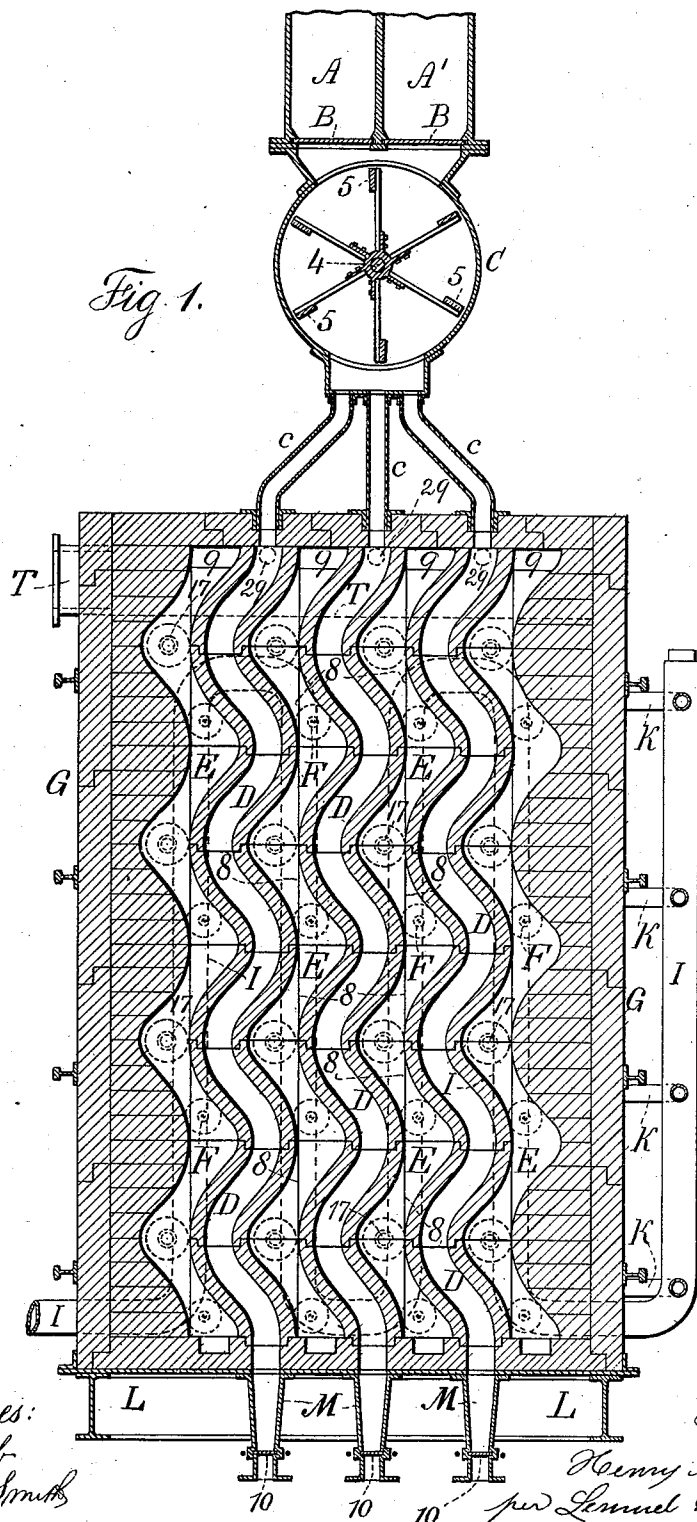


H. A. JONES.
DEOXIDIZING FURNACE.

No. 566,186.

Patented Aug. 18, 1896.

Fig. 1.



