April 18, 1961 G. E. CONWAY 2,980,596

ELECTROLYTIC REDUCTION FURNACE CONSTRUCTIONS AND METHOD

Filed Dec. 27, 1956 3 Sheets-Sheet 1

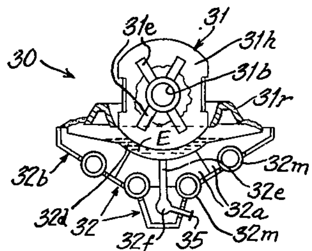

Fig. 6.

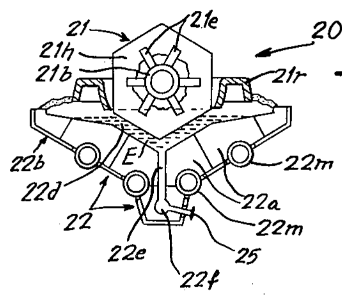

Fig. 5.

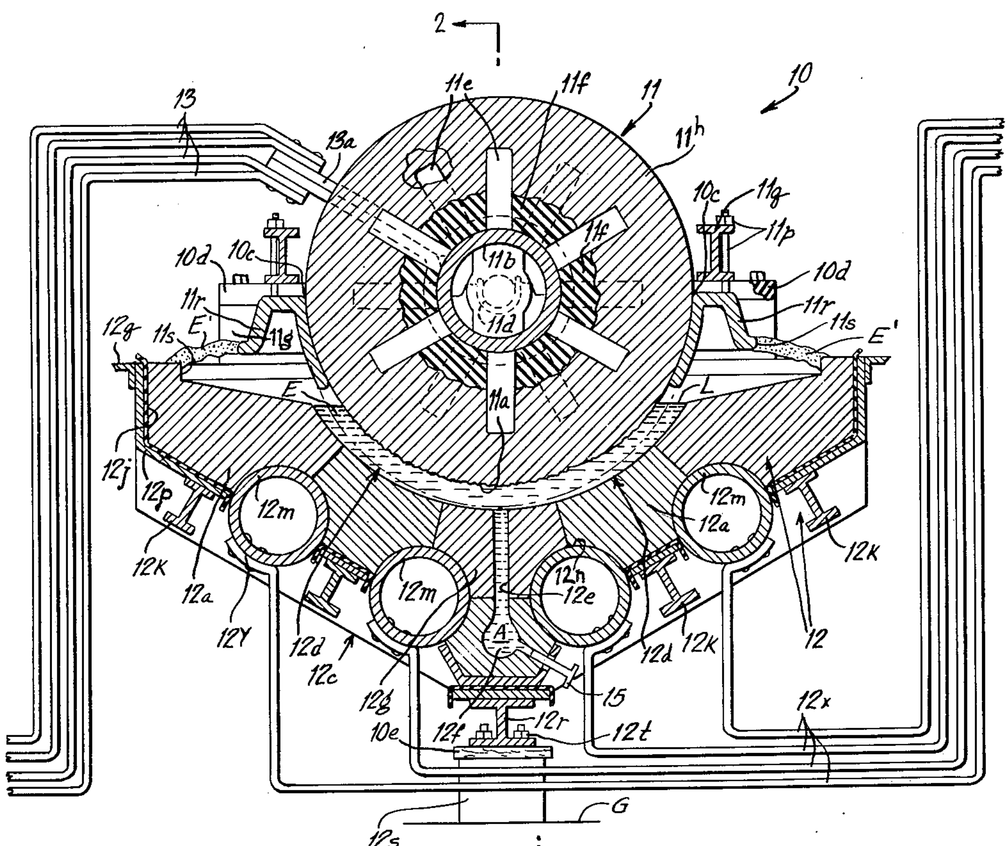

Fig. 1.

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Fig. 2.

