Feb. 7, 1933. C. R. KUZELL 1,896,178

REVERBERATORY FURNACE

Filed Oct. 24, 1930 2 Sheets-Sheet 1

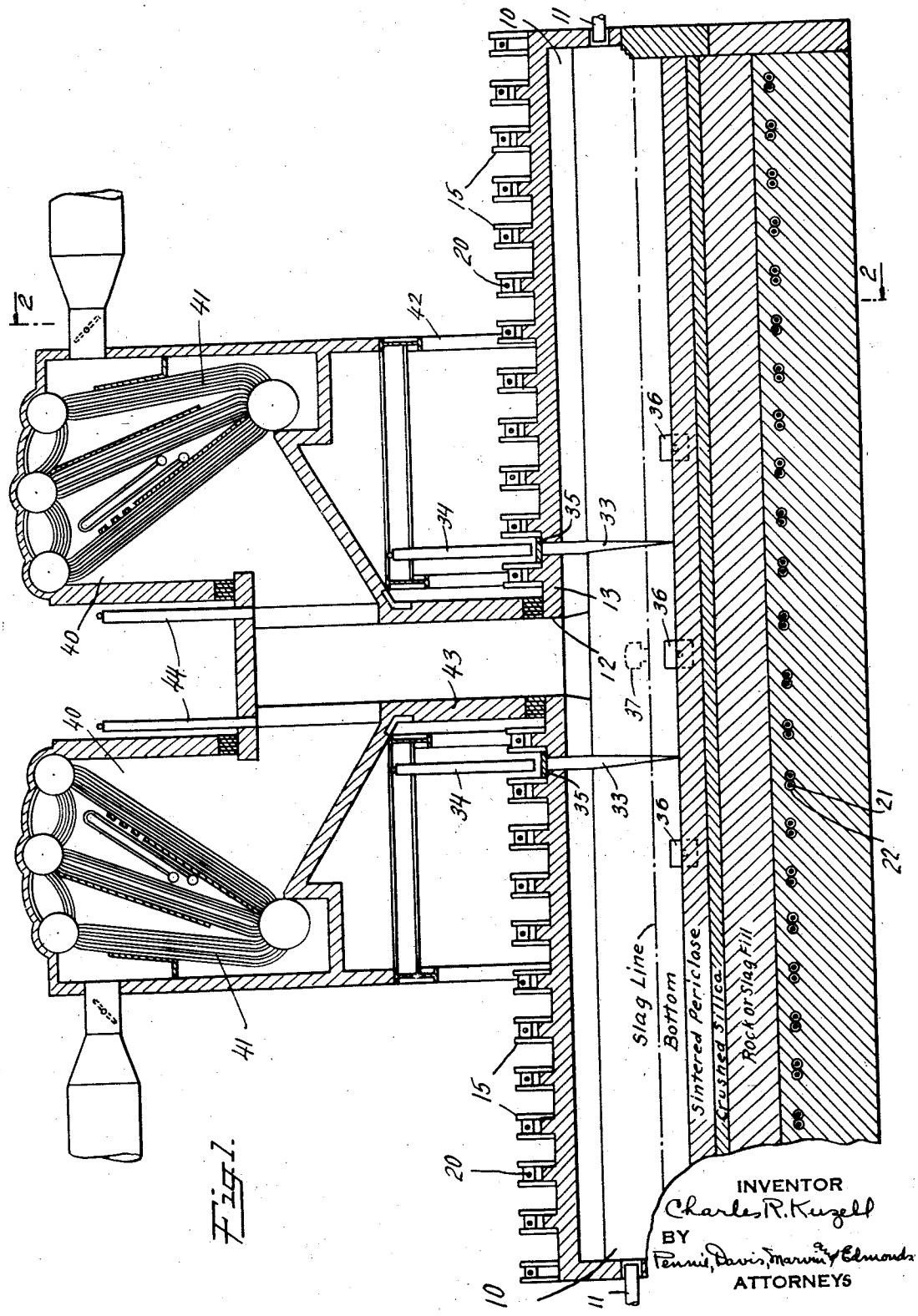


Fig. 1.

