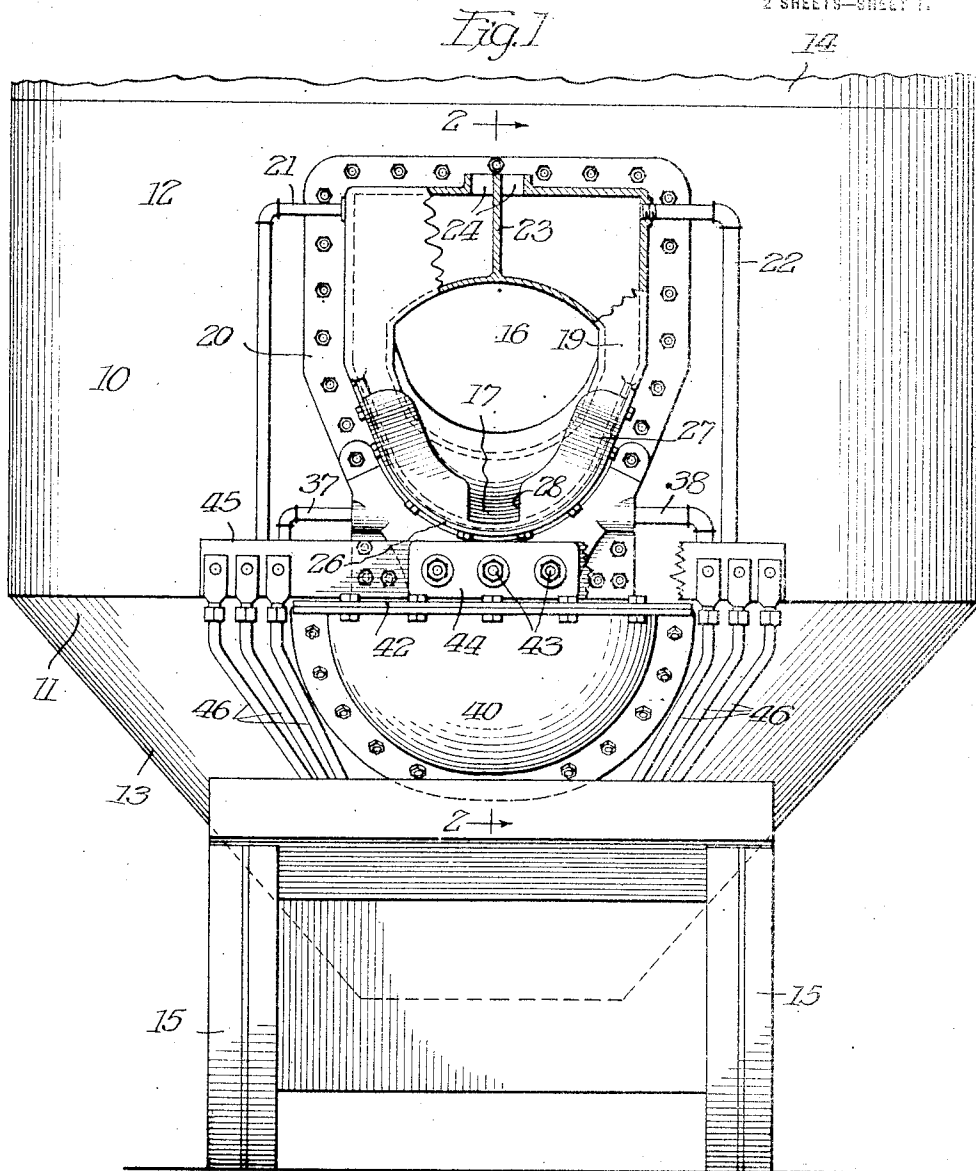


F. VON SCHLEGELL AND W. B. LEWIS.
ELECTRIC FURNACE.
APPLICATION FILED APR. 4, 1919.

1,352,040.