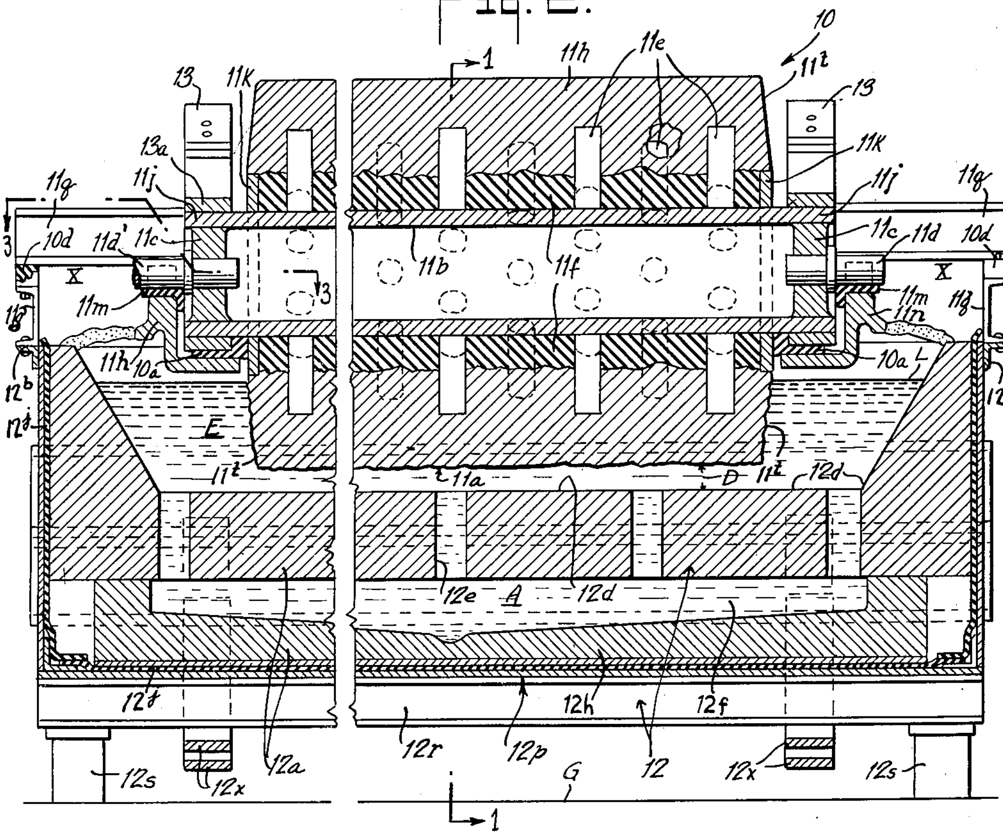
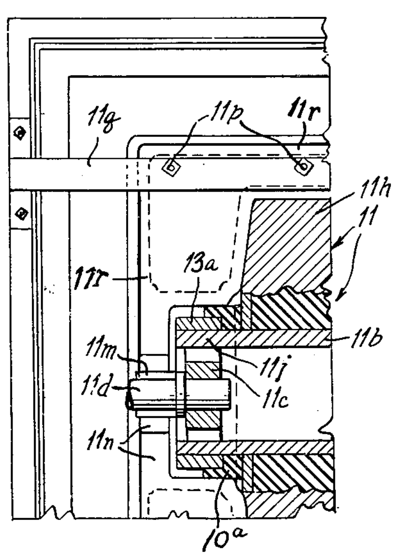


Fig. 3.



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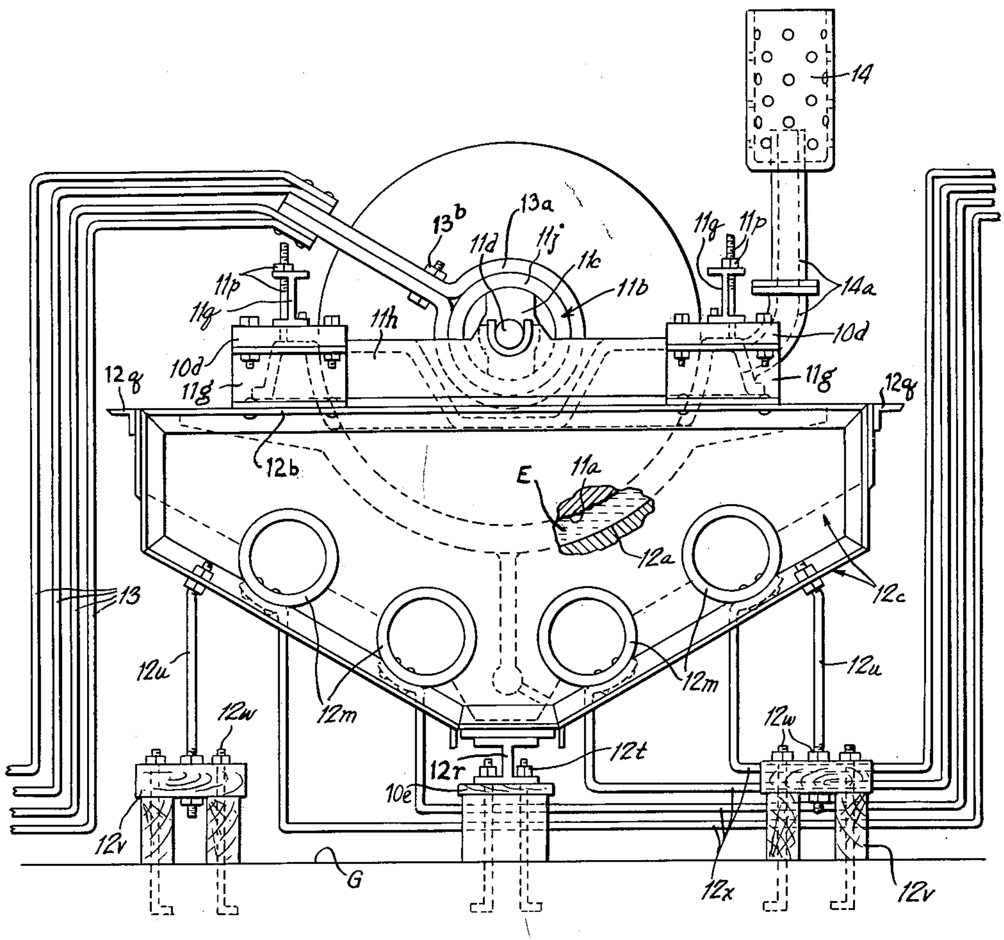

