Nov. 16, 1954 K. A. LANG 2,694,740

POT TYPE FURNACE FOR MOLTEN METAL

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Fig. 1

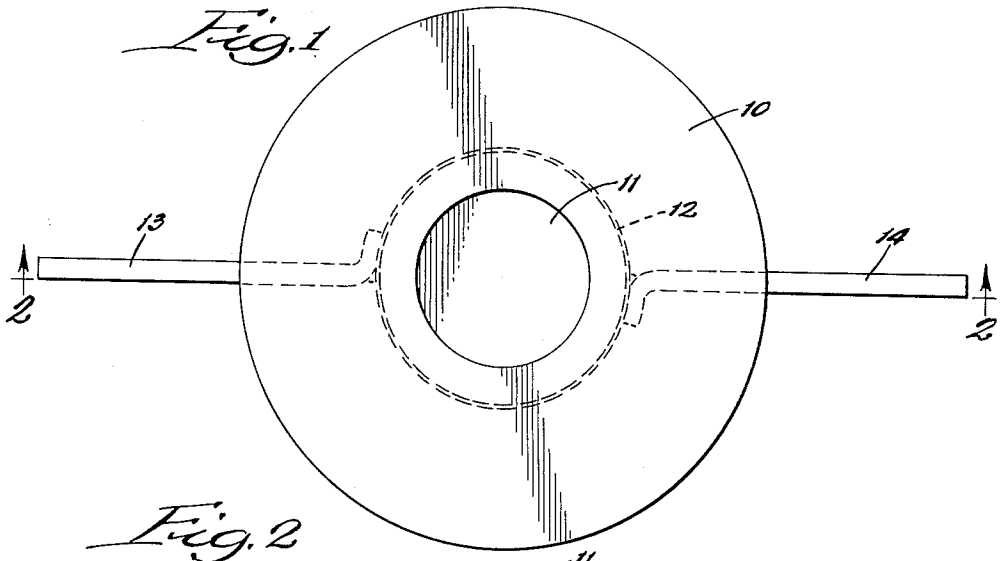


Fig. 2

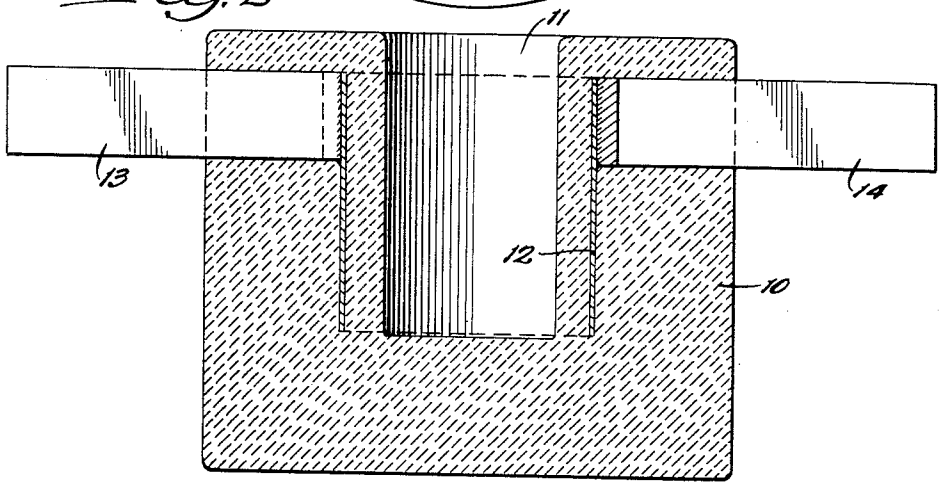
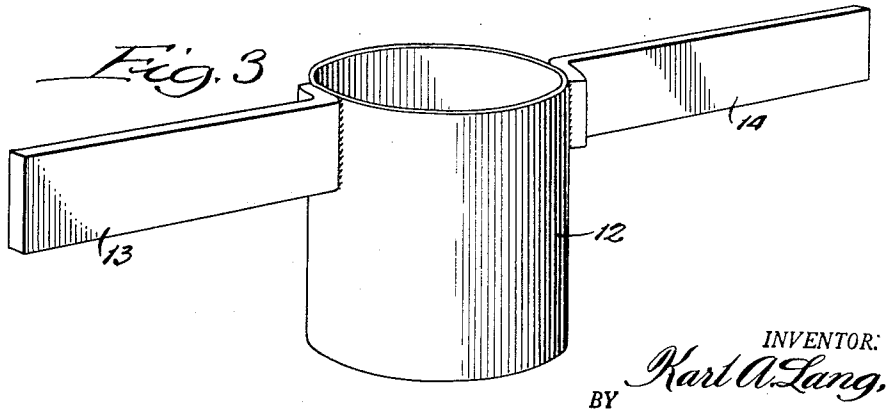