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Fig 2.

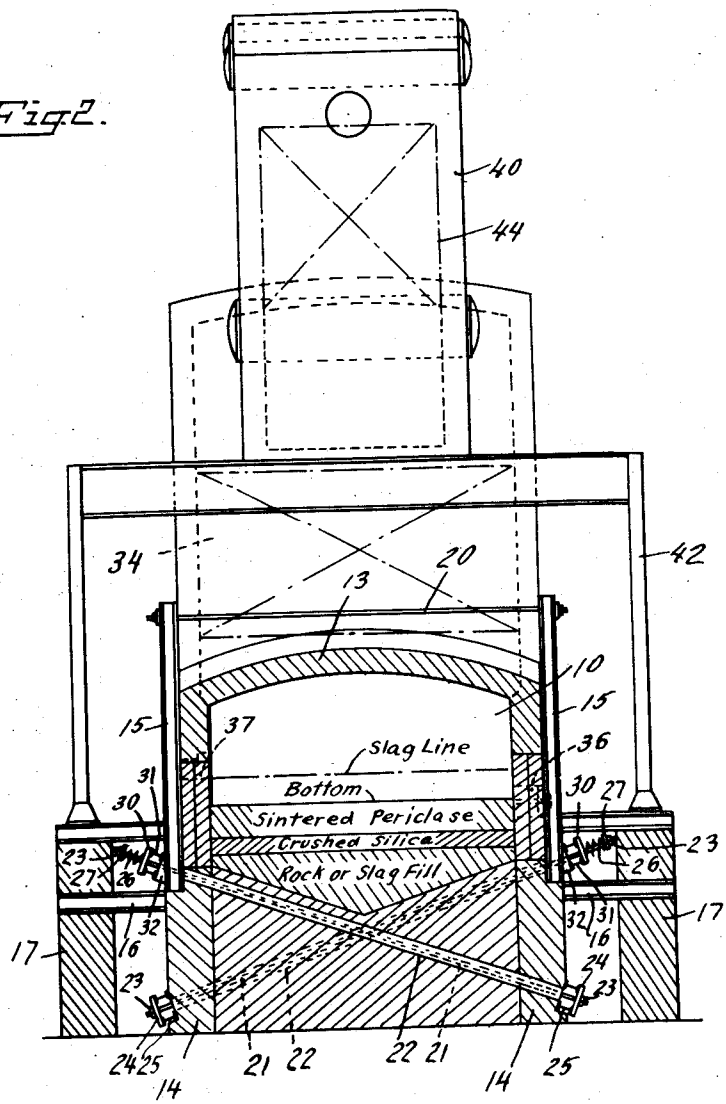
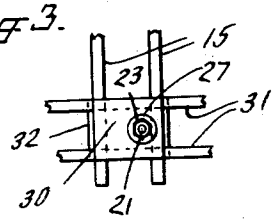


Fig 3.



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UNITED STATES PATENT OFFICE

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REVERBERATORY FURNACE

Application filed October 24, 1930. Serial No. 490,884.

This invention relates to metallurgy and has for an object the provision of improved metallurgical apparatus. More particularly, the invention contemplates the provision of an improved reverberatory furnace and an improved arrangement of reverberatory furnaces and waste heat boilers.

It is common practice to utilize the hot gases from reverberatory furnaces for generating steam for various purposes. Boiler plants are usually located near the sides or the ends of the reverberatory furnaces, and the boiler heating chambers are connected with the reverberatory furnace chambers by means of horizontally extending flues. Considerable space, in addition to that occupied by the reverberatory furnace, is required for the boiler plant in the heretofore customary type of arrangement, and relatively long flues are required for conducting the hot gases from the reverberatory furnace chambers to the boiler heating chambers. Such flues are expensive to install and maintain, and they permit relatively large heat losses because of their large exposed surfaces.