Fig. 4.

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ELECTROLYTIC REDUCTION FURNACE CONSTRUCTIONS AND METHOD

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11 Claims. (Cl. 204—67)

This invention relates to electrolytic reduction furnace constructions, such as used in aluminum production and other like purposes, and the method features of operation thereof.

Among the objects of the invention is to generally improve electrolytic reduction furnace constructions of the character described and the method of operation thereof, which construction shall comprise few and simple parts assembled to form a compact easily operating apparatus by a method requiring a minimum of supervision, attention and maintenance, which shall provide a ready means and method of operation for keeping the furnace in most efficient operation, which shall feature a horizontally disposed cylindrically shaped anode mounted for axial rotation to alternately immerse opposite surfaces thereof in a molten electrolyte, which anode shall initially be provided with a prebaked surface of carbon paste and be arranged for subsequent refinishing in situ, which construction and method provide and maintain uniform spacing between anode and cathode, which shall be capable of giving productive service with less operational adjustment than heretofore, which construction shall be relatively inexpensive to manufacture and which shall be efficient and practical to a high degree in use.

Other objects of the invention will in part be obvious and in part hereinafter pointed out.

The invention accordingly consists of features of constructions and method, combinations of elements and arrangements of parts which will be exemplified in the constructions and method hereinafter disclosed, the scope of the application of which will be indicated in the claims following.

This application is a continuation-in-part of my application Serial No. 412,310, filed February 24, 1954, now abandoned, entitled "Electrolytic Reduction Furnace Construction and Method of Operation."

In the accompanying drawing in which embodiments of the invention are shown:

Fig. 1 is a transverse sectional view taken on line 1—1 in Fig. 2 of an improved electrolytic reduction furnace construction embodying the invention having a cylindrical anode mounted for rotation on its horizontally disposed axis.

Fig. 2 is a shortened longitudinal vertical sectional view taken on line 2—2 in Fig. 1 showing details of said improved construction, a mid-portion thereof being broken away.

Fig. 3 is a detailed fragmentary cross-sectional view taken on line 3—3 in Fig. 2 showing details of an end bearing structure.

Fig. 4 is an elevational end view of said improved furnace construction shown in Figs. 1 to 3, and

Figs. 5 and 6 are views each similar to Fig. 1 showing the general contour of various other illustrative cross-sectional shaped improved anode and pot portion furnace constructions that may be employed in practicing the invention.

Referring in detail to the drawing, 10 denotes an

electrolytic reduction furnace construction embodying the invention, here shown for example, as used for the production of aluminum.

Furnace construction **10** here shown may comprise an elongated cylindrical anode **11** positioned with an axis X—X thereof horizontally disposed and fitted to have a curved peripheral surface portion **11***a* thereof positioned to extend down into a pot portion **12** in an operative spaced relation from a cathode lining **12***a* of the latter and may normally be in a substantially concentric relation with respect to said anode surface portion **11***a*, as is clear from Figs. 1, 2 and 4.

