Dec. 30, 1958 J. G. HOWELL, JR., ET AL 2,866,960

ELECTRODE AND HOLDER ASSEMBLY

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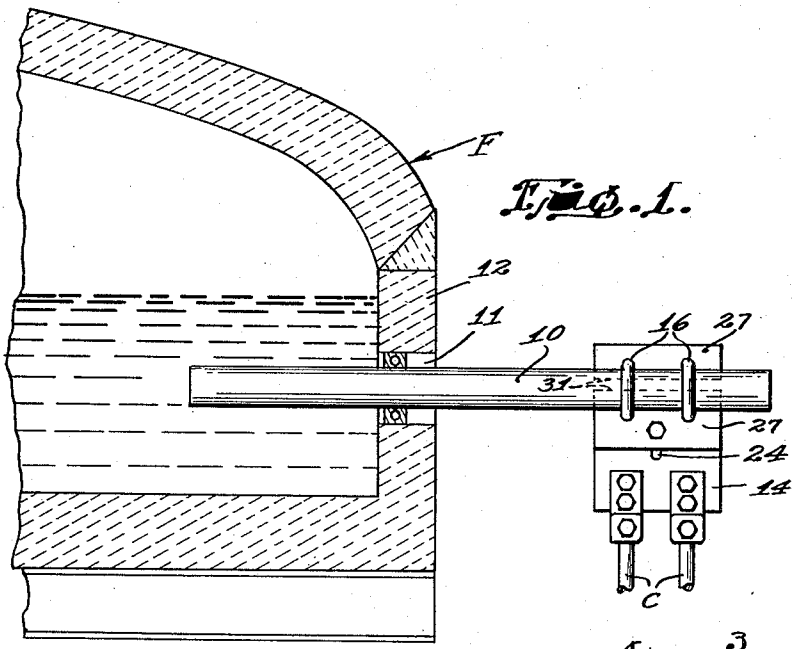


Fig. 1.

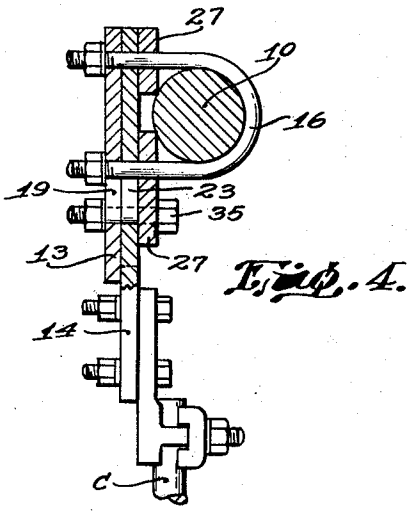


Fig. 4.

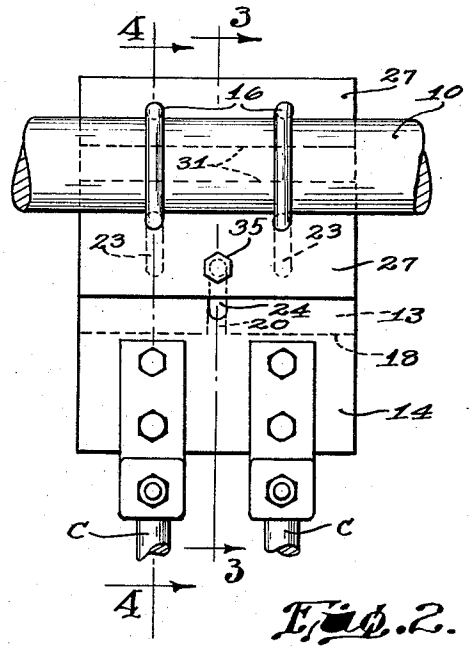


Fig. 2.

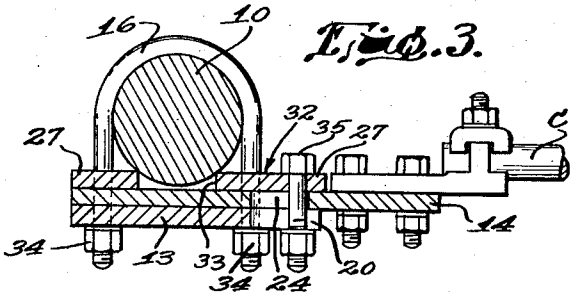


Fig. 3.