The reverberatory furnaces are usually provided with vertical beams for supporting the side walls. Each side of the furnace is provided with a plurality of similarly spaced beams. The beams extend from points slightly below the ground line to points above the upper surface of the roof. The beams are wedged between the furnace wall and a concrete toe at the bottom and tie rods extending transversely over the top of the furnace roof connect the beams at the top. Structures of this type are rigid and do not normally allow for expansion and contraction due to changes of temperature and pressure within the furnace. During the course of normal furnace operations, considerable outward pressure is continuously exerted against the lower portions of the beams, and it frequently happens that the concrete toe, or the wedging means between the toe and beam, crumbles and permits the lower portion of one or more of the beams to move outwardly. Such conditions are commonly produced when the wedging means or the concrete toe becomes wet with water. Movement of the beams results in the withdrawal of the support necessary for maintaining the wall in its proper shape and condition with the result that the wall is weakened and bulges outwardly. Continued operation of a furnace in such condition is very dangerous in view of the possibility of the weakened wall crumbling and permitting the molten material to flow onto the operating floor.

The present invention contemplates the provision of an arrangement of reverberatory furnace and boiler plant whereby an economy of space is effected and whereby the expense and heat losses due to the heretofore customary type of arrangement are reduced. The invention further contemplates the provision of an improved type of supporting means for furnace walls.

An arrangement of furnace and boiler plant in accordance with the invention involves the placing of the boiler plant substantially directly above the roof of the reverberatory furnace in order that the boiler plant and reverberatory furnace may occupy substantially the same ground space. The supporting structure for the boiler plant may straddle the furnace and its side supports may occupy a relatively small amount of ground space in addition to that occupied by the reverberatory furnace. The heating chamber of the boiler plant may communicate directly with the interior of the reverberatory furnace through an opening in the reverberatory furnace roof and a short substantially vertical flue. The heating chamber of the boiler plant may be spaced any desired distance above the roof of the reverberatory furnace and a connecting flue of any desired length may thus be provided.

The preferred arrangement of apparatus includes a reverberatory furnace provided with firing means adjacent two opposite ends and having a gas discharge opening in the roof substantially centrally between the firing ends. A boiler plant is disposed directly above the roof of the furnace adjacent the gas discharge opening, and the heating chamber of the boiler plant communicates with the interior of the furnace through a vertical flue surrounding the gas discharge opening.

The reverberatory furnace of the invention is provided with means for closing off one end portion to permit independent operation of the other end portion.

The wall supporting means of the invention includes resilient supporting members which offer yielding resistance to the movement of upright braces or beams which engage the side walls of the furnace.

The invention will be better understood from a consideration of the following description in conjunction with the accompanying drawings, in which

Fig. 1 is a longitudinal sectional elevation of a reverberatory furnace and superimposed boiler plant;

Fig. 2 is a section taken substantially along line 2—2 of Fig. 1; and

Fig. 3 illustrates a method of tying-in the lower end portions of side wall supports.

The reverberatory furnace 10 is provided with firing means in the form of burners 11 for introducing mixtures of air and powdered coal into the interior of the furnace chamber at its two opposite ends. A gas discharge opening 12 is provided in the furnace roof 13 midway between the firing ends.

The furnace walls are supported on a foundation consisting of reinforced concrete walls 14 provided with ledges for supporting vertical I-beams or buck stays 15 which engage the side walls of the furnace. Short horizontal I-beams 16 having their ends embedded in the concrete foundation walls 14 and parallel concrete walls or piers 17 aid in supporting the beams 15 against vertical movement. Each side wall of the furnace is provided with a plurality of similarly spaced vertical supporting beams 15 and the upper ends of opposite beams are connected by tie rods 20.