Anode **11** may comprise a body portion including a metallic current carrying tube **11***b* terminated at opposite ends **11***j* thereof by spider hubs **11***c* from which outwardly project shafts **11***d* and **11***d'*. Shafts **11***d* and **11***d'* are aligned along said axis X—X about which said anode tube **11***b* may be rotated in journal heat insulating bearing blocks **11***m* carried in spaced apart horizontally disposed cradle cross bars **11***n*. The latter have the opposite ends thereof joined for support with spaced apart longitudinally extending baffle members **11***r* and are heat insulated from anode **11** by suitably inserted liners or shims **10***a*, as is clear from Fig. 2. The enclosure formed by said baffle members **11***r* and said cradle cross bars **11***n* encircling anode **11** is supported from horizontally extending parallelly aligned I-beams **11***q* with said cradle bars **11***n* dependingly mounted from said beams **11***q* through suitable end level adjusting means, such as, for example, hanger bolts **11***p*. An end of shaft **11***d'* beyond bearing block **11***m* shown broken away in Fig. 2 may be made to extend beyond furnace **10** for connection with any suitable means (not shown) for rotating anode **11** on its axis X—X in the manner and for the purpose hereinafter described.

As is clear from Figs. 1, 2 and 3, since I-beams **11***q* together with baffles **11***r*, hanger bolts **11***p*, cradle cross barns **11***n* and anode **11** are mounted in position to form an adjustable assembly for the latter, said assembly may be electrically insulated from relatively stationary channel brackets **11***g* which extend upwardly from frame structure **12***b* of pot portion **12** and is suitably electrically insulated by block liners or shims **10***d*. Said assembly, therefore, through hanger bolts **11***p* can be made effective for lowering or raising anode **11** to set the gap or distance D between the anode surface portion **11***a* and underlying liner cathode **12***a*.

Extending radially outward from said anode tube **11***b* in spaced apart staggered circumferential rows, there are provided metallic electric current distributor studs or extensions **11***e*. The latter serve to conduct the current from the anode tube **11***b* through a bed or covering layer of heat insulating material **11***f* extending about outer surface of tube **11***b* and partly about studs **11***e*. Said insulating layer **11***f* may be of a thickness to reach a mid-section of the length of studs **11***e* with the remaining free end portions thereof firmly embedded in current carrying contact with a surrounding shell of carbon material **11***h*, a down facing portion of which provides the effective electrical terminal below bath level L of molten electrolytic material E comprising cryolite with alumina dissolved therein. From the molten bath of said material E, aluminum product A is extracted in pot portion **12** which flows down into reservoir **12***f*, as is clear from Figs. 1 and 2.

To confine said heat insulating layer **11***f* as a compact body and against accidental crumbling at opposite ends thereof wherethrough anode end terminals **11***j* extend, there may be provided suitable fitted disc closures **11***k*. Said anode end terminals **11***j* may be joined in electrical circuit with positive side (+) of an electric power cable **13** extending from a suitable supply source (not shown) in the well understood manner through suitable connectors, such as, terminal clamp rings **13**a, as is clear from Figs. 2 and 4.

Pot portion **12** may have said cathode lining **12**a thereof formed of current carrying carbon block sections or bricks fitted together inside box-like framework **12**c to provide a trough **12**d of arcuate cross-sectional shaped contour in which said material E is retained until the molten aluminum product A produced gravitates through passageways **12**e into lined reservoir **12**f in establishing an operative bath level L in trough **12**d. Said passageways **12**e may be channeled down through an inverted keystone or center carbon brick **12**g of cathode lining **12**a and reservoir **12**f hollowed out of or otherwise formed in carbon brick structure **12**h in the underportion of cathode lining **12**a, as is clear from Figs. 1 and 2.

Box-like framework **12**c may be constructed to include a suitable casing **12**p for enclosing the bottom, sides and ends of pot portion **12** braced by angle members **12**q extending along the edges thereof and spaced apart beams **12**k serving as bottom ties and supporting structure for the casing and contents thereof. Suitable sheet material sheathing **12**j having heat insulating properties is provided between casing **12**p and the cathode lining **12**a.

As part of the electrical circuit associated with cathode lining **12**a, there is provided metallic load and current carrying tubes **12**m which may be alternately spaced apart with respect to tie beams **12**k and held in direct electric contact along the length thereof by being tightly fitted and cemented with a suitable carbon paste in channeled portions **12**n provided on the down facing side of the various block sections comprising cathode lining **12**a, as is clear from Fig. 1.

The entire pot portion **12** may be rigidly supported from the floor or ground G in any suitable manner, as for example, on a centrally extending main I-beam **12**r resting on end piers **12**s rigidly secured by bolts **12**t anchored to floor G. Said framework **12**c as well as the entire cathode pot portion **12** may be electrically insulated from the ground by providing insulating means **10**e between said end piers **12**s and I-beam **12**r, as is clear from Figs. 1 and 4. Additional spaced apart bracing means, such as, guy rods **12**u also suitably insulated from ground G may be provided, each fastened to a block pier **12**v secured by floor anchoring bolts **12**w.