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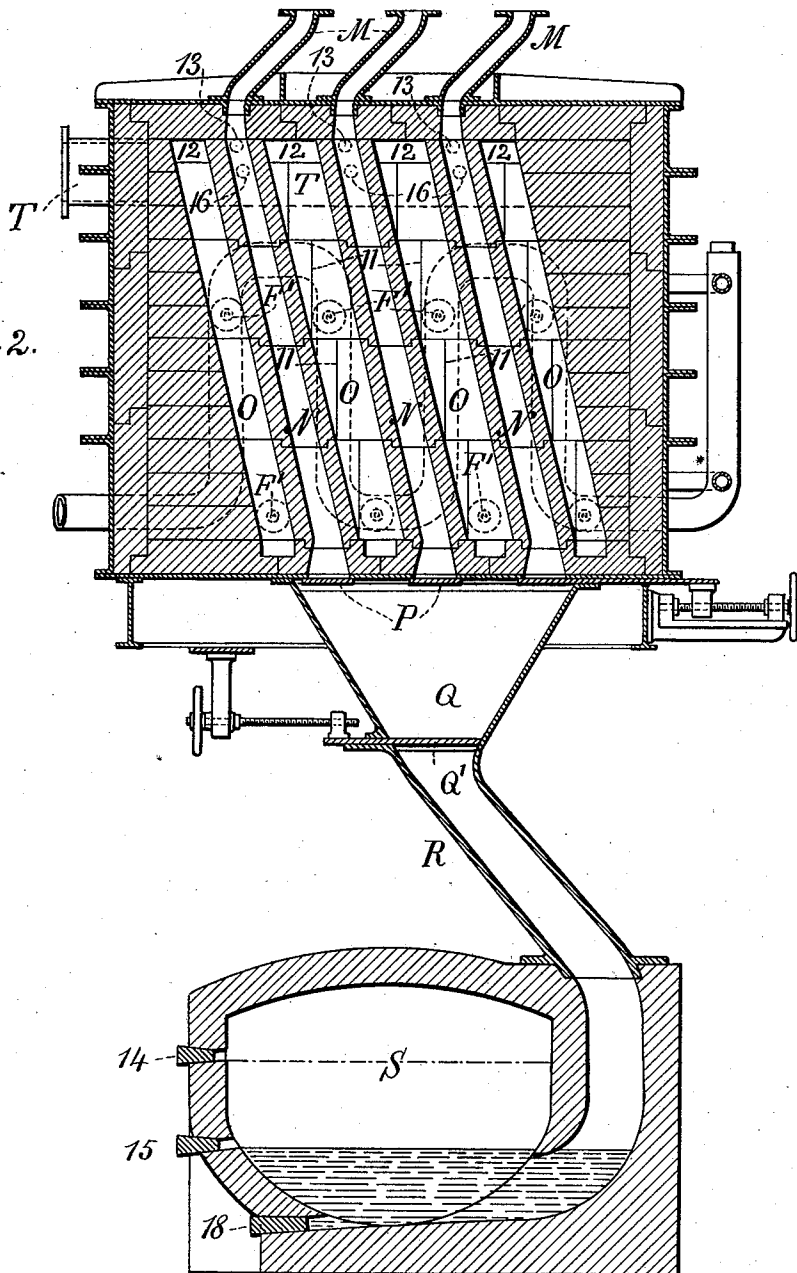
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Fig. 2.



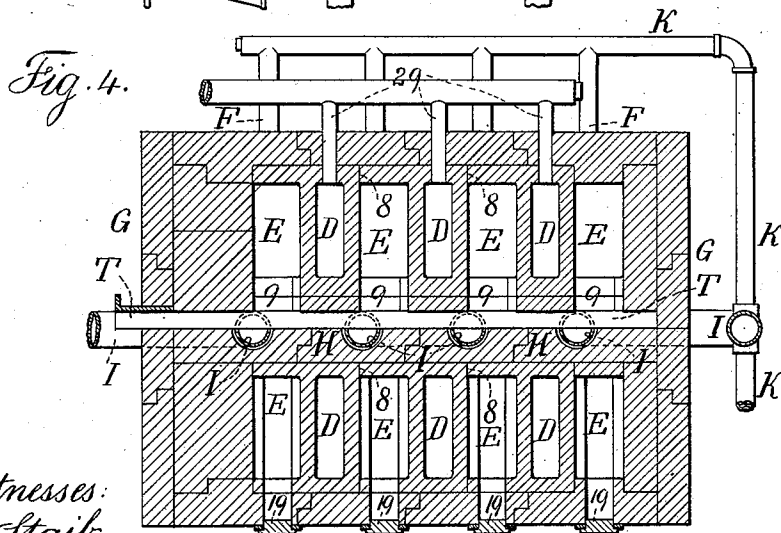
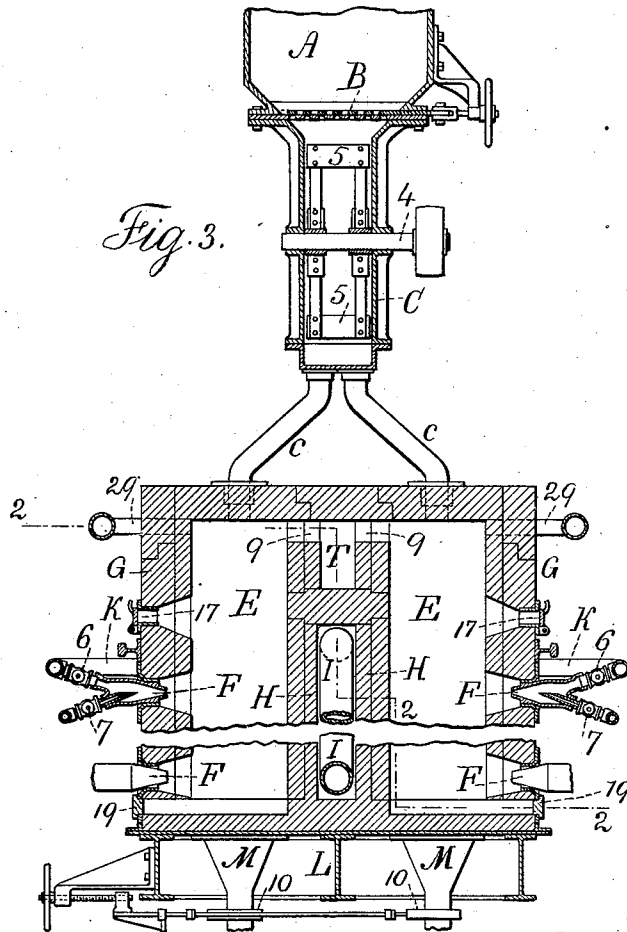
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UNITED STATES PATENT OFFICE.

