June 23, 1936. H. ELDRIDGE 2,045,073

ALUMINUM FURNACE

Filed Sept. 23, 1933 2 Sheets-Sheet 1

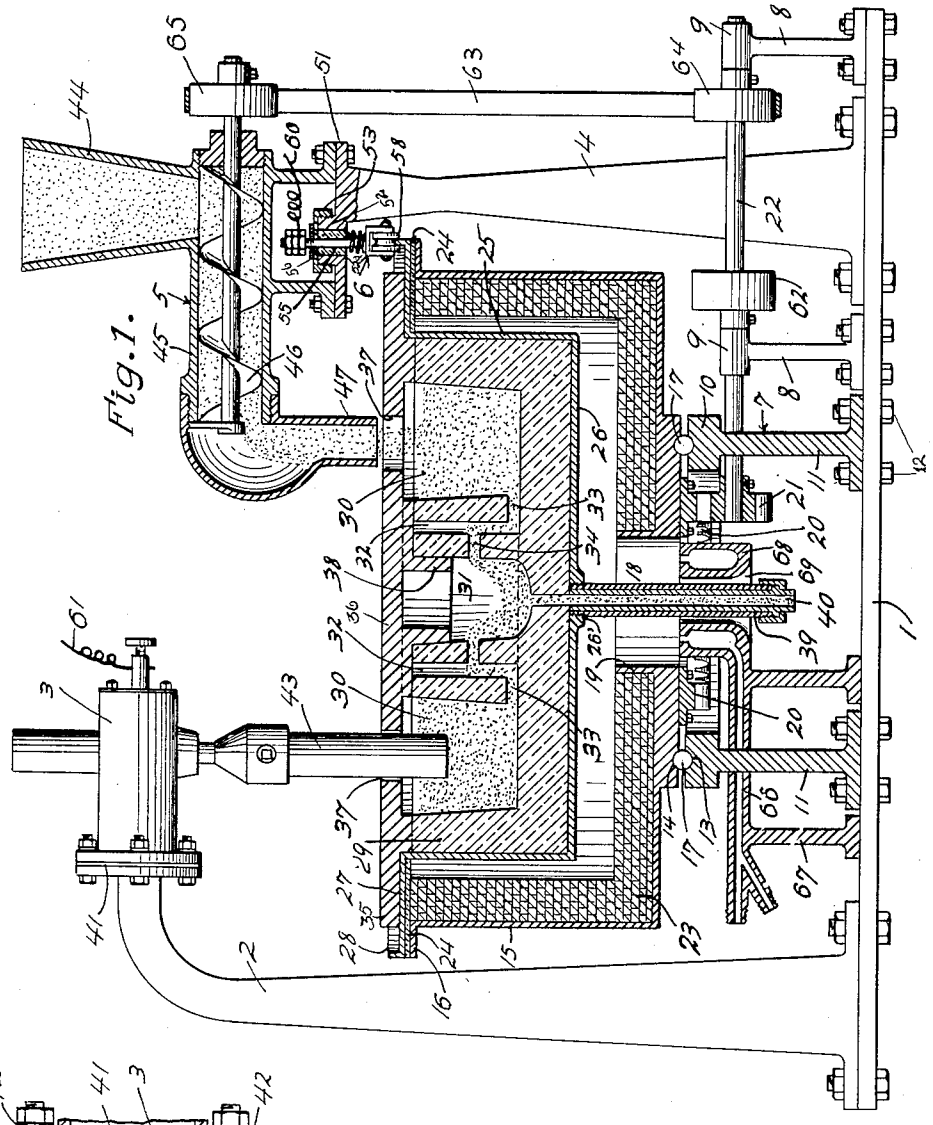


Fig. 1.

