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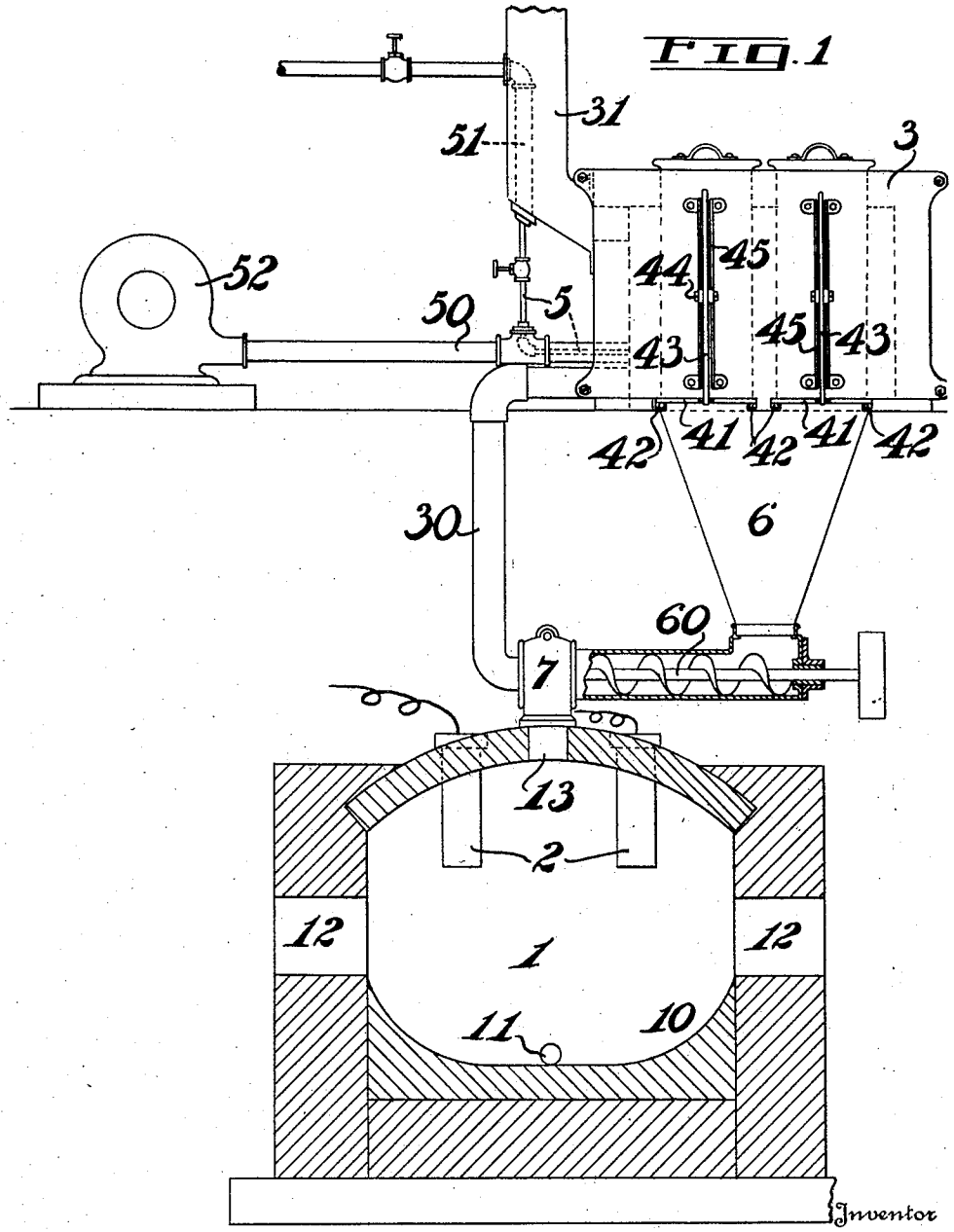
Dec. 26, 1922. 1,440,106.

E. H. ROTHERT.

PROCESS AND APPARATUS FOR ELECTRIC SMELTING OF ORES.

FILED JUNE 14, 1921. 2 SHEETS—SHEET 1.