HENRY A. JONES, OF NEW YORK, N. Y.

DEOXIDIZING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 566,186, dated August 18, 1896.

Application filed August 28, 1895. Renewed June 27, 1896. Serial No. 597,262. (No model.)

To all whom it may concern:

Be it known that I, HENRY ANWYL JONES, a citizen of the United States, residing at the city of New York and in the county and State of New York, have invented an Improvement in Deoxidizing-Furnaces, of which the following is a specification.

Oxid of iron is found to a large extent in a granular form, and to convert the same into cast-iron and steel by a continuous process has been difficult, because it is important that the atmosphere be excluded during the operation, and the carbon employed in the deoxidizing operation requires to be intimately and uniformly mixed with the granular oxid of iron, so that in the roasting operation the oxygen of the iron may be driven off and united with the carbon and escape in a gaseous form. To accomplish these objects in a cheap, reliable, and rapid manner is the object of the present invention.

In carrying out this invention the granular oxid of iron and carbon are supplied in the proper proportion into a hopper, and from there they descend into a peculiarly-constructed retort to which the heat is externally applied, and the gases pass off through openings provided for that purpose, and this retort is advantageously made sufficiently long to hold two charges, and from the first retort the granular ore and carbon pass into a finishing and heating retort, in which the removal of the oxygen from the iron is consummated, and the iron is passed directly into a reverberatory furnace for melting and puddling, and during the operations in the retorts the atmosphere is excluded, so as to prevent the combustion of the carbon and also to prevent the reoxidizing of the iron.

In the drawings, Figure 1 is a vertical section of the upper portion of the apparatus. Fig. 2 is a similar section of the lower part of the apparatus. Fig. 3 is a partial vertical section at right angles to Fig. 1. Fig. 4 is a sectional plan at the line 2 2, Fig. 3.

The ore in a granular form is supplied into the hopper A, and the carbon also in granular form is supplied into the hopper A'. This may be effected by suitable elevators or chains of buckets driven at such a speed or provided with buckets of such relative sizes that the carbon and ore will pass into the hopper or

hoppers in the proper relative proportions—that is to say, there usually is about one-fifth carbon and four-fifths iron ore by weight. At the bottom of the hopper is a slide or regulating valve B, which is to be opened to allow the materials to run in the proper proportions from the hoppers down into the mixer C, which mixer C is formed of a cylindrical case having within it a shaft 4, and arms upon the shaft and blades 5, so that as the mixer shaft and blades are rotated they come into contact with the carbon and ore as the same fall down from the hopper, and such materials are intimately mixed together, so as to bring the particles of carbon and of iron into contact as such materials pass out from the mixer and by the chutes c to the retorts D, which are vertical or nearly vertical and of an undulating or zigzag contour, and between the retorts D are the heating-flues E, into which flues air and gas in the proper proportions for perfect combustion are admitted by the burners F, and there are cocks at 6 and 7 for regulating the supply of air and gas, respectively, so that the proper proportion will be maintained at each burner producing a heating-flame.

The retorts and heating-flues are made of sections, preferably of clay, set together, each section having in it a flue-opening that is a bent curve, and there are projecting flanges forming substantially rectangular edges to the flue-section, which flanges form portions of the sides of the adjacent curved flue, the edges of the sections being set together, as shown at 8, so as to make up a furnace of any desired capacity. I have represented three retorts at each side and four flues, so that each retort is heated on each side and the products of combustion in the flues ascend and pass off by the lateral openings 9, preferably to a suitable chimney, and the retorts are surrounded by a brickwork inclosure at G, and suitable tie rods and bars are provided for holding the parts reliably together; and it is advantageous to provide a middle wall H between the retorts, formed of bricks, through which the air-pipes I pass, and they are provided with branches K to the burners, so that the air consumed is in a heated condition when it reaches the gas, petroleum, or other fuel. By this construction the retorts

and their heating-flues are easily and cheaply built and the parts made air-tight, and the retorts can be taken apart whenever repairs become necessary.