Fig. 3



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Fig. 4

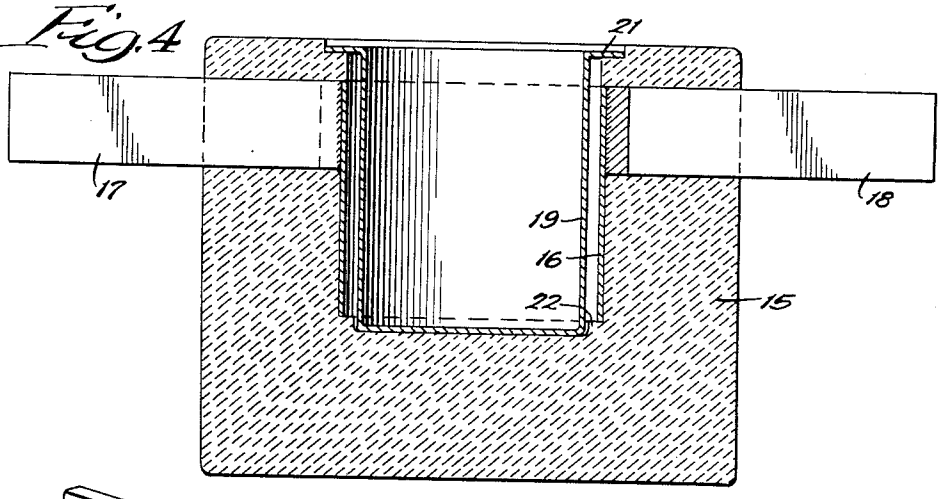


Fig. 5

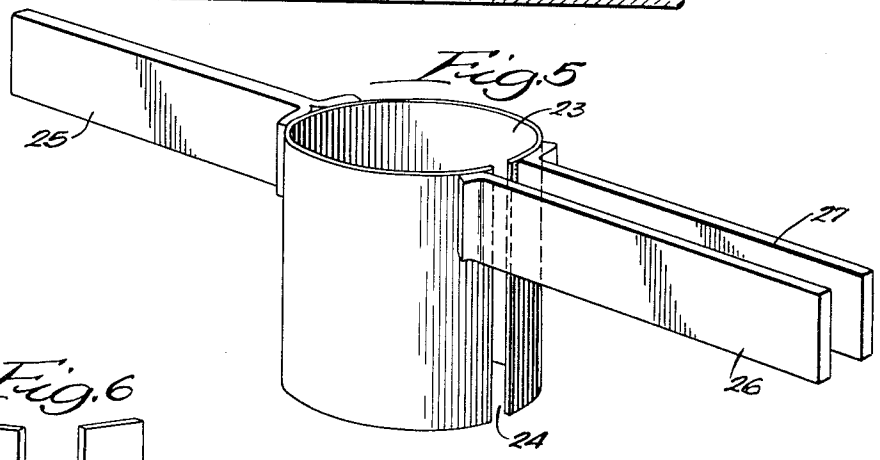


Fig. 6

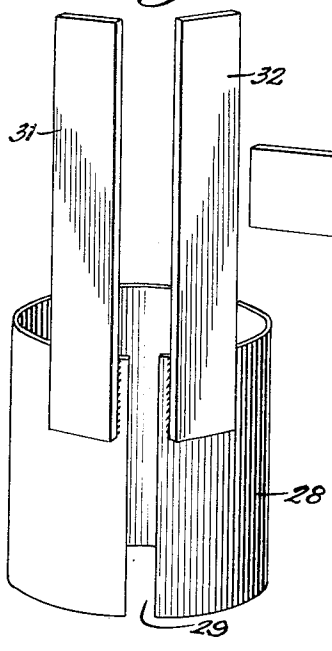
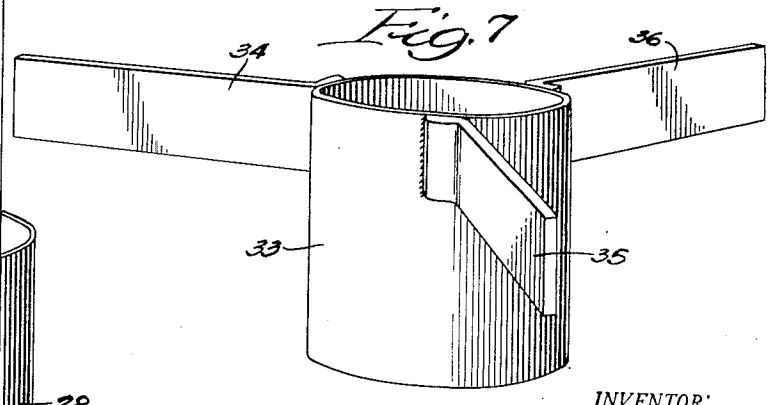


Fig. 7



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2,694,740

Patented Nov. 16, 1954

2,694,740

POT TYPE FURNACE FOR MOLTEN METAL

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Application February 2, 1953, Serial No. 334,465

9 Claims. (Cl. 13—22)

This invention relates to pot type furnaces for molten metal and more particularly to electric resistance furnaces for melting or holding molten metal.

It is one of the objects of the invention to provide a pot type furnace in which the heating element is very simple in construction, is easily mounted in the furnace and provides uniform heating for the metal in the furnace.

According to one important feature of the invention, the heating element is tubular and is mounted around the metal holding cavity in the furnace body with terminals connected to the element and extending through the walls of the furnace body for connection to a source of heating current.

Another object is to provide a pot type furnace in which the heating element is completely embedded in the refractory furnace body around the metal receiving cavity in the body so that only refractory is exposed at the inner surface of the cavity to receive a metal such as aluminum.

In an alternative arrangement for metals, such as magnesium, the heating element lines the cavity and means are provided in the furnace body to hold a separate pot or crucible in the cavity spaced from the heating element.

A further object is to provide a pot type furnace in which the heating element can easily be arranged to accommodate any desired type of operating current, such as single phase, double phase, or three phase.

The above and other objects and features of the invention will be more readily apparent from the following description when read in connection with the accompanying drawing in which:

Figure 1 is a top plan view of a furnace embodying the invention;

Figure 2 is a section on the line 2—2 of Figure 1;

Figure 3 is a perspective view of the heating element;

Figure 4 is a section similar to Figure 2 of a modified form of furnace, and

Figures 5, 6 and 7 are perspective views of modified forms of heating elements.

The furnace, as shown in Figures 1 to 3, is primarily designed to melt aluminum or to hold aluminum in molten condition. As shown, the furnace comprises a body **10** formed of a refractory material and having a central cylindrical cavity **11** therein to receive the metal. It will be understood that the pot might be enclosed by a metal housing and supported in any desired manner at a convenient height.

