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MANUFACTURE OF ELECTRIC HEATERS

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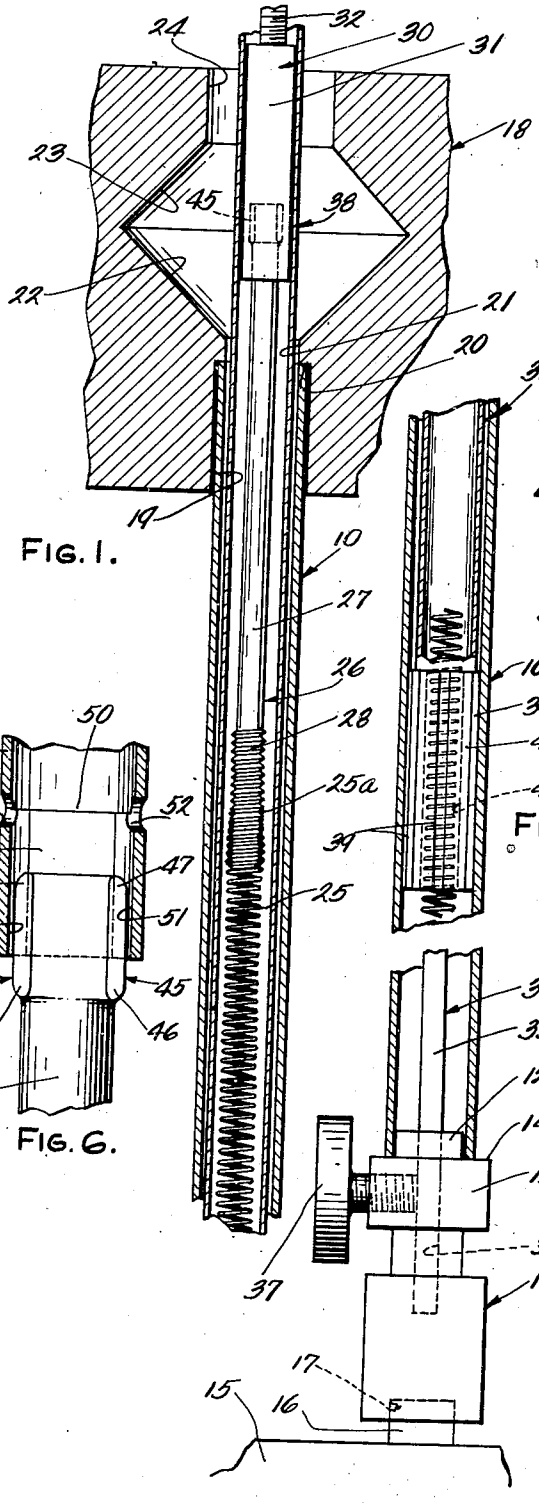


FIG. 1.

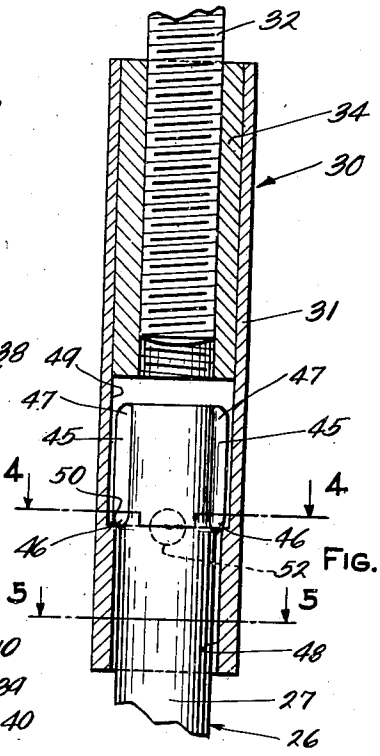


FIG. 3.

FIG. 6.

FIG. 2.

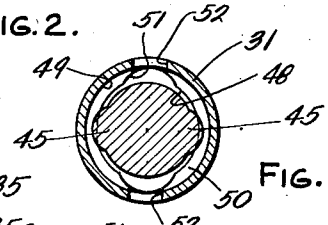


FIG. 4.

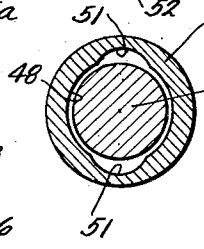


FIG. 5.

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MANUFACTURE OF ELECTRIC HEATERS

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14 Claims. (Cl. 201—67)

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This invention relates to the manufacture of electric heaters, and more particularly to the manufacture of electric heating elements comprising a resistor disposed within and insulated from a tubular metallic sheath. The principal object of the invention is the provision of new and improved apparatus for use in making electric heaters, and more particularly the provision of new and improved apparatus and new and improved resistor terminals used in introducing comminuted insulating material endwise into a tubular sheath to embed a resistor disposed in said sheath.