FIG. 1



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FIG. 2

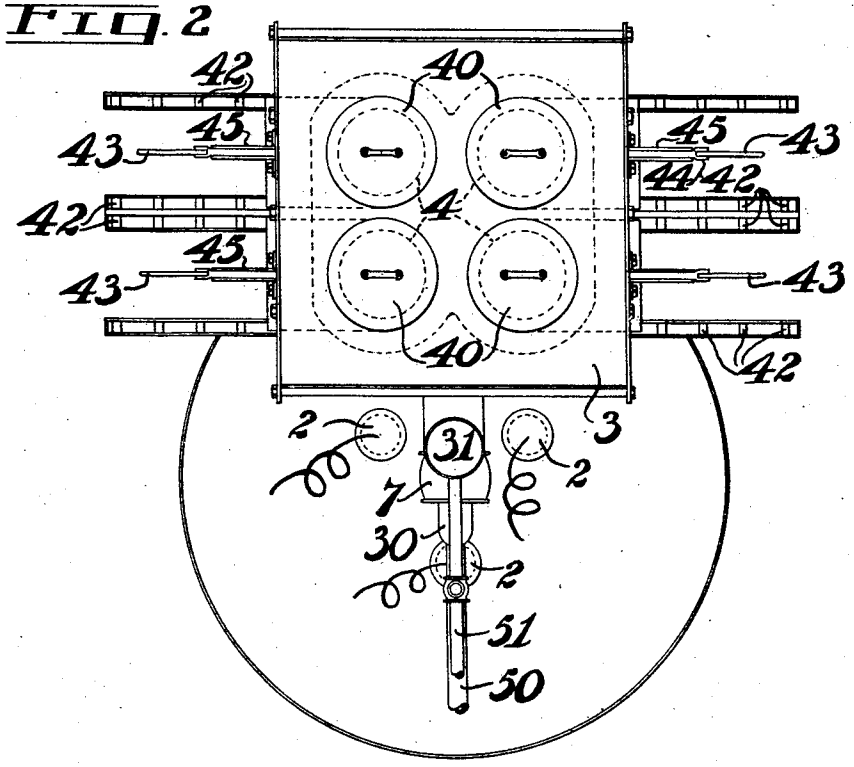


FIG. 3

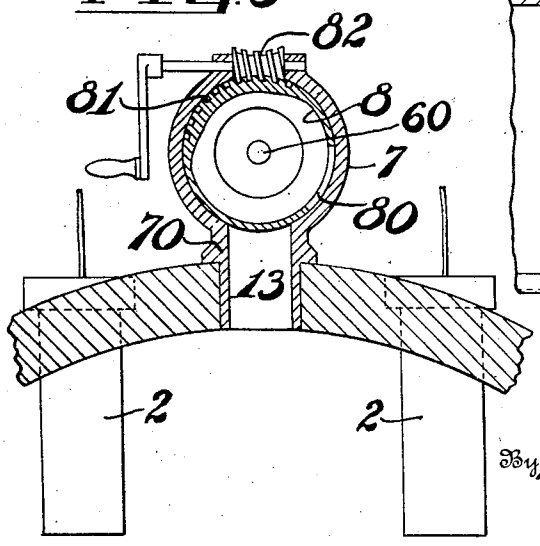
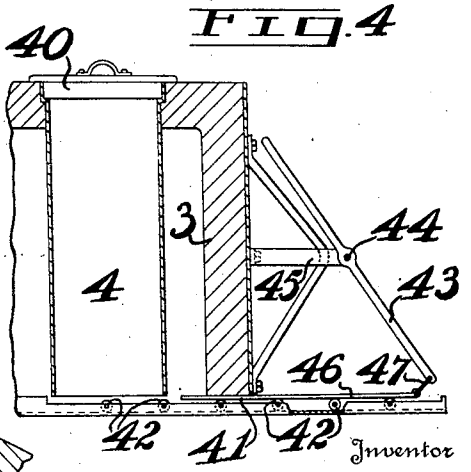


FIG. 4



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Patented Dec. 26, 1922. 1,440,106

UNITED STATES PATENT OFFICE.

EDWARD H. ROTHERT, OF SEATTLE, WASHINGTON.

PROCESS AND APPARATUS FOR ELECTRIC SMELTING OF ORES.

Application filed June 14, 1921. Serial No. 477,421.

To all whom it may concern:

Be it known that I, EDWARD H. ROTHERT, a citizen of the United States of America, and resident of the city of Seattle, in the county of King and State of Washington, have invented certain new and useful Improvements in Processes and Apparatus for Electric Smelting of Ores, of which the following is a specification.

My invention relates to a process and apparatus for the electric smelting of ores.

The object of my invention is to produce an improved process and apparatus for carrying it out wherein the refining of the molten metal may be done in the same furnace in which it has been reduced or smelted from the ores.

In the accompanying drawings I have shown in a simple and somewhat diagrammatic manner, an apparatus made upon the principle of my invention and will hereinafter describe the construction thereof and the manner of using the same in carrying out my process.

That which I consider novel and upon which I desire to secure a patent will be specifically defined by the claims.

Figure 1 is an elevation, partly in plan, of the apparatus employed.

Figure 2 is a plan view of the same apparatus.

Figure 3 is a section through the furnace roof and the sleeve valve by which ore feed is controlled.

Figure 4 is a section illustrating the construction of the individual ore roasting containers.

The furnace 1 is largely of a standard type of construction. It has a hearth 10 which is provided with a tap hole 11 through which the metal is drawn off when desired, It also has doors or working openings 12 through which or through other elevated openings the slag may be drawn off and refining and modifying charges may be added. It also has the electrodes 2 and a charging opening 13 in its roof. The particular construction of these parts shown are given merely to illustrate a mechanism and type of apparatus which may be used to carry out my invention and not in any sense as limiting my invention to the specific constructions shown.

