

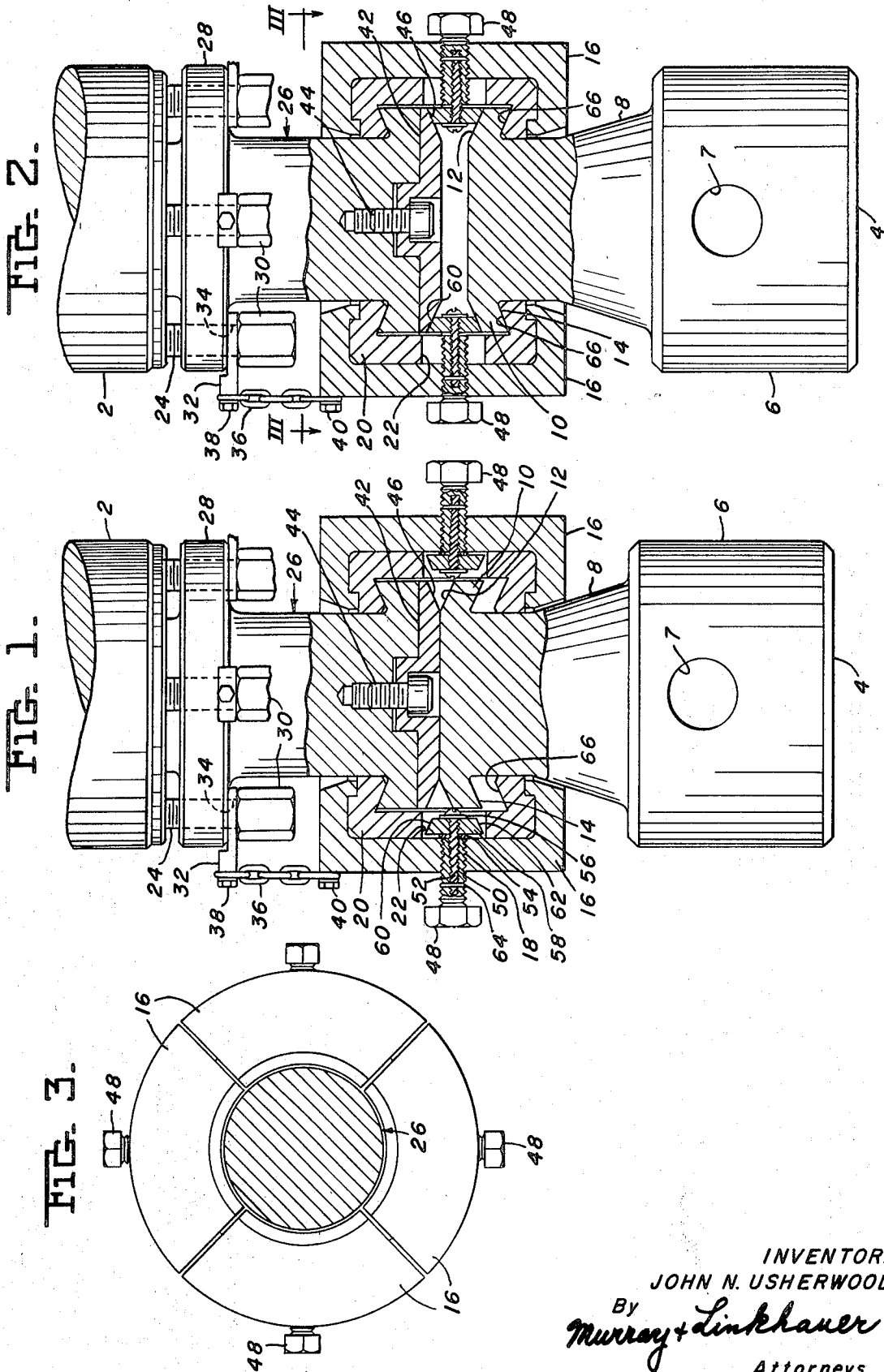
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APPARATUS FOR CONNECTING RAM TO ELECTRODE

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APPARATUS FOR CONNECTING RAM TO ELECTRODE

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3 Claims

ABSTRACT OF THE DISCLOSURE

A furnace electrode structure wherein increased electrode weight promotes the electrical and mechanical connection to the current source ram, are obtained by using an electrode stub having an undercut beveled portion and an upwardly facing beveled surface, a ram stub member having a downwardly facing beveled surface, a plurality of exterior segment members with interior liners electrically connecting the ram-stub member to the electrode stub, and a plurality of thread-bearing members, one in each segment member, urging a wedge-shaped part between said upwardly and downwardly facing beveled surfaces.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to apparatus for connecting electrodes to rams. More particularly, it is concerned with the connection of elongated electrodes of metal to be melted to current source rams or the like in furnaces where a metal is melted under oxygen-excluding conditions to improve the metallurgical characteristics observed in the product ingot. Those skilled in the art will appreciate that this field includes not only vacuum induction melting and vacuum consumable-electrode arc remelting, but also inert-gas arc remelting and processes wherein remelting is done with the bottom portion of the electrode to be melted being protected under a layer of slag or the like (Hopkins process).