Patented Sept. 7, 1926.
2 SHEETS—SHEET 1.



Inventor
William B. Lewis
Frederick von Schlegell
By Sheridan, Jones, Sheridan & Smith
Attys

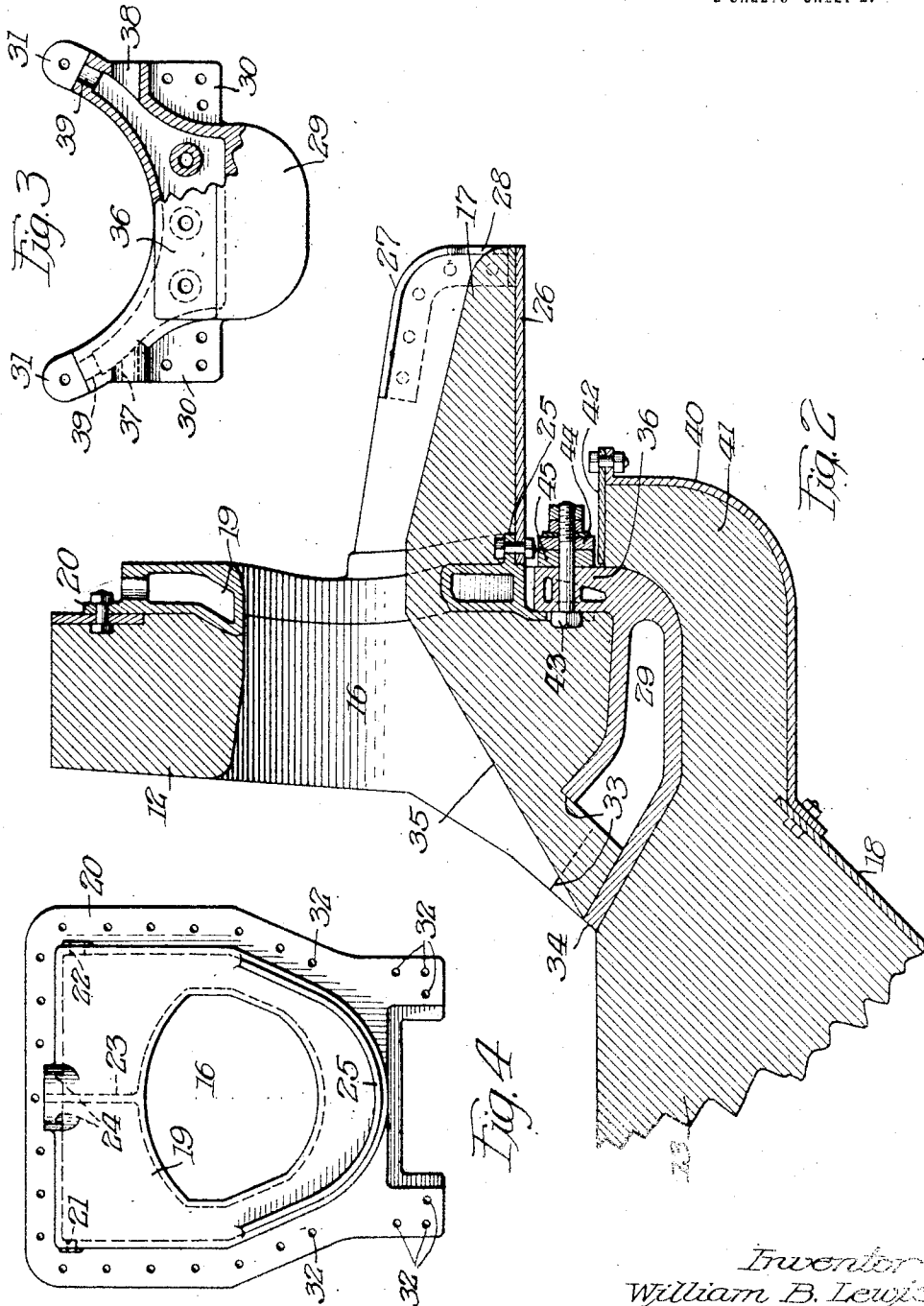
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UNITED STATES PATENT OFFICE.