Metallic tubes **12**m serve as distributed circuit current collectors for the electrical power passing from anode **11** through lining cathode **12**a. The latter may be connected in circuit in any suitable manner as by riveted joints **12**y with each tube **12**m through cables or bus bars **12**x to the electric power negative side (−) which extends from said power supply source (not shown).

Anode **11** when not in operation may be positioned with sufficient clearance with respect to encircling baffle members **11**r and cradle bars **11**n so as not to interfere with turning movement given anode **11** in bearing blocks **11**m whereby inspection of anode surface portion **11**a is facilitated and giving ready access for reconditioning and repairing of any section of anode surface portion **11**a as required. Anode **11**, when in operation, may have spaces forming said clearance caulked with a removable suitable packing of clay or other suitable material as at **10**c to prevent leakage or seepage of combustible waste gas confined under baffle members **11**r, as is clear from Fig. 1.

Baffle members **11**r and cradle bars **11**n may be formed to provide upfacing inlet feeding openings **11**s for furnace construction **10** into which the required granulated cryolite and alumina comprising said material E are dumped or shoveled in proper sequence during operation thereof.

Since combustible waste gases are continuously given off from the molten material in furnace construction **10** being subjected to the electrolytic reduction, there may be provided one or more suitable burners **14** which may be mounted by pipe fittings **14**a to connect with the underside of baffle members **11**r so that combustible gases generated during the operation collect and rise up, pass through fittings **14**a and are consumed by burners **14** thereby safely disposing of such gases.

Suitable carbon material may be utilized for forming carboniferous shell **11**h of the anode as well as the various blocks forming the lining of cathode **12**a. In the first instance, shell **11**h and cathode **12**a may be made of similar composition, as for example, from pulverized coal and coke bound with pitch or asphalt into a paste which is formed into required shapes in a mold and then cured to hardness by baking in an oven at suitable temperatures. The composition of these carbon pastes and method of forming into cathode structure are well known in the art.

After assembling furnace construction **10** from the parts and in the manner shown and described, the anode **11** by means of level adjusting hanger bolts **11**p is adjusted to bring anode carbon surface portion **11**a and the surface of cathode lining **12**a in contact. Granulated cryolite is then poured through said inlet feeding openings **11**s into pot portion **12** between the surfaces of the cathode lining **12**a and anode surface portion **11**a not in contact. On energizing the circuit, the current passing from power cables **13** through ring connectors **13**a to anode tube **11**b and from studs **11**e is distributed through anode surface portion **11**a for the heating operation that will cause the cryolite to melt. The anode surface portion **11**a from said contacting position is then lifted and gradually adjusted by hanger bolts **11**p until a gap distance D in a proper operating desired range is reached while more cryolite is added and melted until a bath thereof is provided in the furnace construction **10** between said anode surface portion **11**a and cathode trough **12**d.

A charge of alumina E is next fed into openings **11**s which dissolves in the molten cryolite. The heated alumina E froths up into said openings **11**s and forms a crust E′ sealing the latter over bath level L. As the furnace **10** continues in operation, the alumina E dissolved in the bath is reduced by electrolysis to aluminum metal A which collects at the cathode and being in a molten state at the operating temperatures of the furnace gravitates down passageways **12**e into reservoir **12**f. Thus, current from the anode surface portion **11**a is passed through the electrolytic bath to the cathode liner **12**a and is collected by the distributed cathode tubes **12**m to flow through bus bars **12**x and generally may then be passed to one or more other furnaces **10** connected in series.

It should be noted that anode **11** has hollow current carrying anode tube **11**b incorporated with layer **11**f of a suitable refractory material such as, asbestos wool, fire brick, or similar material, as a heat insulated structure and by means of the openings in spider hubs **11**c is provided with circulation of cooling air through its hollow center. Anode **11** also has the arrangement of the free ends of the staggered radially extending current distributing studs **11**e permanently embedded in carbon shell **11**h for effective and even distribution of power so that anode **11** may be intermittently turned in bearing blocks **11**m when found necessary for maintaining a smooth relatively unpitted section of surface portion **11**a immersed in the molten material being subjected to electrolytic reduction action so as to practically eliminate the trapping of gases along said anode surface portion **11**a thereby increasing the operation efficiency.