Description of the prior art

The requirements for a ram-to-electrode connection means are well known to those skilled in the art. Such a connection means should be effective over a wide range of electrode weights. It should be capable of carrying to the furnace the maximum rated current. It should connect and disconnect conveniently. It should lock the electrode on the upright axis of the furnace and prevent swinging of the electrode due to electromagnetic or other forces at the lower end of the electrode. The locking and disconnecting action should be positive. It should include provisions for welding together sections of electrodes in the furnace or the like by applying pressure to downward direction without danger of misalignment of the electrode. It should have a relatively low initial cost. It should have very low or minimal maintenance cost due to replacement of wearing parts. Most particularly, it should provide wealth for the support of electrodes of substantial weight, and for the conveying of maximum current thereto from the ram.

Of the known prior art structures for the above purposes, perhaps the most commonly used is that of Pat. No. 3,046,319. In this patent, the weight of the electrode is supported by friction developed between the inner surfaces of the ring of tilting cams and at the outer surface of the electrode stub. Such cams do not prevent the electrode from swinging under the action of electromagnetic forces, are subject to occasional failure due to electrodes slipping out as it is only friction that is used to support the electrode, cannot effectively push a stub or

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electrode section downward to complete a weld, have a relatively high initial cost, and have a very high maintenance cost due to the fact that wearing parts are contour-turned cams of special copper alloy.

Another form of electrode clamp is that shown in U.S. Pat. No. 3,187,079. Although satisfactory for many purposes, the structure shown therein is not especially satisfactory for the supporting of electrodes of great weight, since the weight of the electrode is not used to promote the security of the electrical or mechanical connection between it and the ram.

In the structure of Pat. No. 3,215,974, increased electrode weight is used to promote both the electrical and the mechanical connection between the electrode and the ram, but the structure there shown is suitable only for electrodes of relatively limited weight and for use when the current to be applied to the electrode is relatively modest. The weight of the electrode needs to be supported by a cage movable within an axial aperture of the electrode holder, and all the current needs to be supplied to the electrode stub through the portions of the surface of one or more balls of beryllium-copper or the like that are, as taught in the patent, brought into contact with the exterior of the electrode stub.

DESCRIPTION OF THE DRAWINGS

A complete understanding of the invention may be had from the foregoing and following description thereof, taken together with the accompanying drawings, in which:

FIG. 1 is a sectional view of the clamp of the present invention, illustrating a relationship between the parts of the clamp and stub during the connecting action;

FIG. 2 is a sectional view of the clamp of the present invention showing the relationship between the elements of the clamp and the stub when the stub is locked to the clamp; and

FIG. 3 is a sectional view, taken on the line III—III of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The apparatus of the invention serves to connect to the ram 2 an electrode (not shown) that is attached to the surface 4 of the electrode stub 6. The electrode stub 6 is welded or otherwise connected to the electrode in a suitable manner, as will be understood by those skilled in the art. Extending through the electrode stub 6 in a generally horizontal direction, there is an opening 7 that is used, as is well known, for crane purposes.

The electrode stub 6 has a neck or other portion of reduced diameter 8, and near the top thereof a flange 10. Near the top exterior of the flange 10, there is an upwardly facing beveled surface 12, for a purpose hereinafter later to be more fully explained. The flange 10 further has an undercut beveled portion such that there is presented a downwardly facing beveled surface 14 of substantial extent.

The apparatus of the invention further comprises, as will be seen, a plurality of segments 16 that are arranged exteriorly of the electrode stub 6 and are, as best seen in FIGS. 1 and 2, C-shaped in vertical cross section. The segments 16 have, extending horizontally therethrough, threaded openings 18, for a purpose hereinafter more fully explained.

Fitting snugly interiorly of the segments 16, there are provided liner members 20, which are preferably made of material of high electrical conductivity, such as copper. In contrast, the members 16 are conveniently made of other material of greater strength, such as steel. The liner members 20 also have therein openings 22 that are adapted to be registered with the openings 18 in the segments 16.

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The ram 2 comprises a plurality of studs 24 that extend downwardly therefrom and are threaded at their bottoms. There is provided a ram-stub member 26 having near its top a flange 28 that contains a plurality of openings within which the studs 24 may be received, so that the ram-stub member 26 may be secured to the ram 2 by means of a plurality of nuts 30.

Fitted between the flange 28 and the nut 30, in some cases, there is preferably a lug 32 having therein an opening 34, through which the stud 24 passes, with the lug 32 having one end of a chain 36 secured to it by means of a bolt 38, with the other end of the chain 36 being secured to a segment 16 by means of a bolt 40.