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ELECTRODE AND HOLDER ASSEMBLY

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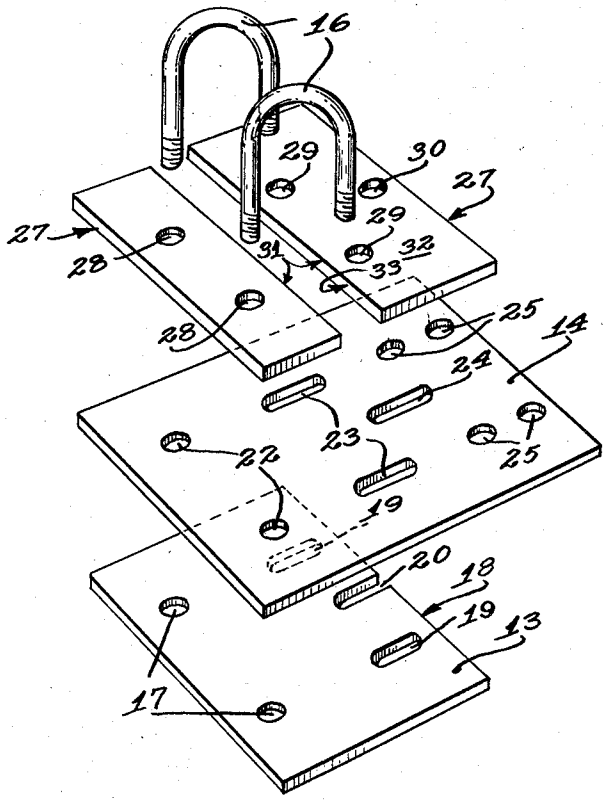


Fig. 5.

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ELECTRODE AND HOLDER ASSEMBLY

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6 Claims. (Cl. 339—265)

Our invention relates to electrode and holder assemblies and holders or clamps per se and more particularly to holders especially adapted for use with electrodes employed in the electric melting of glass batch and electric boosting in fuel oil or gas fired glass melting furnace as well as other similar melting operations where the use of electric power is involved. Electrodes, such as are employed for the above indicated purposes generally are formed of molybdenum and because of manufacturing procedures seldom are accurate as to cross-sectional shape and dimensions and not infrequently have their surfaces coated with an oxide film or scale. Thus, it is impractical to expect the attainment of needed effective large surface area contact between the electrodes and conventional holders or clamps such as is required for low resistance flow of electric current. Further, electrodes are slowly consumed and for this reason it is most desirable to provide means facilitating repositioning such electrodes in or removal from their holders or clamps in order to obtain the most effective performance.

An object of our invention is the provision of means for effectively overcoming the above indicated existing objections to conventional assemblies and to that end our electrode holder has been so designed that it is capable of adequately adjusting itself to compensate for variations in the contour of electrodes and safely developing sufficient pressure to break through the high resistance oxide film and therefore produce the required metal to metal electrical contact.

A further object is the provision of an electrode holder in which narrow line contact between the electrode and holder surfaces engaged thereby is created, to the end that the oxide film may effectively be penetrated.

It is also an object of our invention to provide a holder capable of easy and rapid adjustment to accommodate a wide range of sizes of electrodes.

Other objects will be in part apparent and in part pointed out hereinafter.

In the drawings:

Fig. 1 is a fragmentary sectional view of a glass melting furnace showing our electrode and holder assembly functioning in a booster capacity.

Fig. 2 is a plan view of the holder or clamp with a rod-type electrode.

Fig. 3 is a sectional view with parts in elevation taken substantially along the line 3—3 of Fig. 2 with parts adjusted to positions to accommodate an electrode of large diameter.

Fig. 4 is a sectional view partly in elevation taken substantially along the line 4—4 of Fig. 2.

Fig. 5 is a perspective view showing the several plates, bars, etc., in separated or exploded relationship.

In the drawings, we have illustrated our invention in conjunction with a glass melting furnace F, the electrode and holder assembly in this instance functioning as a booster or supplemental heating means.

The electrode and holder assembly comprises a rod-like electrode 10 which preferably is formed of molybdenum or some other suitable metal. These electrodes, when used as boosters, may project horizontally through openings 11 in the side walls 12 of the furnace at such a level that those portions of the electrodes within the furnace are completely immersed in or covered by the molten glass.

The holder or clamp which provides effective adjustable supporting means for the electrode 10 comprises a plurality of plates and U-bolts which when assembled with a rod-type electrode provides plural line contact between the electrode and portions of the holder in such fashion as not only to compensate for irregular contour of unmachined electrode rods, but additionally, to penetrate entirely through any oxide or other film or scale that might be present on the electrode surface. In the illustrated embodiment of our invention the holder comprises a rigid steel first plate 13 of generally rectangular form, a somewhat larger second plate 14 formed of copper or some other suitable electric current conductive material lying upon the steel first plate 13, a pair of electrode contact bars 27 positioned upon the aforementioned copper plate and themselves preferably formed of copper and a pair of U-bolts 16 which perform the twofold function of securing the several plates and bars together and bringing the electrode into such firm contact with narrow line portions of the contact bars 27 that breaking through any coating or film on the electrode and creating current conducting metal to metal contact is positively assured.