As described above, anode surface portion **11**a is of curved construction, gases evolved and rising during the electrolytic reduction operation are not trapped or do not readily adhere thereon but are more readily guided to float free from the molten electrolyte bath which is desirable. Since less than one-half of said surface portion **11**a is used during each continuous run of operation of furnace construction 10, such surface portion 11a in use that may require inspection, maintenance or rebuilding can be readily attended to by simply turning anode 11 in cradle bearing blocks 11m on axis X—X by suitable hand or power means connected to axial shaft 11d' to bring said consumed surface portion 11a in a fully exposed upfacing position for working thereon while furnace construction 10 continues to operate with another anode surface portion 11a positioned in effective immersed position.

A further improved feature is provided by the arrangement of said cathode tubes 12m which may be aircooled internally and externally and by the provision of reservoir 12f positioned at a level to receive the molten metal A by gravity for draining the latter down from gap D and reducing to a minimum the necessity or readjusting the gap distance D for best electrolytic reduction action.

As the electrolytic reduction action in furnace construction 10 continues, outlet valve 15 provided for reservoir 12f is tapped to withdraw the molten aluminum product A from time to time keeping the trough space at gap D drained.

One of the primary objects of this invention is to provide a novel furnace construction and method of operation whereby the distance D between the anode and cathode surfaces is maintained substantially uniform at all times and whereby the consumed surface of the anode is refinished periodically without interruption of operation. To this end, electric current distributing studs 11e are permanently embedded in anode 11 and extend radially to terminate a sufficient distance short of anode surface 11a to prevent exposure thereof due to consumption of carbon shell 11h at said surface 11a during intended normal operation of furnace 10. This distance or thickness of shell beyond said stud ends may vary from about three to nine inches depending on the overall diameter of the anode.

Furnace construction 10 may be built in a wide range of sizes, for example, to accommodate anodes 11 from three to twelve feet in diameter and in lengths from one to two times the diameter.

In operation, furnace 10 may be expected to consume that portion of carbon shell 11h immersed in the electrolyte E up to a depth of ¾ of an inch during a twenty-four hour period of operation. Thus, by changing the immersed surface portion every eight hours, replenishment and refinishing of the consumed surface will be required only to an average depth of ¼ of an inch. This is readily accomplished by utilizing a carbon paste similar in composition to that used in originally forming carbon shell 11h as hereinbefore described. This layer of new carbon paste is applied by any suitable means at a temperature of about 150° C. (known as the "spreading point") which imparts a plastic workable spreading consistency to the paste.

The upturned surface portion of anode 11 during normal operation of furnace 10 will be kept at a temperature of about 200° C. to 300° C. by the radiation of heat from the electrolytic bath E which operates at about 900° C. to 950° C.

Thus, it will be observed that by applying the refinishing carbon paste at the beginning of the period following rotation of anode 11, the newly formed surface will have ample time for said heat radiation to drive off most of the volatile components of the paste material so that the refinished portion will be partly cured to a semi-hardened state. At the end of said period, anode 11 is rotated, exposing a newly consumed portion of surface 11a and introducing said refinished and partly cured portion into the molten electrolytic bath E. Said ¼ inch thick semi-hardened partly cured refinished portion on contact with the molten material E will quickly "fry" and form into a hardened crust that becomes electrically conductive for continuing the proper functioning of anode 11. Said "frying" may be accompanied by sizzling of the newly applied and partly cured layer of carbon paste along the line of entry, anode 11 being rotated at a rate of about one linear foot of circumference per second to effect the change-over to a refinishing surface in operative position immersed in said molten material E in a relatively short period of time. The clamp ring connectors 13a at bolt and nut 13b may be loosened sufficiently to permit rotation of anode 11 but otherwise it is intended that the current be permitted to continue flowing through furnace 11 while said rotation is being accomplished.

It is to be understood that the consumed surface portion of the opposite ends 11t of anode shell 11h will likewise be refinished as required.

From the above, it is seen that the resulting improved method may include the steps of electrically energizing the furnace construction 10 for continuous reduction operation of molten material E while intermittently drawing off excess molten reduced product A and keeping the anode 11 and cathode pot portion 12 in a desired adjusted substantially constant spaced relation. Under normal operating conditions, a gap distance D of about two inches will give satisfactory results, although this may be varied when found desirable. Said continuous operation is maintained by adding alumina periodically as needed, this being accomplished in the well understood manner by breaking away portions of crust E' which seals the openings 11s.