At a point which is elevated relative to the furnace, is a chamber 3 within which are a series of ore roasting chambers 4 open at top and bottom. A removable lid or cover 40 closes the upper end of each and a slidable plate 41 mounted upon rollers 41, or in any other suitable manner, closes the bottom of each. The slides 41 are separately movable to open and to close the chambers 4. The operating mechanism shown consists of a lever 43 pivotally mounted at 44 upon a bracket or arm 45 and connected with an arm 46 extending from plate 41, as by a link 47.

The chamber 3 is larger than the ore receiving containers 4 enough so that there is an open space all around said containers. Into this chamber is conducted heated gases from the furnace 1, by means of the connecting pipe 30. A stack 31 discharges the waste gases from the chamber 3.

As an additional means for heating the ore roasting containers, which means may at times be the chief means and which at other times may be only supplemental or entirely dispensed with, I have provided an oil burner or supply pipe 5 and a surrounding air supply pipe 50, which receives the discharge from a fan 52, or other source of supply of air under pressure. The oil supply pipe may have a section as 51, located within the stack 31 or otherwise heated.

Beneath the chamber 3 in which the ore is roasted and preliminarily heated, is a hopper 6 of sufficient size to receive ore discharged from all of the containers 4. A feed screw 60 conveys the ore in a steady and uniform manner to the furnace.

The ore discharge is through a controlling device which may be called a valve. It has an outer casing or barrel 7 into one end of which the ore is fed and from the other end the gases received from the furnace are discharged into the flue 30. It has a side opening connecting, as by a sleeve 70, with the ore charging opening in the top of the furnace.

Within this casing is a rotatable sleeve 8 which is open at both ends and has a side opening 80, adapted when properly positioned to register with the bottom discharge opening of the outer casing 7. When turned to the position shown in Figure 3, the discharge of ore to the furnace is prevented by the closure of the opening 13. The sleeve rotation may be secured by any suitable means. The means illustrated consists of a toothed segment 81 on the sleeve 8 and a worm 82 journaled in the casing 7.

The operation of the furnace is as fol-

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lows: We will first assume that the apparatus has been heated to a suitable temperature for carrying on the work. The ore roasting containers 4 are charged and the ore heated. These are in turn and at such intervals as required, discharged into the hopper 6, from which the ore is slowly and continuously fed into the furnace where it is subjected to the reducing action of the electric arc. The ore containers 4, as discharged are refilled with ore. The hot gases generated in the furnace 1 escape through the opening 13, casing 7 and pipe 30 to the ore roasting chamber 3.

When this has reached the point where the desired amount of molten metal has been produced, the feeding of ore is stopped and the refining treatment begins. It is of course understood that removal of the slag is provided for either through the openings 12 or such other openings as may be required.

At this time, or at any later period desired, the sleeve 8 is turned to close communication with the ore roasting and supplying parts of the apparatus. The furnace can then be operated as a closed furnace. Such refining or modifying components as it may be desired to incorporate in the metal may be introduced through the openings 12, or otherwise and the contents subjected to the heat of the furnace as long as necessary or desired. The furnace may be operated successively as a reducing or smelting furnace and as a refining furnace, the molten metal not being discharged or cooled until it has been refined and made of the exact composition desired for the finished metal.

The molten metal may be discharged from the furnace by opening a pouring hole, as 11, by tilting, if the furnace be of that type, or in any suitable manner. If the furnace be of a tilting type, the casing 7 should not be mounted upon or secured to the furnace, but be disconnectible therefrom.

What I claim as my invention is:

1. An electric smelting apparatus comprising a furnace having reducing electrodes therein, ore roasting containers, means for applying heat generated in the furnace to said ore roasting containers and controllable means for positively feeding ore discharged from said containers into the furnace.

2. An electric smelting apparatus having a reducing furnace and electrodes therein, a series of ore roasting containers, a hopper adapted to receive the discharge from all said ore roasting containers, means for regularly feeding roasted ore from said hopper to the furnace and means for closing the ore receiving opening of said furnace whereby the same furnace may be operated as a finishing furnace.

3. An electric smelting apparatus comprising a furnace having electrodes therein, a series of ore roasting containers and a heating enclosure surrounding said containers, a hopper adapted to receive the ore as discharged from said containers, means for feeding ore from said hopper to the furnace, and means for conducting heat from said furnace to the enclosure which contains the ore roasting containers.

4. An electric smelting furnace comprising a furnace and electrodes therein, said furnace having an ore charging opening in its top, means for feeding ore through said opening and a valve for closing said opening, consisting of a rotatable shell having a feed discharge opening in its side adapted to be turned into and out of registry with the charging opening of the furnace.

5. The process of electric smelting and refining of metals which consists in reducing the ore by the action of an electric arc thereon in a furnace, and then refining the molten metal in the same furnace.

6. The process of electric smelting of ores which consists in forming a reducing arc in a furnace, feeding the ore to the furnace so as to be acted upon by the arc to reduce it, drawing off the slag, cutting off the ore supply and refining the ore in the same furnace.

Signed at Seattle, King County, Washington, this 9th day of June, 1921.

EDWARD H. ROTHERT.