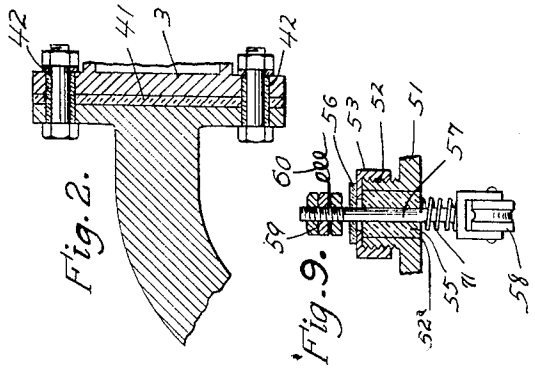


Fig. 2.

Fig. 9.

INVENTOR.
HILLIARY ELDRIDGE, DECEASED.
BY
Macarthur H. Eldridge
ADMINISTRATRIX

June 23, 1936. H. ELDRIDGE 2,045,073

ALUMINUM FURNACE

Filed Sept. 23, 1933 2 Sheets-Sheet 2

Fig. 3.

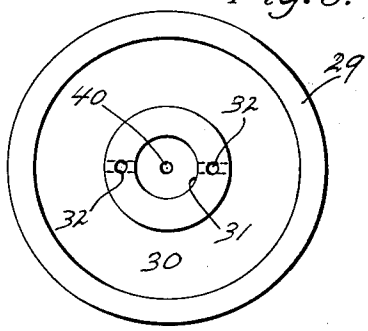


Fig. 4.

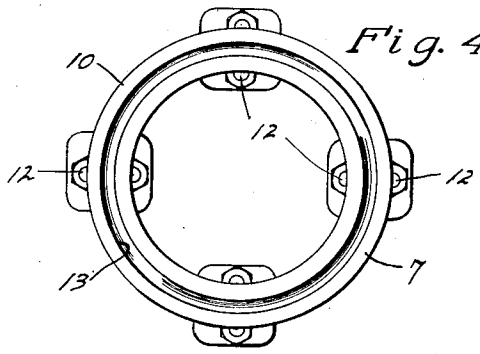


Fig. 5.

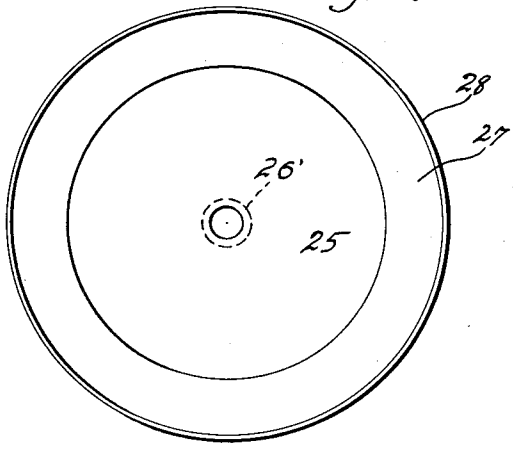


Fig. 6.

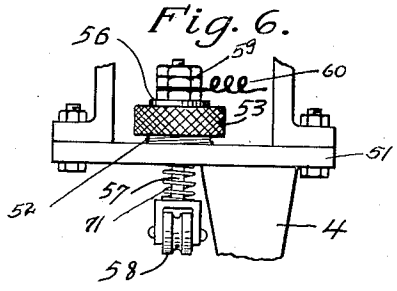


Fig. 8.

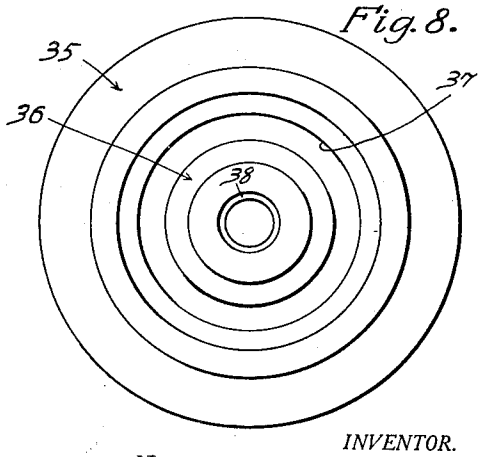
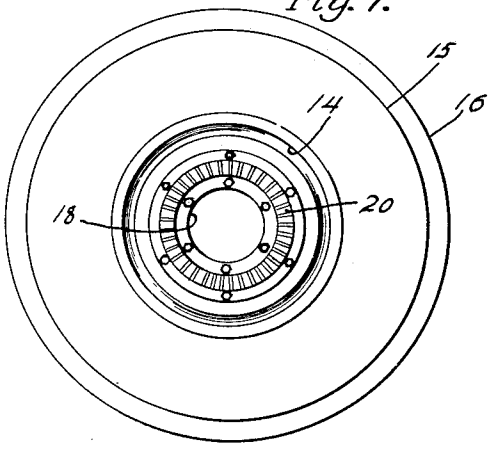