In the drawing accompanying this specification, and forming a part of this application, there is shown, for purposes of illustration, one form which the invention may assume, and in this drawing:

Figure 1 is a vertical sectional broken view of an uppermost portion of apparatus embodying the invention,

Figure 2 is a vertical sectional broken view of a lowermost portion of the apparatus of Figure 1,

Figure 3 is a vertical sectional fragmentary view, on an enlarged scale, of a positioning means and resistor terminal means forming part of the embodiment shown in Figure 1,

Figure 4 is a section taken on the line 4—4 of Figure 3,

Figure 5 is a section taken on the line 5—5 of Figure 3, and

Figure 6 is a fragmentary view showing the positioning means and terminal means partly assembled (or disassembled), the positioning means, but not the terminal means, being turned 90° from the position shown in Figure 3.

Referring to Figures 1 and 2, a tubular metallic sheath 10 has its lower end supported and positioned in any suitable way, in this instance by a support member 11 having a cylindrical upper end portion providing a plug 12 insertable in the lower end of the sheath. The support member 11 has an enlarged portion 13 providing a shoulder 14 against which the end of the sheath 10 abuts when the plug 12 is in the end of the sheath. The support member 11 may itself be supported and positioned in any suitable way, in this instance by a base 15 having an upstanding stud 16 fitting in a recess 17 in the support member 11.

The upper end of the sheath 10 is held and positioned by a funnel member 18 having a bore 19 in which the end of the sheath may be slidably inserted against a shoulder 20 terminating the bore 19. Communicating with the bore 19 and

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concentric therewith is a smaller bore 21 having the same diameter as the inside of the sheath 10, so that the smaller bore 21 forms an upward continuation of the inside surface of the sheath. The smaller bore 21 communicates with a downwardly tapering conical recess 22 in the funnel member 18, this recess being here shown as joining an inverted conical recess 23 communicating with a cylindrical opening 24.

A resistor 25, here shown as of helical form, is disposed in the sheath 10. The upper end portion 25a of the resistor 25 has a terminal 26 fastened thereto. The terminal 26 is made of a relatively stiff wire or rod, desirably of circular cross-section and, in this instance, comprises a shank 27 provided at its lower end with threads 28, so that the lower end may be screwed into the end portion 25a of the helical resistor 25. The end portion 25a of the resistor may be brazed or otherwise fastened to the threaded end of the terminal 26.

The upper end of the terminal 26 is connectable to and disconnectable from a positioning means 30 merely by relative movement of the terminal and the positioning means, as will fully appear. In the position of the parts shown in Figures 1 and 3 the upper terminal 26 is connected to the positioning means 30.

The positioning means 30 comprises a sleeve 31 carried by a rod 32 which may be supported in any desired vertically adjusted position, in any suitable way. As shown in Figure 3, the sleeve 31 is conveniently carried by the rod 32 by drive-fitting an internally threaded bushing 34 into the upper end of the sleeve 31, and providing the rod with threads cooperating with the internal threads in the bushing 34.

The lower end of the resistor 25 (broken away in Figure 2) is provided with a terminal 35, having a threaded end fastened to the lower end portion of the resistor in the same manner as set forth in connection with the upper terminal 26. The shank 35a of the terminal 35 is of the same cross-section throughout, circular in this instance. The lower end of the terminal 35 is insertable in a hole 36 in the support 11, and may be held in the hole by a set screw 37 extending through the portion 13. The hole 36 is desirably of such depth that the terminal 35 projects a desired distance beyond the lower end of the sheath 10.

Disposed about the sleeve 31 and freely slidable thereon is a tube 38 of such length that when filling of the sheath 10 with comminuted insulating material is started, the lower end of the

tube 38 is long enough to reach the plug 12 while the upper end of the tube is a desired amount above the level of the opening 24. The diameter of the sleeve 31 and the outside diameter of the tube 38 are such that the outer surface of the tube 38 is spaced a desired distance from the inside of the sheath 10, the sleeve 31 positioning the upper end of the tube 38 concentric with the sheath 10. The lower end of the tube 38 is positioned concentric with the sheath 10 by a plurality of circumferentially spaced, longitudinally extending ribs or splines 39 which may be provided on the lower end of the tube 38. In this instance the splines are on a thickened portion 40 of the tube 38, the portion 40 having a bore 41, within which the helical resistor 25 is disposed, and of such diameter that the inside surface of the bore 41 is freely movable longitudinally with respect to the resistor. The splines 39 slidably engage the inside wall of the sheath 10.