Metal within the cavity **11** is adapted to be heated by an electrical resistance element **12** which is tubular in form and which may be formed of any desired resistance material such as a nickel chrome alloy. The tubular heating element **12** is of larger diameter than the cavity **11** and is completely embedded in the body concentric with the cavity body. In a preferred construction, there may be from one to one and a half inches of refractory material on the inside of the heating element defining the walls of the cavity. With this construction, the metal in the cavity contacts only the refractory material which is highly desirable in the case of metals like aluminum which would react with the heating element.

Heating current is supplied to the heating element **12** through terminals **13** and **14**, which, as shown in the form of conducting bars, extend through the walls of the refractory body **10** at diametrically opposite points. The inner ends of the terminals may be bent over as shown

to increase the area of contact with the heating element **12** and may be intimately secured to the heating element as by welding. The outer ends of the terminals project beyond the body for connection to a source of heating current. In the construction shown in Figures 1 to 3, it is intended that the heating current employed be single phase current.

In use, it will be seen that because the heating element is completely embedded in the refractory body, the metal cannot contact the heating element at any time. The heating element can easily be mounted in the pot during pouring of the refractory material and the terminals will be securely embedded in the pot at the same time. When current is supplied the heating element will heat uniformly completely around the cavity **11** so that metal therein will be uniformly heated and difficulties due to uneven expansion or contraction of the material will be avoided.

For melting metals, such as magnesium, which would react with the refractory, the construction may be modified as shown in Figure 4. In this construction, the furnace comprises a pot **15** of refractory material formed with a central cylindrical cavity and having a tubular heating element **16** lining the walls of the cavity with its top and bottom terminating short of the ends of the cavity. The element **16** may be identical with the element **12** with the difference that the relative diameters of the element and the cavity are altered so that the element will be exposed at the inner surface of the cavity, as shown. Terminals **17** and **18** are connected to diametrically opposite points on the element and extend through the walls of the body for connection to a current source.

The molten metal is adapted to be held in a separate pot or crucible **19** which for metals such as magnesium might be formed of iron or steel. The pot **19** is of smaller diameter than the element **16** and is held in spaced relation thereto by a top flange **21** fitting into an annular recess in the top of the furnace body. In addition, if desired, the bottom of the cavity in the furnace body may be defined by a reduced diameter annular shoulder **22** to engage the sides of the pot.

In this construction, the metal is contained entirely within the pot **19** which is held in spaced relation to the heating element and which is heated by radiation and conduction from the heating element. Otherwise, the operation is identical with that of Figures 1 to 3.

Figure 5 illustrates an alternative form of heating element for use with two phase current. As shown, a tubular heating element **23** is provided which is axially split, as indicated at **24**. Three terminals **25**, **26** and **27** are employed. The terminal **25** is secured to the heating element at a point diametrically opposite to the split **24** and the terminals **26** and **27** are connected to the element closely adjacent to and on opposite sides of the split **24**.

This element may be mounted in a furnace body in exactly the same manner as the element **12** of Figures 1 to 3 or the element **16** of Figure 4. In use the terminals are connected to the leads of a two phase three wire source with the terminal **25** being connected to the center lead and the terminals **26** and **27** connected to the outside leads. As shown for current balance the terminal **25** may be split and folded in opposite directions from its center over the resistance element.

Figure 6 illustrates another variation of heating element for use with single phase current. This element comprises a tubular resistance **28** split along one side as indicated at **29**. A pair of terminals **31** and **32** extend parallel to the axis of the tubular element **28** and are secured thereto on opposite sides of the split **29** by welding or the like.

The element **28** can be mounted in a furnace body, as shown in either Figures 1 to 3, or in Figure 4, and when so mounted, the terminals **31** and **32** will extend out through one end, either the bottom or the top wall of the body, for connection to a current source.