The first plate 13, which may be formed of steel, or other like material to provide rigidity in the holder, is formed near one margin with a pair of relatively widely spaced holes 17 and adjacent the opposed parallel margin 18 with a pair of short closed-ended slots 19, the longitudinal axes of which extend through and in a direction normal to the axis of said pair of said holes 17. Medially of these two closed-ended slots 19 and extending parallel therewith is an elongated notch 20 which opens through the aforementioned margin 18 of the plate 13.

The second plate 14 which is the primary conductor and directly connected to cables C is of generally rectangular form and lies against one face of the steel plate 13. This second plate has a pair of spaced openings 22 in register with the previously mentioned holes 17 in the first plate 13 and a pair of slots 23 which register with the described closed-ended slots 19 in the latter plate. A third intermediate slot 24 registers with the previously described notch 20 in the first plate. Beyond the slots and notch are several openings 25 providing for attachment of cable connectors 26 and the aforementioned cables C.

Overlying that portion of the second plate 14 which actually contacts the first or steel plate 13 is a pair of electrode contact bars 27 preferably formed of copper. One of these bars is provided with a pair of openings 28 which are in alignment with the previously mentioned pairs of holes and openings 17 and 22 in the first and second plates 13 and 14, respectively. Two spaced openings 29 in the other contact bar 27 register with the pairs of aligned slots 19 and 23, while a third opening 30 in this second contact bar registers with the intermediate slot 24 and notch 20. The previously mentioned pair of U-bolts 16 are intended to securely hold the electrode 10 in such position that narrow sharp line electrical contact is effected between circumferentially spaced longitudinal extending areas of the electrode surface and the adjacent upper corners 31 of the contact bars 27 provided at the juncture of the upper and inner side surfaces 32 and 33, respectively. These U-bolts include pairs of arms 16*a* having threaded end portions, such arms straddling the electrode and extending through the previously described registered or aligned holes and openings. Nuts 34 are threaded onto the extremities of these arms 16*a* and

effectively secure the plates and bars together and apply sufficient pressure to the electrode to cause, where necessary, penetration of the corners 31 of the contact bars through any film or scale that might be present, with the result that a perfectly satisfactory electrical contact is established between the contact bars and electrode.

A bolt 35 extends through the opening 30 in the second contact bar 27 and downwardly through the aligned slot 24 and notch 20 and in part provides for shifting of the second contact bar in relation to the other bar in order that U-bolts of various dimensions as required by differences in the diameter of the electrodes may be accommodated. It is apparent that with a larger diameter electrode than that shown in Fig. 3, for example, U-bolts with more widely spaced arms would be required in consequence of which the contact bar nearest the cable C would have to be moved laterally away from the other bar as indicated in Fig. 3. As also shown in Fig. 4, one arm 16*a* of each U-bolt extends through aligned slots 19 and 23. By reference to Figs. 3 and 5, it will be apparent that the structure illustrated and described is quite capable of performing the functions attributed to it and it is thought that the manner of adjusting and/or removing parts is entirely obvious in view of the foregoing and without further elaboration.

Modifications may be resorted to within the spirit and scope of the appended claims.

We claim:

1. In combination an electrode and holder therefor, a rigid first plate, a second plate lying upon one face of the first plate and formed of electric current conductive material, a pair of electrode contact bars arranged in parallel spaced apart relationship upon said second plate, said bars being of such cross-sectional shape as to provide a pair of opposed narrow elongated electrode contact surfaces, an electrode of rod-like form generally cylindrical in cross-section disposed parallel to the length of said contact bars with two circumferentially spaced longitudinal areas in line engagement with said contact surfaces, means common to the plates and electrode for securing the plates together and the electrode in firm engagement with the contact bars and means whereby cables may be connected to the second plate.

2. The combination defined in claim 1, the securing means comprising a U-bolt straddling the electrode and having arms extending through all of said plates and the contact bars.

3. The combination defined in claim 2, the first and second plates having elongated aligned slots therethrough extending in a direction at right angles to the length of the contact bars to receive one arm of the U-bolt and provide means for accommodating U-bolts of varying dimensions as to the arm spacing.

4. An electrode holder comprising a rigid first plate, a second plate lying upon one face of the first plate and formed of electric current conductive material, a pair of electrode contact bars arranged in parallel spaced apart relationship upon the second plate, said bars shaped in cross-section to provide a pair of narrow line elongated electrode contact surfaces extending the full length of the bars and means including at least one U-bolt for securing the plates and bars together and an electrode in engagement with the line contact surfaces of the bars.

5. The combination defined in claim 4, each of the electrode contact bars being of such cross-sectional shape that the narrow elongated electrode contact surface of each is a line at the juncture of top and innermost substantially vertical walls.

6. The combination defined in claim 1, the securing means comprising a pair of U-bolts straddling the electrode and having arms extending through all of the plates and contact bars, the first and second plates having slots to receive one arm of each U-bolt whereby to provide means to accommodate U-bolts of varying dimensions as to arm spacing as required by the variations in the cross-sectional dimensions of the electrode.

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