FREDERICK VON SCHLEGEL, OF EVANSTON, AND WILLIAM B. LEWIS, OF CHICAGO,
ILLINOIS.

ELECTRIC FURNACE.

1,352,040.

Specification of Letters Patent.

Patented Sept. 7, 1920.

Application filed April 4, 1919. Serial No. 237,538.

To all whom it may concern:

Be it known that we, FREDERICK VON SCHLEGEL, a citizen of the United States, residing at Evanston, in the county of Cook and State of Illinois, and WILLIAM B. LEWIS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric Furnaces, of which the following is a specification.

This invention relates to improvements in electric furnaces.

One object of the invention is to provide in a furnace of this character a bottom contact so located relatively to the tap hole of the furnace that, when said furnace is tilted, as in the operation of pouring the molten metal therefrom, the metal forming the inner portion of the contact, should the same also be in a molten state, due to the intense heat within the furnace, will not be poured out of the furnace along with the other metal, but will remain intact with the unmelted portion of said contact and in proper position for completing the electrical circuit throughout future heating operations. As will be apparent to those skilled in the art, this overcomes one of the chief objections to bottom contacts as the same are now employed, according to which employment said contacts are projected into the melting chamber of the furnace at such a point or points that upon a tilting thereof a portion of the metal of the contact, should the same be in a molten state, is poured out with the metal being tapped off. Furthermore, due to the fact that in a construction embodying the present improvements, wherein the above object is realized, the contact is maintained intact throughout the heating and pouring operations, the wearing or burning down of the bottom of the furnace around the contact is reduced to a minimum and accordingly frequent patching is obviated.

Another object of the invention resides in the provision of a contact for a furnace of the type set forth, which contact shall be provided with a water cooling chamber located above the portion of said contact which is embedded in the wall of the furnace.

A further object is to provide an electric furnace contact having a cooling chamber

exterior of the furnace and so arranged relatively thereto as to provide means for cooling the breast of the furnace.

Another object is to provide a comparatively thin protecting casing of refractory material for the contact whereby a substantial portion of the heat generated in said contact, due to electrical resistance, will be carried off through radiation; said casing being so designed and mounted on the furnace in suchwise as to preclude all possibilities of metal from within the furnace leaking out around said contact and also to prevent the metal of the contact, should the same be in a molten state, from flowing out through the bottom of the furnace.

A further and important object of the present improvements is to provide, in combination with an electrical contact of the type above described, means for cooling substantially the entire front of the furnace and particularly the area surrounding the tap hole thereof.

Other objects and advantages will be apparent from the following description, taken in connection with the accompanying drawings, wherein one embodiment of the invention is illustrated.

Figure 1 is a front elevation of an electric furnace of the tilting type showing the cooling front and contact in position;

Fig. 2 is a sectional view taken on the line 2--2 of Fig. 1;

Fig. 3 is a front elevation of the contact showing the same removed from the furnace, and

Fig. 4 is a similar view of the water cooled front.

Referring more in detail to the drawings, 10 designates an electric furnace comprising a body 11, the upper portion 12 of which is of cylindrical shape while the lower portion 13 thereof is of conical design, the sides of said lower portion tapering downwardly and inwardly toward the vertical axis of said furnace. The roof of the furnace is shown at 14. The entire furnace is preferably mounted in an upright position on a plurality of rockers 15, whereby said furnace may be tilted in order to pour the contents thereof out through the tap hole 16, after each heating operation. The

mechanism for tilting the furnace on the rockers 15 may be of any suitable construction and forms no part of the present invention. Extending outwardly from the body of the furnace around the lower portion of the tap hole is a suitable pouring spout 17. The body of the furnace is constructed of the usual refractory material, surrounding which is the outer shell 18.