As described hereinbefore, when anode 11 requires refinishing after a predetermined time interval of operation, the seal formed by caulking at 10c is broken away and anode 11a rotated on axis X—X to move a first portion of anode surface 11a which has been consumed to a desired degree out of effective registering alignment with cathode pot portion lining 12a while simultaneously immersing a previously semi-hardened partly cured refinished portion of anode surface 11a in said molten material or bath E which "fries" said refinished portion to a hardened crust having electrically conductive properties. Rotation of anode 11 is continued until an entirely new surface is brought into proper register with said cathode surface 12a and said first consumed portion is accessible for rebuilding and refinishing. Caulking at 10c is then restored and said first consumed portion of anode surface 11a refinished as hereinbefore described. By carrying on this method in successive cycles, furnace 10 is kept in continuous operation for long periods of time without delays or shutdowns and at a minimum of maintenance costs.

While the above description suggests utilizing eight hour intervals between successive rotations of the anode, this is to be taken as illustrative since it may be found desirable to utilize shorter or longer periods when conditions so dictate within the scope of the invention. It will be observed, however, that in the selection of such time intervals, the rate of consumption of the anode shell 11h under a given set of operating conditions, the desirability of maintaining the gap distance D uniform throughout the operative surface and the labor costs involved in carrying out the repositioning and refinishing operation are to be taken into consideration.

While anode 11 is of cylindrical shape having a circular cross section, others such as hexagonal, octogonal or symmetrically arranged segments or sector cross-sectional shapes or the like, may be employed in practicing the invention. Thus, in Fig. 5, a cross-sectional view in outline, like Fig. 2, is shown to illustrate an example of a modified form of the invention in which furnace construction 20 has an anode 21 of hexagonal cross-sectional contour body. Pot portion cathode 22 of said furnace construction 20 may have its lining 22a shaped to conform with anode 21, that is, provided with a trough 22d having sides thereof disposed in angular hexagonal relation corresponding with the contour surface portion of anode 21 spaced therefrom.

Furnace construction 20 otherwise may be made like that shown in more detail in Figs. 1 to 4 and described above for furnace construction **10** and may include similar box framework **22**_b_, passageways **22**_e_, reservoir **22**_f_, cathode tubes **22**_m_, anode tube **21**_b_, anode studs **21**_e_, carbon shell **21**_h_, baffle members **21**_r_ and tapping valve **25**.

In Fig. 6 a cross-sectional view in outline is shown of another modified form of the invention in which furnace construction **30** may be provided with anode **31** formed with symmetrically arranged cross-sectional body sectors. Pot portion cathode **32** of said furnace construction **30** may have a lining **32**_a_ formed with an arcuate shaped trough **32**_d_ conforming with the curved surface portion of sector of anode **31**.

Furnace construction **30** otherwise may be like that shown in more detail in Figs. 1 and 4 as described above for furnace construction **10** and may include box framework **32**_b_, passageways **32**_e_, reservoir **32**_f_, cathode tubes **32**_m_, anode tube **31**_b_, anode studs **31**_e_, carbon shells **31**_h_, baffle members **31**_r_ and tapping valve **35**.

Said furnace constructions **20**, **30** and the like, each operate in the same manner as shown and described above for furnace construction **10**. The term cylindrical when used to describe the anode in the claims following shall be interpreted in a broad sense to include the configurations of anodes **21** and **31** as well as anode **11**.

It is thus seen that there is provided improved furnace constructions and method of operation whereby the several objects of this invention are achieved and which are well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention and as various changes might be made in the embodiments above set forth, it is to be understood that all matters herein set forth or shown in the accompanying drawings are to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. In an electrolytic reduction furnace, an anode mounted for rotation on a longitudinal horizontal axis comprising an elongated tubular metallic electric courrent carrying core having a longitudinal axis forming said axis of rotation, spaced apart metallic electric current distributing studs radiating from said core substantially along the length thereof, a current carrying carboniferous shell in which outer end portions of said studs are embedded, said shell extending radially beyond the free ends of said studs providing an effective terminal surface portion of said anode, and a layer of heat insulating material interposed between said current carrying tubular core and said carboniferous shell, said studs extending through said insulating layer into said carboniferous shell.

2. The electrolytic reduction furnace defined in claim 1 including shafts outwardly projecting in alignment along said axis carried on opposite ends of said tubular core.

3. The electrolytic reduction furnace defined in claim 1 including shafts supported at opposite ends of said tubular core outwardly projecting in alignment along said axis, spaced apart cradle cross arms carrying bearing blocks in which said shafts are journaled for said rotation of said anode, baffle members extending in parallel relation along the surface of said carboniferous shell interconnecting with said cradle cross arms, and adjustable leveling means electrically insulated from a cathode pot portion and supported in relatively stationary position connecting with said arms and baffle members for selectively varying the anode level to be effective for furnace operational requirements.