Referring now more particularly to Figures 3 through 6. The terminal 26 is provided with circumferentially spaced lateral projections 45, in this instance two, 180° apart. The projections 45 may be in the nature of splines, extending longitudinally a desired distance and in this instance they extend from a place near the upper end of the terminal 26 to the upper end of the terminal. The outermost surface of each lateral projection 45 desirably has longitudinally tapering portions 46 (see also Figure 4), tapering inwardly to a junction with the surface of the shank 27. The upper ends of the lateral projections 45 desirably also have inwardly tapering portions 47. As here shown, the lateral projections 45 are of arcuate cross-section, as seen in Figure 4. The lateral projections 45 may be formed by side-pressing the initially circular cross-section shank 27, or the projections may be provided in any other suitable way.

The sleeve 31 is constructed and arranged to cooperate with the terminal 26, as follows. The sleeve 31 has an open cylindrical bore 48 at its lower end, of sufficiently large diameter to freely receive the shank 27 but not large enough to permit passage of the upper end of the terminal with its lateral projections 45. The sleeve 31 has a larger bore 49 spaced from the lower end of the sleeve and providing a shoulder 50 at the junction between the bores. The larger bore 49 is of sufficient diameter to freely receive the upper end of the terminal 26 with its lateral projections 45. In order to permit the terminal 26 to be brought to the position shown in Figures 3 and 4, in which the lower ends of the projections 45 are seated on the shoulder 50, longitudinal grooves or channels 51 are provided in the wall of the bore 48, the channels being complementary to the cross-sectional aspect of the projections 45 and constructed and arranged to permit free sliding of the projections in the channels. By bringing the terminal 26 to a position in which the projections 45 register with the channels 51, the terminal may be moved longitudinally into the bore 48 (see Figure 6), and when the lower ends of the projections 45 are at a level at or above the shoulder 50, the terminal 26 may be rotated, desirably 90°, to bring the parts to the position shown in Figures 3 and 4. It will be understood that in order to disconnect the terminal 26 from the sleeve 31 all that is necessary is to execute the described movements in reverse order. One, or two holes 52 are desirably provided, extending through the sleeve 31 at the upper ends of the channels 51, at approximately the level of the shoulder 50, to permit observation of the relative position of the terminal and the sleeve.

It will be understood that in order to connect (or disconnect) the terminal 26 and the sleeve 31, the tube 38 and the funnel means 18 are moved upwardly out of the way. The connection between the sleeve 31 and terminal 26 having been made, and the parts of the apparatus assembled as in Figures 1 and 2, comminuted insulating material is introduced through the opening 24. The insulating material falls down between the tube 38 and the inside of the sheath 10, passing down between the splines 39, and accumulating at the bottom of the sheath. The tube 38 may be reciprocated, or the entire apparatus may be vibrated, or both, to tamp and compact the comminuted insulating material, and as the tamped compacted material accumulates, the tube 38 gradually assumes a higher and higher position, until the sheath 10 is filled to somewhere near the top, or to any desired extent.

A slight longitudinal tension on the resistor 25 is desirable to keep it centrally located in the sheath 10 and prevent undesired sagging. This tension may be secured by adjustment of the vertical position of the rod 32, and hence of the terminal 26. The tension on the resistor 25 in conjunction with the mode of engagement here shown between the tapering surfaces 46 and the right angled shoulder 50, whereby the shoulder bites slightly into the tapering surfaces, better keeps the terminal 26 from rotating with respect to the sleeve 31 when the parts are in the position shown in Figure 3, while at the same time not interfering with the disconnection of the terminal and the sleeve when the sheath-filling operation has been completed. The tapering surfaces 47 facilitate insertion of the terminal 26 into the sleeve 31.

From the foregoing it will be apparent to those skilled in the art that the illustrated embodiment of the invention provides new and improved apparatus for use in the manufacture of electric heaters, and accordingly, accomplishes the principal object of the invention. On the other hand, it also will be obvious to those skilled in the art that the illustrated embodiment of the invention may be variously changed and modified, or features thereof, singly or collectively, embodied in other combinations than those illustrated, without departing from the spirit of the invention, or sacrificing all of the advantages thereof, and that accordingly, the disclosure herein is illustrative only, and the invention is not limited thereto.

I claim:

1. Apparatus for use in introducing comminuted insulating material endwise into a tubular sheath to embed a resistor disposed in said sheath, comprising: positioning means, connectable to terminal means fastened to an end of said resistor, constructed and arranged to position said resistor spaced from the inside surface of said sheath; said positioning means and said terminal means being so constructed and arranged that they are connectable and disconnectable merely by relative movement of said means; and said positioning means being so constructed and arranged as to permit view of the position of said terminal means relatively to said positioning means.

