Feb. 7, 1928. 1,658,651

R. B. PRINDLE

ELECTRIC FURNACE

Filed Dec. 29, 1926

Fig. 1.

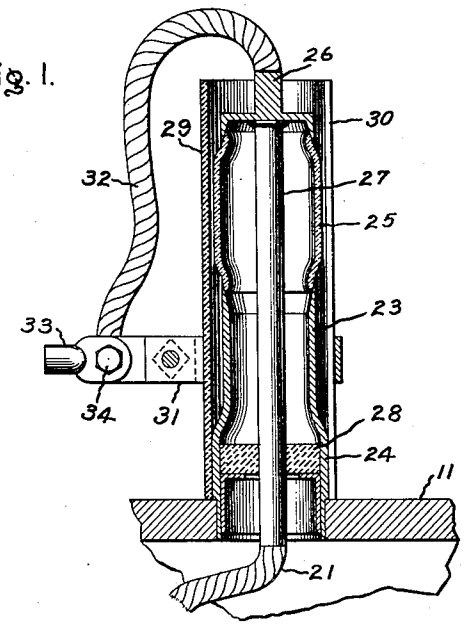
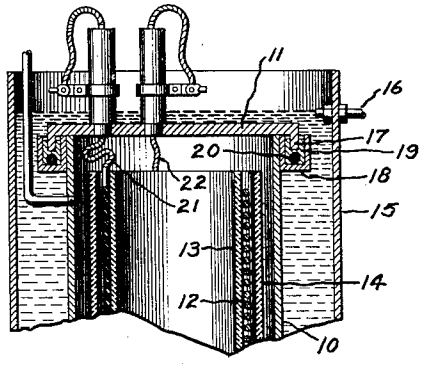



Fig. 2.

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His Attorney.

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# UNITED STATES PATENT OFFICE.

RAYMOND B. PRINDLE, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## ELECTRIC FURNACE.

Application filed December 29, 1926. Serial No. 157,816.

My invention relates to electric furnaces and has for its object the provision of simple and reliable means for sealing a furnace receptacle around an electrical conductor passing through the wall thereof.

More particuularly my invention relates to electrical apparatus, such as electric furnaces, and the like, in which a sealed chamber is used, such for example as a vacuum furnace, in which the air is evacuated from the heating chamber. In such furnaces, it is customary to place the electric heater in the evacuated heating chamber, and my invention in one of its applications relates to means for sealing the chamber around the electrical terminals or leads for the heater.

In carrying out my invention I provide a seal including an annular member made of a suitable vitreous material, such as glass. This member is sealed in the opening for the terminal lead and electrically insuluates the terminal as well as facilitating the formation of a seal.

For a more complete understanding of my invention reference should be had to the accompanying drawing in which Fig. 1 is a fragmentary sectional view of a seal for electric furnaces embodying my invention, while Fig. 2 is a fragmentary sectional view to a reduced scale showing an electric furnace embodying my invention.

Referring to the drawing, I have shown my invention in one form as applied to a vacuum furnace of the type shown in Patent No. 1,566,224 to Massey, although obviously my invention has application to various other types of furnaces. Briefly, this furnace comprises a cylindrical casing or tank 10 forming a heating chamber and provided with a cover 11. This casing is made of a non-porous material of sufficient strength to permit the air to be evacuted, such for example as steel. Inside the casing is an electric heating resistor 12 shown in the form of a wire wound in a helix on a cylindrical support 13 made of a suitable heat refractory, electrically insulating material, such as alundum. Between the heating resistor and the casing 10 is a cylindrical heat refractory insulating member 14 which also may be made of alundum. To facilitate cooling, the casing 10 is placed in a large tank 15 which is filled with water to cover the casing 10. The cooling water is preferably admitted at the bottom of the tank through a pipe, not shown, an overflow pipe 16 being provided to limit the water level.

A downwardly projecting flange 17 is provided around the periphery of the cover 11. This flange projects into a trough-like receptacle 18 secured to the casing 10 at the top thereof. A quantity of metal 19 of low melting point, such for example as solder, is provided in the receptacle 18. The flange 17 is embedded in the solder and a tight seal thereby formed between the cover and the casing. A suitable electric heating unit 20 is provided in the receptacle whereby the solder may be melted to permit the cover to be put in place and removed.