According to the present invention, the portion of the shell which covers the area of the front of the furnace surrounding the tap hole thereof is preferably cut away and in place thereof a water cooled front for the furnace is provided. This water cooled front comprises a hollow water jacket 19 in the form of an annulus which preferably completely surrounds the tap hole, the lower portion of said annulus extending beneath the spout 17 of the furnace and being embedded within the refractory material thereof immediately adjacent to and in contact with the breast lining of the furnace, as shown more clearly in Fig. 2. The water jacket is provided with an outwardly extending flange 20, which completely surrounds the same and by means of which the jacket is bolted or otherwise secured to the adjacent edges of the shell 18 of the furnace. This water jacket 19 is provided with an inlet 21 and an outlet 22, the outlet being slightly larger than the inlet so that the cooling medium may pass quickly through the jacket and off through said outlet without the creation of any back pressure. Located in the water jacket intermediate the inlet and outlet is a baffle plate 23 designed to insure a passage of the water, admitted into the jacket through the inlet 21, downwardly therefrom and around the tap hole and then upwardly and outwardly through the outlet 22, thus preventing the water from passing directly through the upper portion of the jacket from said inlet to said outlet. It is preferred to provide the jacket on each side of the baffle plate 23 with an opening such as shown at 24, in order to provide a communication between the interior of the jacket and the atmosphere exteriorly of the furnace whereby steam, which may be generated within the jacket during the operation of the furnace, may readily escape, thus reducing to a minimum the possibility of an explosion by maintaining the pressure within the jacket at a minimum.

It will be noted from the foregoing that the entire front of the furnace surrounding the tap hole is cooled at all times, the hollow annulus through which the water passes from the inlet to the outlet thereof being mounted directly in contact with the refractory material of the front, thus serving to materially lengthen the life of such material. As is well known, the arch of re-

fractory material above the tap hole in electric furnaces of the type now used gradually burns away, requiring frequent repairs. This burning away is also quite pronounced over the area of the tap hole and adjacent refractories over which the molten metal from the furnace is poured when the same is tilted.

It will be noted by the construction herein provided that this burning away of the arch refractories and the breast lining of the furnace is effectively guarded against by the provision of the cooling front, the water jacket of which is in direct contact with the arch and, in fact, the entire area of the furnace front which surrounds the tap hole, the lower portion of said jacket being embedded in the refractory material immediately below the tap hole and adjacent to and in contact with the breast lining. Thus it will be noted that these portions of the furnace are protected and cooled, as a result of which the burning away thereof, due to the intense heat within the furnace, is greatly reduced.

Around the lower edge of the water jacket 19 there is provided an outwardly projecting semi-circular shaped flange 25, to which may be secured in any suitable manner a supporting shell 26 for the spout 17. This shell 26 is provided at its outer end with a flange 27 which is curved over the outer end of the spout to thereby protect the same. The flange 27 adjacent the pouring area of the outer end of the spout is preferably cut away as at 28, in order that the metal, as the same is poured from the furnace, may not contact with the metal of the shell. If desired, this curved over flange 27 may be formed integral with the spout supporting shell 26 or it may be constructed separately and secured thereto by means of bolts or other fastening elements, as shown in the drawings.

The improved contact, which forms a very important part of the present improvements, is shown in the drawings at 29, said contact being provided with two pairs of opposite flanges 30 and 31, preferably provided with a plurality of bolt holes common to the bolt holes 32 provided in the flange 20 of the water jacket 19 near the lower end thereof. By means of these flanges 30 and 31 and the holes for the fastening means just described, the contact 29 may be securely and rigidly attached to the water front of the furnace immediately beneath the spout 17 thereof, as shown more clearly in Fig. 2 of the drawings. From these points of attachment the contact extends downwardly for a short distance over the outer surface of the furnace and then inwardly and upwardly into the melting chamber thereof, said contact being preferably hollow from a suitable point adjacent the portion of the contact which lies