Fig. 7.



INVENTOR.

HILLIARY ELDRIDGE, DECEASED

BY

Martha H. Eldridge

ADMINISTRATRIX

Patented June 23, 1936 2,045,073

UNITED STATES PATENT OFFICE

2,045,073

ALUMINUM FURNACE

Hilliary Eldridge, deceased, late of Oakland, Calif., by Martha K. Eldridge, Oakland, Calif., administratrix

Application September 23, 1933, Serial No. 690,675

7 Claims. (Cl. 204—20)

The present invention relates to improvements in aluminum furnaces particularly adapted for producing aluminum by electrolizing bauxite ores, or the like.

One of the objects of the improvements is the provision of a furnace whereby aluminum can be economically produced from aluminum oxide or bauxite, or the like.

With the foregoing and further objects and purposes in view which will appear as the description proceeds, the present invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed can be made within the scope of what is claimed without departing from the spirit of the invention.

In the accompanying drawings—

Figure 1 is an axial vertical section of the present improved furnace;

Figure 2 is a median vertical sectional view of parts forming the connection between one of the electrode elements and its supporting standards;

Figure 3 is a top plan view of the graphite block;

Figure 4 is a top plan view of the supporting table;

Figure 5 is a top plan view of the graphite crucible;

Figure 6 is a view in elevation of the contact brush element and parts associated therewith;

Figure 7 is a bottom plan view of the furnace casing and gear ring secured thereto;

Figure 8 shows top plan views of the cover plates in their relative operative position; and

Figure 9 is an axial sectional view of parts associated with the contact brush element, with portions shown in elevation.

Referring to the drawings in detail, throughout which like reference characters designate like parts:

The numeral 1 designates the base plate, to which is fixedly secured a principal standard 2 supporting an electrode element 3, a complementary standard 4 supporting an ore-feeding element 5 and a contact brush element 6, a furnace-supporting table 7, and shaft-supporting supports 8.

The furnace-supporting table 7 comprises a ring like member 10 supported by legs 11, the latter preferably fixedly secured to the base 1 by means of screws 12.

The upper face of the member 10 is provided with an annular groove 13 registering vertically with an annular groove 14 formed in the lower face of the bottom of the furnace casing 15, the latter being provided with an outwardly projecting annular flange 16, the function of which will become apparent as the description proceeds.

In the grooves 13, 14 are disposed bearing balls 17, which are adapted for rolling along in said grooves upon the rotation of the casing 15 during the operation of the furnace. Obviously, any suitable number of bearing balls may be employed.

A centrally disposed opening 18, having an upwardly projecting annular flange 19, is formed in the bottom of the casing 15, and to the bottom face of said casing, encircling the opening 18, is fixedly secured the gear ring 20, which is provided with downwardly projecting gear teeth in mesh with the teeth of a gear 21 fixedly secured to one end of a shaft 22 rotatably mounted in bearings 9 supported by the supports 8. The arrangement being such that the rotation of the shaft 22 will cause rotation of the gear ring 20 and casing 15 on the bearing balls 17.

The casing 15 is lined on its inner sides with a lining of fire-brick 23, on the top of which lining and overlying the flange 16 is disposed a flat insulating ring 24, which is preferably formed of asbestos, mica, or the like.