The ram-stub member 26 further comprises a wear plate 42 that is secured to the body of the ram-stub member 26 by means of a centrally located, upwardly extending screw 44 and has, at the bottom exterior of the ram-stub member 26, a downwardly facing beveled surface 46.

Extending through each of the threaded openings 18, there is a bolt 48 that has exterior threads matching with the opening 18 and interior threads 50. By means of a bolt 52 having exterior threads mating with the interior threads 50 and washers 54 and 56, there is secured to the bolt 48 a piece 58 having an upwardly facing beveled surface 60 and a downwardly facing beveled surface 62. The surfaces 60 and 62 are adapted to match with the surfaces 46 and 12 respectively. An opening 64 extending radially through the structure comprising the bolts 48 and 52 is provided with a pin, which insures that the bolts 48 and 52 turn as one unit.

In the construction of the apparatus described above, the liner member 20 is slid circumferentially into the interior of the segments 16 until the opening 22 therein registers with the opening 18 in the segment 16. The bolt 48 is then threaded into the opening 18, and after the washer 54, the piece 58, and the washer 56 have been suitably placed, the bolt 52 is run into the threaded opening 50, so that the desired opening 64 is obtained and filled with the above-mentioned pin. Thereafter, the piece 58 serves to prevent circumferential movement of the lining member 20.

It will be apparent that the apparatus described above can be used in the following manner. The electrode stub 6, with an appropriate electrode welded thereto, is brought into the vicinity of the ram 2. The segment members 16, suspended upon their chains 36, are placed around the flange 10 of the electrode stub 6. The ram 2 is then operated in an upward direction, causing the surface 14 of the flange 10 to be brought into contact with the surface 66 of the liner 20, as shown in FIG. 2. To secure the structure in this position, the bolt 48 is operated to run the piece 58 inwardly, causing its surfaces 60 and 62 to come into contact with the beveled surfaces 46 and 12, respectively, as aforesaid.

By means of the invention, there is obtained a structure of relatively light weight and small vertical extent that is altogether satisfactory for supporting large and heavy electrodes and conveying large amounts of electrical current thereto. Electrical current flows to the electrode from the ram 2 through the ram-stub member 26, liner members 20, and electrode stub 6. All of these are made of material of high electrical conductivity, except that the electrode stub member 6 is preferably made of the same material as the electrode, to avoid contamination of an ingot top in the event that a melting operation is carried somewhat farther than intended.

While I have shown and described therein a certain embodiment of my invention, I intend to cover as well

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any change or modification therein which may be made without departing from its spirit and scope.

I claim as my invention:

1. Apparatus for connecting a ram to an electrode comprising, in combination,
 - a an electrode stub having a bottom surface by which it is capable of being attached to said electrode, a horizontally extending opening being provided in said electrode stub, said stub having an upper surface having an edge portion with an upwardly facing surface beveled at an angle with respect to the horizontal, and said stub having an undercut beveled portion that presents downwardly a surface of substantial extent,
 - a plurality of exterior segment members, each of said segment members being generally C-shaped in vertical cross section and having therein an interiorly threaded opening extending horizontally thereof, each such segment member having near its bottom an upwardly facing surface adapted to be brought into area contact with said downwardly facing surface of said undercut beveled portion of said electrode stub,
 - a plurality of members of high electrical conductivity, each received within one of said segment members and each having therein an opening adapted to register with one of said openings in said segment members,
 - a ram-stub member of good electrical conductivity having means for connecting it to said ram, and having further a flange near to the bottom thereof, said flange being adapted to be brought into close contact with all of said members of high electrical conductivity by means of an upwardly facing surface of said flange that, approaching the center of said apparatus, is beveled downwardly with respect to the horizontal, said ram-stub member further having a downwardly facing beveled surface near to its bottom exterior,
 - means securing said ram to said segment members and a plurality of members, each being threadedly engaged with one of said threaded openings and having at an interior end thereof a wedge-shaped member adapted to be brought into contact with said upwardly facing beveled surface of said electrode stub and said downwardly facing beveled surface of said ram-stub member.

2. Apparatus as defined in claim 1, characterized in that said means associated with said ram for securing thereto said segment members comprise a plurality of chains secured at one end to a lug attached to said ram and secured at an opposite end to one of said segments.

3. Apparatus as defined in claim 1, characterized in that said ram-stub member comprises at its bottom a plate of wear-resistant material secured to the body of said ram-stub member, said wear plate containing said downwardly facing beveled surface of said ram-stub member.

References Cited

UNITED STATES PATENTS

2,726,278	12/1955	Southern	13—14 X
3,014,119	12/1962	Jorgensen	13—18 X
3,046,319	7/1962	Daley	13—14
3,363,083	1/1968	O'Conner	13—16 X

H. B. GILSON, Primary Examiner

U.S. Cl. X.R.

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