The lower ends portions of the vertical beams are held in position against the furnace walls by means of the rods 21 each having one end anchored against a foundation wall 14 and the other end extending to a point beyond the vertical supporting beams on the opposite side of the furnace. The rods 21 are encased in pipes 22 which extend through the foundation walls and the earth between the walls and which are of greater inside diameter than the diameter of the rods. The ends of the rods 21 project into open spaces between the walls 14 and 17. The ends of the rods 21 are threaded and provided with nuts 23. A washer 24 is mounted on the lower end portion of each rod between the nut and the outer faces of a pair of spaced I-beams 25 the inner faces of which bear against a beveled surface on the foundation wall. A helical spring 26 is mounted axially on the upper end portion of each rod 21 between a washer 27 which bears against the nut and a plate 30 which bears against the outer faces of two parallel I-beams 31. The inner faces of the I-beams 31 lie in contact with a beveled bearing plate 32 which extends between and bears upon the outer faces of two adjacent vertical beams 15. Instead of the separate tie rods for the lower portions of the side wall braces on each side of the furnace, horizontal rods connecting side wall braces on opposite sides of the furnace may be employed, and the horizontal tie rods may be provided with springs or other resilient means at one or both ends.

The furnace chamber is provided with slots 33 in its roof and side walls on opposite sides of the gas discharge opening to permit the insertion of a damper or curtain 34 for closing off one end portion of the furnace to permit independent operation of the other end portion. The slots 33 may be wide expansion joints which are normally closed by suitable bricks or tiles 35. The dampers or curtains may be of any suitable construction, and they may be mounted for use in any suitable manner. A sheet metal casing provided with suitable connections for permitting circulation of water therethrough forms a suitable damper or curtain. The dampers may be suspended above the furnace by means of pulleys and cables (not shown). The slots and dampers may be of any suitable configuration.

Three tap hole blocks 36 provided with tap holes for withdrawing matte are provided in one side wall of the furnace.

One tap hole block is located at about the longitudinal center of the side wall and one on the opposite side of each damper slot. A skimming block 37 and opening are located at about the longitudinal center of the opposite side wall.

A boiler plant consisting of two heating chambers 40 each having a standard make of boiler 41 mounted therein is mounted directly above the furnace on a frame structure 42 which straddles the furnace. The upright members of the frame structure 42 are supported by the concrete piers 17. The heating chambers 40 are connected to the reverberatory furnace by means of a short vertical flue 43 which surrounds the gas discharge opening 12 in the roof of the furnace. Water cooled dampers 44 are provided for closing the heating chambers when necessary.

The reverberatory furnace illustrated in the drawings is, in effect, a double reverberatory and it may have a length equal to substantially twice the length of the normal furnace. The apparatus of the invention may include a reverberatory furnace having firing means at one end only instead of a furnace having firing means at two opposite ends.

I claim:

1. The combination with a reverberatory furnace provided with firing means adjacent two opposite ends of a boiler plant disposed directly above said furnace substantially centrally between the firing ends, and

a flue for conducting hot gases from the interior of said furnace to said boiler plant.

2. The combination with a reverberatory furnace comprising a substantially rectangular furnace chamber provided with firing means adjacent two opposite ends and having a gas discharge opening in its roof between the firing ends of a boiler plant disposed immediately above the furnace chamber adjacent the gas discharge opening, and a flue for conducting hot gases from the interior of the furnace chamber through the gas discharge opening to the boiler plant.

3. Apparatus of the class described, comprising a reverberatory furnace provided with firing means adjacent two opposite ends, a substantially centrally disposed gas discharge flue extending transversely of the furnace chamber between the side walls, and a boiler plant disposed above and connected to the gas discharge flue.

4. A reverberatory furnace comprising a furnace chamber, firing means adjacent two opposite ends of said chamber, a gas outlet between the two firing ends, and means adjacent the gas outlet for dividing said furnace chamber to permit the independent operation of one end portion.

5. Apparatus of the class described comprising a reverberatory furnace provided with firing means adjacent two opposite ends, a substantially centrally disposed gas discharge flue extending transversely of the furnace chamber between the side walls, a boiler plant disposed above the furnace and connected to the gas discharge flue, and means adjacent the gas outlet for dividing the furnace chamber to permit independent operation of one end portion, the dividing means being so disposed as to permit gases to flow through the discharge flue to the boiler plant during the course of operation of one or both end portions of the furnace chamber.

In testimony whereof I affix my signature.

CHARLES R. KUZELL.