exteriorly of the furnace and being open at its inner end. A portion of the upper wall of the contact at the inner end thereof is cut away as shown at 33, in order to permit of the refractory lining extending from the tap hole uninterruptedly to and in contact with the lower side of the contact, the edge 34 of which, it will be noted, being left exposed on the interior of the chamber so that the current may readily flow from the electrode through the slag to the contact during the heating operation. It will, of course, be obvious that, as soon as the first heat is passed into the furnace, the portion of the lining which closes the inner end of the contact will burn away and a portion of the metal from the furnace will flow into and fill the hollow cavity of said contact.

It is usual in the construction of electric furnaces, which are tilted in order to pour the contents thereof, to provide in the lining of the melting chamber, between the tap hole and the bottom of said chamber, a suitable channel 35 through which the molten metal may flow outwardly through said tap hole when the furnace is tilted. The bottom of this channel 35, when the furnace has reached its limit of tilt as in the pouring operation, is substantially horizontal and constitutes the lowest portion of the melting chamber. In positioning the contact in the present improvements the same is projected into the melting chamber of the furnace through the bottom of this channel 35 and accordingly it will be noted that when the furnace is tilted, as in the pouring operation, the metal of the contact, should the same be in a molten state, will not flow outwardly through the tap hole along with the metal being tapped off, but, on the other hand, will remain intact with the other metal of the contact and thus in proper position for completing the circuit during the following heating operations.

In the use of contacts, such as now commonly employed, which extend upwardly through the bottom of the furnace substantially along the vertical axis thereof, there has always been more or less difficulty encountered in that some of the metal of the contact would flow out of the furnace along with the metal being tapped off when the furnace was tilted, by reason of the fact that, when tilted, the point of entrance of the electrode into the melting chamber was a considerable distance above the tap hole thereof. This lowers the inner end of the contact relatively to the bottom of the furnace to a certain extent each time the furnace is tilted and thus exposes the furnace bottom around the contact to deterioration due to the intense heat, this portion of the bottom gradually burning or wearing away, thereby necessitating frequent patching, which is always a more or less difficult and

hazardous undertaking when attempted during the operation of the furnace.

In the present improvements by projecting the electrode into the melting chamber through the bottom of the channel 35 thereof, the metal of the contact remains in position throughout the heating and pouring operations, as above pointed out, and thus greatly reduces this burning or wearing away of the lining therearound and consequently eliminates frequent patching. It will be noted, however, in the event that the lining at the bottom of the furnace around the contact should burn down or wear away to such an extent as to require patching, that such patching may be effected directly through the tap hole of the furnace, in view of the fact that the point of entrance of the contact into the melting chamber is comparatively close to such hole and therefore easily accessible therethrough. In this manner, the patching may be effected quickly and with certainty, and may also be made far more effective and permanent than is possible in the use of contacts of the type above described.

The upturned portion 36 of the contact, which lies exteriorly of the furnace, is preferably in the form of a hollow crescent-shaped head, being substantially of the contour of the lower surface of the spout 17 and fitting therebeneath and in close proximity thereto. This hollow head is provided with an inlet 37 and an outlet 38, the outlet 38 in this case also being slightly larger than the inlet so that the water entering the head or cooling chamber may quickly pass therethrough without the creation of any back pressure. Adjacent the upper ends of the head 36 above the inlet and outlet thereof it is preferred to provide a plurality of openings 39, which expose the interior of the chamber to the atmosphere as in the water cooled front construction, whereby any steam which may be generated within the chamber may readily escape. The cooling medium passing through this chamber not only provides means for cooling the contact but also provides a cooling element for the breast of the furnace beneath the tap hole thereof. As will be noted from the construction just described, and as shown more clearly in Fig. 2 of the drawings, the water jacket or chamber provided in the upturned head 36 of the contact is above the portion of the contact which is embedded in the wall of the furnace, and that accordingly the water within said chamber will always be above the metal of the contact. This is particularly advantageous in the event the contact is reduced to a molten state during the heating operations. The mounting of the cooling chamber exteriorly of the furnace also gives rise to many advantages in that said cooling chamber may be exposed to the

atmosphere exteriorly of the furnace, as above described, thereby precluding all possibilities of the cooling water causing an explosion within the furnace as occasionally results in the use of water cooled bottom contacts of the type heretofore commonly employed.