Figure 7 shows an element adapted for three phase current and comprises a tubular resistance **33** having three terminals **34**, **35** and **36** secured thereto at uniformly spaced points in its periphery. This element is mounted

in a furnace body in the same ways as the element discussed above with the single difference that the three terminals are connected to the three wires of a three phase current source.

While several embodiments of the invention have been shown and described in detail, it will be understood that these are illustrative only and are not to be taken as a definition of the scope of the invention, reference being had to the appended claims.

What is claimed is:

1. A pot type furnace for molten metal comprising a cup shaped body of refractory material formed with a central cavity therein having an open top and an integral closed bottom, a substantially tubular resistance element in the body around the cavity therein, the resistance element being open at the top and bottom and being substantially coextensive axially with the cavity and terminals secured to and extending outward from the resistance element through the walls of the body for connection to a source of electric current.

2. A pot type furnace for molten metal comprising a cup shaped body of refractory material formed with a central cavity therein having an open top and an integral closed bottom, a substantially tubular resistance element in the body around the cavity therein, the resistance element being open at the top and bottom and being substantially coextensive axially with the cavity and terminals secured to and extending outward from the resistance element through the walls of the body for connection to a source of electric current, the resistance element being completely embedded in the walls of the body so that only refractory material is exposed at the inner surface of the cavity.

3. A pot type furnace for molten metal comprising a cup shaped body of refractory material formed with a central cavity therein, a substantially tubular resistance element in the body around the cavity therein, and terminals secured to and extending outward from the resistance element through the walls of the body for connection to a source of electric current, the resistance element fitting against the inner surface of the cavity and being exposed at the inner surface of the cavity, a pot to hold metal of smaller external diameter than the internal diameter of the resistance element, and interfitting parts on the body and the pot to hold the pot centered in the cavity in spaced relation to the resistance element.

4. A pot type furnace for molten metal comprising a cup shaped body of refractory material having a central cavity therein having an open top and an integral closed bottom, a tubular resistance element in the body around the cavity, the resistance element being open at the top and bottom and being substantially coextensive axially with the cavity and a plurality of terminals secured to the resistance element at uniformly spaced points around its circumference and extending therefrom through the body for connection to a source of electric current.

5. A pot type furnace for molten metal comprising a cup shaped body of refractory material having a central cavity therein, a tubular resistance element in the body around the cavity, and three terminals secured to the resistance element at three evenly spaced points around the circumference of the resistance element and extending therefrom through the walls of the body for connection to a source of three phase current.

6. A pot type furnace for molten metal comprising a cup shaped body of refractory material having a central cavity therein, a tubular resistance element in the body around the cavity, said resistance element being split axially at one point in its circumference, and terminals connected to the resistance element at opposite sides of the split and extending through the body for connection to a source of electric current.

7. A pot type furnace for molten metal comprising a cup shaped body of refractory material having a central cavity therein, a tubular resistance element in the body around the cavity, said resistance element being split axially at one point in its circumference, and three terminals connected to the resistance element and extending therefrom through the walls of the body for connection to a source of two phase electric current, one of the terminals being connected to the body diametrically opposite to the split and the other two closely adacent to and on opposite sides of the split.

8. A pot type furnace for molten metal comprising an integral unitary body of refractory material having a cup shaped cavity formed in the top thereof, a thin walled tubular metal heating element open at its top and bottom mounted in the body around the cavity and substantially coextensive axially with the cavity, and a plurality of terminal bars extending through the body into contact with the thin walls of the heating element and having end portions overlying and secured to the walls of the heating element throughout a substantial area.

9. A pot type furnace for molten metal comprising an integral unitary body of refractory material having a cup shaped cavity formed in the top thereof, a thin walled tubular metal heating element open at its top and bottom mounted in the body around the cavity and substantially coextensive axially with the cavity, and a plurality of terminal bars extending radially inward through the body to the heating element and having turned over ends fitting against and secured to the walls of the heating element over a substantial area.

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