fill the space between the filament and the interior of the metal tube and applying pressure longitudinally of the glass tube during the application of the heat.

3. The method of making a heating element comprising placing a glass tube within a metal tube and around a filament located within the metal tube to thereby position the glass tube between said filament and metal tube, and heating the glass tube while applying pressure to the same to cause it to flow about the filament and completely fill the space between the filament and the interior of the metal tube.

4. The method of making a heating element comprising, placing a glass tube within a metal tube and around a filament located within the metal tube to thereby position the glass tube between the filament and the metal tube, heating the glass by heating means travelling the length of the tube to thereby render the glass tube molten and cause it to completely fill the space between the filament and the interior wall surfaces of the metal tube, and applying pressure in a direction axially of the glass tube during the application of the heat.

5. The method of making a heating element comprising, surrounding a spiral filament with a glass tube, surrounding said glass tube with a metal tube, progressively heating the glass tube by travelling heating means moving from one end of the glass tube to its other end to thereby melt the glass tube inside of the metal tube and cause the molten glass to flow around the filament and fill the space between the filament and the interior of the metal tube, and applying pressure on the tube in a direction opposite to the direction of movement of the travelling heating means while the glass tube is being heated thereby.

6. The method of making a heating element comprising surrounding a filament with a glass tube, surrounding the glass tube with a metal tube, applying pressure on one end of the glass tube while applying heat against the glass tube with the source of heat movable in a direction opposite to the direction of imposed pressure on the glass tube.

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