Bolted to the shell 18 of the furnace and extending outwardly therefrom around the lower portion of the contact 29 is what may be termed a contact bowl 40, preferably constructed of sheet metal. This bowl-shaped member 40 is spaced away from the contact 29 and provides a support for the refractory lining 41 which is placed in said bowl and which fills the space between the same and the contact, as shown clearly in Fig. 2. It will be noted from the drawings that the contact is attached to the water front adjacent the cylindrical portion of the furnace and that it extends downwardly from such point of attachment and into the melting chamber of the furnace through the conical portion thereof. This, in the absence of some provision, such as the bowl 40 and the lining 41, would, it will be noted, leave the portion of the contact where the same is curved inwardly into the wall of the furnace unprotected. In providing the bowl 40 and lining 41 this portion of the contact is not only protected with refractory material, but the escape of metal from the furnace through the bottom thereof around the contact is provided against, as well as the escape of any of the contact metal should the same be in a molten state. Furthermore, in providing this lining 41 on the exterior of the furnace for the protection of the contact, said lining may be made of such thickness that a large portion of the heat produced in and around the contact, due to electrical resistance, may radiate outwardly through said lining, thus aiding materially in cooling the contact. The space between the upper edge of the bowl 40 and the adjacent surface of the contact is preferably covered by means of a suitable plate 42 secured to the bowl in any suitable manner.

By means of the bolts 43 and washer 44 the cable yoke or bus bar 45 is rigidly attached to the outer face of the upturned head 36 of the contact. At 46 the cables or electrical conductors are shown, the same being attached in any suitable manner to the outer ends of the cable yoke.

In attaching the water cooled front, contact and bowl to the shell of a furnace, it is preferred to use bolts in order that said parts may be quickly removed, should repairs or replacement become necessary. It is obvious that these parts, owing to their construction, may be mounted in position on practically any of the electric furnaces of the tilting type now in use by merely cutting the shell of the furnace away, as has

already been indicated, and providing a suitable opening through the wall below the tap hole for the insertion of the contact.

While the contact has been herein described and illustrated as located in the wall of the furnace immediately below the tap hole thereof, and as entering the melting chamber of the furnace at a point intermediate said tap hole and the vertical axis of said furnace, it is obvious that said contact may be positioned at various other locations in the furnace wall without departing from the spirit of the invention. In other words, the exact location of the contact is immaterial so long as the same enters the melting chamber at such a point that the metal thereof, should the same be in a molten state, will not be poured out through the tap hole upon a tilting of the furnace as in a pouring operation.

It is also obvious that the construction herein illustrated and described is susceptible to many changes and modifications within the spirit of the invention, and it is not, therefore, desired nor intended to limit said invention to the particular embodiment shown except where limitations appear in the appended claims.

What we claim is:—

1. The combination with an electric furnace having a melting chamber and a tap hole, of an electrical contact for said furnace projecting through the wall thereof below said tap hole into said melting chamber, the outer end of said contact being upturned and provided with a cooling chamber above the inwardly projecting portion of said contact.

2. A contact for electric furnaces comprising a substantially horizontally extending portion adapted to project into the melting chamber of the furnace through the wall thereof, and an upturned portion at the outer end of said contact adapted to be secured to said wall adjacent the outer surface thereof, said upturned portion being provided with a cooling chamber which extends above the plane of said horizontal portion.