As shown, the terminal leads 21 and 22 for the heating resistor are brought out through the cover 11, a suitable air-tight seal being provided for each terminal. The construction of the seal is shown in detail in Fig. 1. It comprises a metallic sleeve 23 which is tightly secured at its lower end by means of a welded or similar joint in an aperture in the cover 11. The upper end of the sleeve is reduced in diameter as compared with the lower end so as to form an enlarged base portion 24. Secured to the upper end of the sleeve 23 is a sleeve 25 made of a suitable vitreous insulating material, such as glass. The upper end of the sleeve 25 in turn is closed by a metallic cap member 26 which serves as a support for the terminal lead 27 extending centrally through the sleeves 23 and 25 into the furnace chamber. The sleeve 23 and the cap 26 are made of a suitable metal having a temperature coefficient of expansion similar to that of the glass sleeve 25 and a surface oxide which combines readily with the glass. This material, for example, may be copper, invar or chrome-steel. The terminal lead 27 is shown as a solid rod made of a suitable electrically conducting material, such as copper, although it may be flexible. A lava spacing insulator 28 is provided in the lower end of the sleeve 23 to prevent lateral displacement of the terminal lead 27 and resultant breakage of the glass sleeve 25, as well as to insulate the lead 27. The lead 27 is free to slide in the insulator 28 to allow expansion and contraction of the various parts in response to changes in temperature. The leads 21 and 22 extending from the terminal leads 27 to the extremities of the heating resistor are preferably made of flexible

stranded material and are of sufficient length to allow the cover to be tilted upward to give access to the interior of the heating chamber.

The glass sleeve 25 is enclosed and protected from mechanical injury by means of a sleeve 29 made of a suitable flexible electrically insulating material, such as fibre. This sleeve has a slot extending throughout its length, as indicated by the numeral 30, so that it may be slipped over the enlarged base portion 24 of the metallic sleeve and contracted and secured tightly thereon by means of a clamp 31. The glass sleeve 25 and the cap member 26 are both smaller in diameter than the base portion 24 and are consequently spaced from the sleeve 29 which thus forms an efficient guard for these parts. A flexible lead 32 extends from the upper end of the cap 26 to the clamp 31 where it is secured to a connection lug 33 by means of a suitable bolt 34. This construction prevents breakage of the glass sleeve 25 by a pull which might otherwise be applied to the lead 32. It will be observed that all strains set up in the external electrical connections for the furnace are taken up by the protecting sleeve 30.

While I have described my invention as embodied in concrete form and as operating in a specific manner in accordance with the provisions of the patent statutes, it should be understood that I do not limit my invention thereto since various modifications thereof will suggest themselves to those skilled in the art without departing from the spirit of my invention the scope of which is set forth in the annexed claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electric furnace comprising a receptacle forming a heating chamber, said receptacle being provided with an opening, an electric heater in said chamber, a terminal lead for said heater extending through said opening, and means for sealing said receptacle around said terminal lead including an insulating vitreous sleeve, said sleeve being combined at its ends with said terminal lead and said receptacle to form sealed joints therewith.

2. An electric furnace comprising a receptacle forming a heating chamber, said receptacle being provided with an opening, an electric heater in said chamber, a terminal lead for said heater extending through said opening, and means for sealing said receptacle around said terminal lead including an annular glass member, said glass member being combined at its ends with said terminal lead and said receptacle to form sealed joints therewith.

3. An electric furnace comprising a receptacle forming a vacuum heating chamber, an electric heater in said chamber, an opening in said receptacle, a glass sleeve secured to said receptacle in said opening, a metallic cap member secured to said glass sleeve, and a terminal lead extending through said sleeve connecting said heater with said cap member.

4. The combination with a receptacle forming a vacuum heating chamber, said receptacle being provided with an opening, of an electric heating unit in said chamber, a terminal lead for said heating unit extending through said opening and a seal for said receptacle around said terminal including a metallic sleeve surrounding said terminal secured to said receptacle, a glass sleeve secured to said metallic sleeve, and a metallic supporting member for said terminal secured to said glass sleeve.

5. The combination with a receptacle provided with an opening, of an electrical conductor extending through said opening, an annular glass member secured to said receptacle around said conductor, a metallic member secured to said glass member forming a support for said conductor, an outer protecting member surrounding said glass member, and an electrical conductor having one end secured to said metallic member and its other end carried by said protecting member.

6. The combination with a receptacle provided with an opening, of an electrical conductor extending through said opening, a metallic member secured to said receptacle in said opening, a glass member secured to said metallic member, a metallic cap member secured to said glass member, an electrical connection between said conductor and said cap member, an outer protecting member of insulating material, a clamping member securing said protecting member to said metallic member, and an electrical conductor secured to said cap member and said clamping member.

7. The combination with a receptacle provided with an opening, of an electrical conductor extending through said opening, a metallic sleeve secured to said receptacle in said openings, a glass sleeve secured to said metallic sleeve, a metallic cap member secured to said glass sleeve, an electrical connection between said conductor and said cap member, an outer protecting member of insulating material surrounding said sleeves, a clamping member securing said protecting member to said metallic sleeve, and an electrical conductor secured to said cap member and said clamping member.

In witness whereof, I have hereunto set my hand this 28th day of December, 1926.

RAYMOND B. PRINDLE.