Projecting downwards into the casing 15, but spaced a suitable distance from the lining 23, is a cylindrical core-supporting crucible 25, which has a flat bottom 26 provided with a centrally disposed opening 26' in axial alignment with the opening 18. The upper rim of the crucible 25 has an outwardly projecting annular flange 27 provided at its outer edge with an upstanding annular contact flange 28.

The crucible 25 is supported by means of its flange 27 seated on the insulating ring 24, the latter being intended to form electrical insulation between the pot 24 and casing 15.

In the crucible 24 snugly fits a graphite core 29, which has an annular ore chamber 30, a central recess 31, a pair of vertically extending openings 32 intermediate said ore chamber and recess, a pair of opposed horizontally extending openings 33 connecting the lower ends of the openings 32 with lower portions of the ore chamber 30, and a pair of horizontally extending openings 34 connecting intermediate portions of the recess 31 with mid portions of the openings 32. The openings 32, 33 and 34 are intended to permit fluid or semi-fluid material to flow from the chamber 30 to the recess 31.

A cover, preferably formed of cast iron, and comprising a ring-like outer plate 35, and a cy-

lindrical inner plate 36, are disposed to seat on the flange 27 and core 29. The relative dimensions and disposition of the plates 35 and 36 are such as to provide an annular channel 37 therebetween in central registration with the annular ore chamber 30. The plate 36 has a centrally disposed annular flange 38 fitting snugly into the recess 31, whereby lateral movement thereof is intended to be prevented. The plate 35 may, if desired, be secured to the flange 27 by means of bolts or screws, not shown.

In the opening 26' is threadedly secured the upper end of a vertical pipe 39, which is lined on the inner side with a discharge tube 40 preferably formed of refractory material.

If desired, openings (not shown) may be formed to extend through the casing 15 and fire-brick 23, to provide for the escape of air or gases formed or accumulated in the space intermediate the pot 25 and the lining 23. Also, if found desirable, openings (not shown) may be formed in the cover plate 36 intersecting with the recess 31 and openings 32 for the escape of air or gas accumulating therein.

The electrode-supporting element 3, which may be of any suitable construction, and which is preferably electrically insulated relative to the standard 2, as best shown in Fig. 2, by means of a gasket 41, and sleeves 42, supports a depending carbon electrode 43, which projects downwardly through the annular channel 37 a distance into the annular ore chamber 30.

The ore-feeding element 5 comprises a hopper 44, a body portion 45, in which is rotatably mounted a feed-screw 46, and a delivery nozzle 47, the free end of the latter being disposed directly above the channel 37, whereby ore fed through the ore-feeding element will be deposited in the annular ore chamber 30 through the channel 37. The feed-screw 46 is connected to the shaft 22 by means of pulleys 64, 65 and a belt 53. The contact brush element 6 embodies a frame 51 preferably formed en bloc with the upper end of the standard 4 and having an upwardly projecting exteriorly threaded boss 52 having a central vertical opening 52*a*, the boss threadedly engaged by an interiorly threaded cap 53, a guide bushing 55 formed of electric insulation material, a washer 56 also of insulation material, and a transmitting-stem 57, which has its lower end forked for rotatably supporting a grooved roller brush 58, the transmitting-stem projecting longitudinally slidably through the bushing 55, cap 53 and the washer 56 and is provided at its upper end with nuts 59 for securing thereto the electric circuit wire 60.

The brush 58 is adapted to operatively roll along on the annular contact flange 28, and to make electric contact therewith during the operative rotation of the furnace body.

An extensile coil spring 71, encircling the stem 57, is confined against the resilient tension of itself between the lower forked end of the stem 57 and the bushing 55 for maintaining proper electric contact between the brush 58 and flange 28.

The element 3 is intended to provide electrical connection between the electrode 43 and circuit wire 61, which, in association with the wire 60, forms the electrical connection between the present furnace and the source of electrical supply. The element 3 forms preferably the positive, and the element 6 the negative, terminal of the circuit.