3. In an electric furnace, a metallic bottom contact, and means for cooling the same, said cooling means being located above the metal of the contact.

4. The combination with an electric furnace, of a contact therefor attached to the outer surface thereof below the tap hole, said contact extending from its point of attachment downwardly and then inwardly and upwardly through the wall of said furnace into the melting chamber thereof.

5. The combination with an electric furnace, of a contact therefor attached to the outer surface thereof below the tap hole, said contact extending from its point of attachment downwardly and then inwardly

and upwardly through the wall of said furnace into the melting chamber thereof, said downwardly extending portion being provided with a cooling chamber.

5 6. The combination with an electric furnace, of a contact therefor attached to the outer surface thereof below the tap hole, said contact extending from its point of attachment downwardly and then inwardly
10 and upwardly through the wall of said furnace into the melting chamber thereof, said downwardly extending portion being provided with a cooling chamber, the lowest point of which is above said inwardly extending portion of said contact.

15 7. The combination with a tilting electric furnace, of a contact therefor designed to project through the wall of the furnace and into the melting chamber thereof at a point which is substantially the lowest point of
20 said chamber when said furnace is in its tilted position, whereby the contents of said furnace may be poured without removing any of the metal of said contact, should the latter be in a molten state.

25 8. The combination with a tilting electric furnace, of a contact therefor designed to project through the wall of the furnace and into the melting chamber thereof at a point which is substantially the lowest point
30 of said chamber when said furnace is in its tilted position, whereby the contents of said furnace may be poured without removing any of the metal of said contact, should the latter be in a molten state, and a cooling chamber for said contact mounted exteriorly of the furnace and extending above
35 the point at which said contact enters said melting chamber.

40 9. The combination with a tilting electric furnace, of a contact therefor designed to project through the wall of the furnace and into the melting chamber thereof at a point which is substantially the lowest point of
45 said chamber when said furnace is in its tilted position, whereby the contents of said furnace may be poured without removing any of the metal of said contact, should the latter be in a molten state, the outer end
50 of said contact being upturned and anchored adjacent the outer surface of the furnace, said upturned portion being provided with a cooling chamber which extends above the point at which said contact enters said melting
55 chamber.

10. The combination with an electric furnace, of a contact therefor projecting through the wall of the furnace and into the melting chamber thereof, the outer end
60 of said contact being provided with a water cooling chamber having an inlet and outlet both above the level of the inner end of said contact.

11. The combination with an electric furnace, of a contact therefor projecting

through the wall of the furnace and into the melting chamber thereof, the outer end of said contact being provided with a crescent-shaped hollow head provided with a passage forming a communication between
70 the interior of said head and the atmosphere, and a water inlet and an outlet for said head, both communicating therewith at points above the level of the inner end of said contact and below said passage.

12. A contact for electric furnaces comprising a substantially horizontal portion adapted to extend into the furnace, and an exterior portion disposed at an upward angle to said horizontal portion and provided
75 with a cooling chamber.

13. A contact for electric furnaces comprising a substantially horizontal portion adapted to extend into the furnace, an exterior portion disposed at an upward angle
80 to said horizontal portion and provided with a cooling chamber, and means for connecting the electric conductors to the angularly disposed portion of said contact.

14. The combination with a tilting electric furnace, of a contact anchored adjacent the outer surface of said furnace below the tap hole thereof and extending downwardly and inwardly therefrom into the melting
85 chamber of the furnace, a substantially bowl-shaped member secured to the wall of the furnace below said contact and surrounding the lower portion thereof, and refractory material interposed between said member and the adjacent surface of said
90 contact.

15. The combination with an electric furnace having a conical base portion and a cylindrical upper portion, a tap hole in said cylindrical portion, of a contact anchored
95 to the outer surface of said cylindrical portion below said tap hole and extending downwardly therefrom and then inwardly through the wall of said conical portion into the melting chamber of said furnace.