2. Apparatus for use in introducing comminuted insulating material into a tubular sheath to embed a resistor disposed in said sheath, comprising: positioning means, connectable to terminal means fastened to an end of said resistor,

constructed and arranged to position said resistor spaced from the inside surface of said sheath; and said positioning means and said terminal means being so constructed and arranged that they are connectable merely by longitudinal relative movement followed by rotative relative movement, and disconnectable merely by aforesaid movements in the reverse order.

3. Apparatus for use in introducing comminuted insulating material into a tubular sheath to embed a resistor disposed in said sheath, comprising: positioning means, connectable to terminal means fastened to an end of said resistor, constructed and arranged to position said resistor spaced from the inside surface of said sheath; said positioning means and said terminal means being so constructed and arranged that they are connectable merely by longitudinal relative movement followed by rotative relative movement, and disconnectable merely by aforesaid movements in the reverse order; and said positioning means being so constructed and arranged as to permit view of said terminal means at the place where the directions of said longitudinal and rotative movements intersect.

4. A terminal for a resistor, for use in holding said resistor positioned in a tubular sheath while comminuted insulating material is introduced endwise into said sheath, said terminal having circumferentially spaced lateral projections.

5. A terminal for a resistor, for use in holding said resistor positioned in a tubular sheath while comminuted insulating material is introduced endwise into said sheath, said terminal comprising a generally cylindrical shank having circumferentially spaced lateral projections.

6. A terminal for a resistor, for use in holding said resistor positioned in a tubular sheath while comminuted insulating material is introduced endwise into said sheath, said terminal having circumferentially spaced lateral projections of arcuate cross-sectional outline.

7. A terminal for a resistor, for use in holding said resistor positioned in a tubular sheath while comminuted insulating material is introduced endwise into said sheath, said terminal having a shank with circumferentially spaced lateral projections, said projections having outermost surfaces tapering longitudinally to a junction with the surface of said shank.

8. A terminal for a resistor, for use in holding said resistor positioned in a tubular sheath while comminuted insulating material is introduced endwise into said sheath, said terminal having a shank with circumferentially spaced lateral projections of arcuate cross-section, said projections having outermost surfaces tapering longitudinally to a junction with the surface of said shank.

9. A terminal for a resistor, for use in holding said resistor positioned in a tubular sheath while comminuted insulating material is introduced endwise into said sheath, said terminal comprising a shank having circumferentially spaced lateral projections integral with said shank.

10. A terminal for a resistor, for use in holding said resistor positioned in a tubular sheath while comminuted insulating material is introduced endwise into said sheath, said terminal comprising a shank having circumferentially spaced lateral projections formed by side pressing said shank.

11. Apparatus for use in introducing comminuted insulating material endwise into a tubular sheath to embed a resistor disposed in said sheath, comprising: positioning means, connectable to terminal means fastened to an end of said resistor, said positioning means comprising a sleeve having an open bore at its lower end and having an enlarged bore spaced from its lower end and providing a shoulder at the junction of said bores, said open bore having circumferentially spaced longitudinal channels.

12. Apparatus for use in introducing comminuted insulating material endwise into a tubular sheath to embed a resistor disposed in said sheath, comprising: positioning means, connectable to terminal means fastened to an end of said resistor, said positioning means comprising a sleeve having an open bore at its lower end and having an enlarged bore spaced from its lower end and providing a shoulder at the junction of said bores, said open bore having circumferentially spaced longitudinal channels of arcuate cross-section.

13. Apparatus for use in introducing comminuted insulating material endwise into a tubular sheath to embed a resistor disposed in said sheath, comprising: positioning means, connectable to terminal means fastened to an end of said resistor, said positioning means comprising a sleeve having an open bore at its lower end and having an enlarged bore spaced from its lower end and providing a shoulder at the junction of said bores, said open bore having circumferentially spaced longitudinal channels, and an opening through a wall of said sleeve at the approximate level of said shoulder.

14. Apparatus for use in introducing comminuted insulating material into a tubular sheath to embed a resistor disposed in said sheath, comprising: positioning means, connectable to terminal means fastened to an end of said resistor, constructed and arranged to position said resistors spaced from the inside surface of said sheath; and said positioning means and said terminal means being so constructed and arranged that they are connectable merely by longitudinal relative movement followed by rotative relative movement, and disconnectable merely by aforesaid movements in the reverse order, said positioning means comprising a sleeve having an open bore at its lower end and having an enlarged bore spaced from its lower end and providing a shoulder at the junction of said bores, said open bore having circumferentially spaced longitudinal channels, and said terminal means comprising a shank having circumferentially spaced lateral projections slidable in said channels and seatable on said shoulder.

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