4. The electrolytic reduction furnace defined in claim 1 in which said core has a hollow center and openings at opposite ends thereof to permit circulation of air therethrough for cooling.

5. An electrolytic reduction furnace for extracting aluminum from its ore comprising a cylindrical shaped anode mounted horizontally for axial rotation, said anode having a carboniferous shell with surface portions thereof adapted to be alternately immersed in a molten electrolytic bath and removed therefrom for rebuilding by intermittent rotation on said axis, a cathode pot portion having a lining of carboniferous material formed with a trough for retaining said bath, said trough being shaped to conform to the peripheral contour of said immersed surface portion of the anode to provide a uniform gap distance between said anode and cathode, a mid-portion of said trough having through-channels to provide a passage, a reservoir connected with said passage formed in said lining below the level of the trough, and means for connecting said lining in an electric circuit when energizing said furnace.

6. In a method of continuously operating an electrolytic reduction furnace having an anode formed with a current carrying carboniferous shell mounted to turn on a horizontally disposed axis and fitted in operative relation to immerse a first surface portion of said shell in an electrolytic bath contained in a trough portion of a cathode and to position a second surface portion of said shell accessibly for rebuilding, said first and second anode shell surface portions being of similar predetermined shape and substantially conforming to said cathode trough portion; the steps of operating said furnace with the anode at rest and with said first shell surface portion in register with and at a desired substantially uniform gap distance from said cathode trough portion and immersed in said bath at a required normally high operating temperature for a predetermined time interval until said first shell surface portion is consumed to a desired relatively shallow depth, rotating said anode on said axis through an increment of at least 120° of arc to immerse said second shell surface portion in said bath in register with and at a desired substantially uniform gap distance from said cathode trough portion and to simultaneously position said consumed first shell surface portion accessibly for rebuilding, coating said consumed first shell surface portion with a carboniferous paste to rebuild said consumed layer forming a refinished surface, partially curing said refinished surface to semi-hardness by heat radiation from said furnace while said second shell surface portion is being consumed by the operation of the furnace, and thereafter rotating said anode to replace in the bath in operative position said consumed second shell surface portion by said first refinished partially cured portion, while simultaneously "frying" the latter to a current conducting hardened crust.

7. In the method of operating an electrolytic reduction furnace defined in claim 6, said predetermined time interval for operating the furnace being on the order of eight hours to consume said shell to a depth on the order of ¼ of an inch.

8. An electrolytic reduction furnace as defined in claim 5 which includes an adjustable leveling means supported in a relatively stationary position electrically insulated from said cathode for selectively varying the spaced relation of the anode with respect to the cathode as required for furnace operation.

9. An electrolytic reduction furnace comprising an anode mounted for turning movement having an axis thereof horizontally disposed and provided with a metallic tubular core extending lengthwise thereof, a current carrying outer shell for said anode supported at a spaced distance from the core and electrically connected therewith, a horizontally disposed pot portion cathode having a current carrying lining formed with a trough shaped to conform with surface contour portions of said shell, aligned baffle members spaced to extend longitudinally along parallel sides of said anode, spaced apart cross cradle bars on which said anode is mounted for turning movement spanning opposite ends of said baffle members, and leveling means for said baffle members, cradle bars and anode electrically insulated from said cathode pot portion for selectively raising and lowering the anode to

vary the effective spaced distance between the anode and cathode as required for surface operation.

10. An electrolytic reduction furnace as defined in claim 9 in which said cathode includes spaced apart current carrying tubular members electrically connected to an underside of said cathode lining on which the latter is mounted, and a supporting framework extending along vertically disposed sides, ends and bottom of the cathode pot portion.

11. An electrolytic reduction furnace, a horizontally disposed cathode pot portion comprising a current carrying lining having an elongated trough for retaining material to be subjected to the electrolytic action, said trough being shaped to conform with an elongated section of a anode of cylindrical peripheral contour, a mid-portion of said trough being through-channeled to provide a passage communication with a reservoir formed in said lining below the level of the trough, a framework for supporting said lining having a bottom substantially V-shaped in cross section, longitudinally extending spaced apart beams for supporting said framework bottom, and spaced apart metallic current carrying tubes longitudinally extending along an underside of said lining between said beams electrically contacting said lining to serve as distributed collectors of current in an electric circuit when said furnace is energized and to carry said lining thereon, each of said tubes being connected with a terminal for tapping a power source.

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