16. The combination with an electric furnace having a conical base portion and a cylindrical upper portion, a tap hole in said cylindrical portion, of a contact anchored
100 to the outer surface of said cylindrical portion below said tap hole and extending downwardly therefrom and then inwardly through the wall of said conical portion into the melting chamber of said furnace, the exterior portion of said contact being
105 provided with a crescent-shaped cooling chamber surrounding the lower portion of said tap hole.

17. The combination with an electric furnace having a conical base portion and a cylindrical upper portion, a tap hole in said cylindrical portion, of a contact anchored
110 to the outer surface of said cylindrical portion below said tap hole and extending downwardly therefrom and then inwardly
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through the wall of said conical portion into the melting chamber of said furnace, a bowl-shaped member secured to the outer surface of said conical portion and extending outwardly therefrom below said contact and refractory material filling the space between said contact and said member.

18. In an electric furnace, a bottom contact, a portion of which projects exteriorly of the furnace wall and a thin casing of refractory material covering said portion.

19. In an electric furnace, a bottom contact, and a thin casing of refractory material therefor mounted exteriorly of said furnace, said casing covering said contact at its point of entrance into the wall of said furnace and extending upwardly from such point to a plane substantially coincident with the horizontal plane containing the inner end of said contact.

20. The combination with a tilting electric furnace having a melting chamber, a tap hole and an inclined channel extending from the bottom of said chamber to said tap hole, the bottom of said channel being substantially horizontal when said furnace has reached its limit of tilt as in a pouring operation, of a bottom contact for said furnace extending through the wall thereof and entering the melting chamber through the bottom of said channel whereby substantially no portion of the metal of said contact is displaced during a tilting of the furnace, should said contact be in a molten state at the time of tilting.

21. The combination with a tilting electric furnace having a tap hole and a melting chamber, a portion of the bottom of which between said tap hole and the vertical axis of the furnace remains below said tap hole throughout the tilting of the furnace, of a bottom contact for said furnace extending through the wall thereof and entering said chamber within said portion.

22. The combination with a tilting electric furnace having a tap hole and a melting chamber, a portion of the bottom of which between said tap hole and the vertical axis of the furnace remains below said tap hole throughout the tilting of the furnace, of a bottom contact for said furnace extending through the wall thereof and entering said chamber within said portion, and a cooling chamber exterior of the furnace and formed

integral with said contact, said cooling chamber being normally above the inner end of said contact.

23. The combination with an electric furnace, of a water cooled front therefor surrounding the tap hole of the furnace, and a bottom contact attached to said front beneath said tap hole and extending downwardly and inwardly therefrom into the melting chamber.

24. The combination with an electric furnace, of a bottom contact therefor attached to the outer surface of said furnace immediately beneath the pouring spout thereof, said contact extending into the melting chamber from such point of attachment through the adjacent wall of the furnace and entering said chamber at a point which is normally below the outer end of said contact.

25. The combination with an electric furnace, of a bottom contact therefor attached to the outer surface of said furnace immediately beneath the pouring spout thereof, said contact extending into the melting chamber from such point of attachment through the adjacent wall of the furnace and entering said chamber at a point which is normally below the outer end of said contact, said outer end being provided with a cooling chamber.

26. The combination with a tilting electric furnace, of a contact therefor designed to project through the wall of the furnace to the contents thereof, and a cooling chamber for said contact mounted exteriorly of the furnace and above the point at which said contact enters said furnace.

27. The combination with a tilting electric furnace, of a contact therefor designed to project through the wall of the furnace to the contents thereof, a cooling chamber for said contact mounted exteriorly of the furnace and above the point at which said contact enters said furnace, and a refractory pocket for the portion of said contact which lies exteriorly of said furnace whereby leakage of the metal of said contact, should the latter be in a molten state, is avoided.

In testimony whereof, we have subscribed our names.

FREDERICK VON SCHLEGEL.
WILLIAM B. LEWIS.