The shaft 22, which may be operated by means of the pulley 62 connected to a power plant (not shown), rotates the furnace body by means of the gear 21 and gear ring 20, as well as the feed-screw 46 through the medium of the belt 63 operating over the pulleys 64, 65.

A gas stove comprising an intake pipe 66, supporting legs 67, and cylindrical head 68 having a central vertical opening 69 through which the pipe 39 projects, is provided for maintaining the desired temperature of the furnace body as well as the pipe 39, whereby the fluidity of the decomposed ore mass may be maintained for passing from the ore chamber 30 to the discharge end of the pipe 39.

In operation, after heating the furnace to a proper degree by means of the gas stove, the shaft 22 is rotated through the medium of the pulley 62, causing the furnace body to rotate on the table 7, and the feed-screw 46 to rotate in the feed-element 5 and to propel the granulated bauxite deposited in the hopper 44 from the latter to the nozzle 47 and through said nozzle to the ore chamber 30. After a sufficient amount of the bauxite granulations (70) has been scattered along in the rotating ore chamber 30, to be properly engaged by the electrode 43, an electric connection is set up extending from the source of electric supply to and through the element 3, electrode 43, bauxite ore in the chamber 30, graphite core 29, pot 25 to the flange 28 and brush 58, and from the latter through the stem 57 to the return current wire 60. After the decomposition of the ore by means of the electric current, the fluid bauxite, or mass, passes from the chamber 30 to the recess 31 and thence out through the pipe 39, after which it may be separated by proper means into its several component parts.

If desired, a carbon block may be substituted for the graphite core 29.

Obviously, a plurality of thermometers and/or pyrometers may be projected into the recess 31 and the air space between the lining 23 and pot 25, to determine the degree of heat set up therein by the decomposition of the bauxite ore and heat furnished by the gas stove through the opening 18.

What is claimed, is:

1. In an aluminum furnace of the character described, a furnace body provided with a refractory core having a central recess formed in its upper face, and having an annular ore chamber encircling said recess and having a plurality of openings formed in said core for connecting said recess with said chamber.

2. In an aluminum furnace of the character described, a base, a furnace body rotatably supported by said base, said furnace body including a core-supporting crucible, a graphite core fitted inside said crucible and having a centrally disposed recess formed in its top surface and having an annular ore chamber encircling said recess, an anode electrode supported by said base, and projecting into said ore chamber, and a contact brush in electrical contact with said crucible, said crucible and said graphite core forming portions of an electric circuit of which said electrode and said brush form portions.

3. In an aluminum furnace of the character described, the combination with a body portion comprising a rotatably supported furnace casing open at its upper end and lined on its inner surface with refractory material, of a core-supporting crucible projecting downwards into said body portion and electrically insulatedly supported by the upper rim portion of said body portion, said crucible being spaced from said refractory material whereby an air space is formed therebetween, said crucible containing a graphite core

provided with an ore chamber, means for conducting molten aluminum from said crucible downwards through said air space and body portion, and means for rotatably supporting said body portion.

4. In an aluminum furnace of the character described, an ore-smelting crucible having its upper rim provided with an upstanding annular flange, and a wheel to roll on said flange, said wheel adapted to provide electrical contact between said crucible and a source of electrical power.

5. A furnace casing lined on its inner surface with refractory material, an ore-smelting crucible supported within said casing whereby air space is provided between said crucible and said refractory material, and a core of refractory material disposed in said crucible, said core provided with an annular ore chamber.

6. A graphite core having an annular ore chamber formed in its upper face side, said core having a centrally disposed recess and an opening or duct extending from said recess to said ore chamber.

7. An ore-smelting crucible in which is disposed a core of refractory material, said core having a centrally disposed recess formed in its upper face side and an annular ore chamber encircling said recess and a plurality of openings connecting said recess and ore chamber together, and a cover disposed above said core, said cover having an annular opening or slot registering vertically with said ore chamber.

MARTHA K. ELDRIDGE,
Administratrix of the Estate of Hilliary Eldridge, Deceased.