5 I have represented at L a supporting beam or floor for the retorts, and at the lower ends of the retorts the tubes M are connected and provided with slides or gates 10, by which the passage of the material under treatment can be regulated, and these tubes M lead to the
10 secondary or finishing retorts N, which are advantageously placed at an inclination, as shown, and between them are the heating-flues O, into which air and gas or other com-
15 bustible materials are supplied at F', so as to burn with the heat necessary for finishing the treatment of the oxid of iron, such burners being similar to those before described. These retorts N are widest at the bottom, so
20 that the materials in them will not become wedged or clogged in such retorts, and these retorts are made generally in a similar manner to the retorts D—that is to say, the retorts are made of clay sections set together with
25 edge flanges coming together at 11, so as to form the heating-flues O, the retorts themselves being air-tight and without any vertical seams, and the clay sections are set together end to end as they are built up vertically, and at 12 the products of combustion
30 pass away, and there are openings at 13 for the escape of gases from the retorts.

At the lower ends of the retorts N are slides P, actuated by any suitable means, such as
35 lever-handles or screws, and these slides when closed retain the ore and carbon in the secondary or finishing retorts N, and when open allow the materials to slide down into the hopper Q and by the feed-pipe R directly to the
40 reverberatory furnace or hearth S, in which the iron is melted and may be puddled or otherwise treated, according to the product desired. I have represented the tap-hole 14, through which melted slag may be drawn off,
45 and the tap-hole 15, through which the melted iron may be withdrawn, and the final discharge-hole at 18. This apparatus is to be operated in the following manner:

The burners are to be set in operation so
50 as to supply flame into the heating-flues of the retorts, and when such retorts are at the proper temperature the valve B is opened sufficiently to allow the carbon and oxid of iron to pass down into the mixer C, in which
55 the shaft and blades are revolving, and the carbon and iron ore are intimately and uniformly mixed together and pass on into the retorts and about half fill the same, and the material is allowed to remain under the action
60 of heat a sufficient length of time for the oxygen to be driven off from the iron and to combine with the carbon. The valve B is then withdrawn and a second charge of material allowed to pass down and be mixed in the
65 mixer and fill the retorts to the top, such materials remaining under the action of the

heat the proper length of time, and then the gate or valve 10 is opened to allow about half the contents of the retorts to pass down into the secondary or finishing retorts, which, being about half the size, are full, or nearly so,
70 and it is advantageous to provide peep-holes at 16, so as to stop the flow of the material when the retorts N have received the proper quantity of material, the valve B is again
75 withdrawn and the materials are supplied down into the retorts D to nearly fill the same, and the operations are performed successively, so that the apparatus is made substantially continuous; and when the materi-
80 als in the secondary or finishing retorts have been exposed to the proper temperature and for the required time the slides P are withdrawn and the contents of the retorts N are allowed to pass down into the reverberatory
85 furnace or hearth for final melting. During these respective operations the granular ore and the carbon are intimately mixed by the disturbing action produced as the materials pass down the zigzag retorts, and at the same
90 time atmosphere is excluded, and with but little or no loss of heat, because the materials pass from the retorts into the secondary retorts, and from the latter to the melting-furnace, without coming in contact with the
95 external atmosphere and without losing their heat perceptibly.

In the walls of the heating-flues E there are openings with plugs 17, that are removable, so as to give access to the flues for
100 igniting the flames and also for observing the heated condition of the retorts. I, however, prefer also to provide small removable plugs 19 at the lower ends of the flues E and O for the insertion into such flues of incandescent
105 charcoal or other fuel when starting the apparatus, so that the same will immediately ignite the gases that are introduced first at the bottom portions of the flues and then successively in the burners that are higher up,
110 so that the lower burner ignites the higher burners, and the products of combustion pass away laterally by any suitable flues to a pipe or chimney T. The gases driven off
115 from the retorts might be allowed to pass away by this pipe or chimney T if there were openings communicating with such pipe T, but usually it is advantageous to provide a
separate escape-flue from the openings 13 and 29, so that any carbonic-oxid gas may
120 pass from such retorts to a suitable holder and subsequently utilized.

In my Patent No. 466,045, granted December 29, 1891, a series of zigzag flues and heating-burners are represented and the oxidized
125 ore is allowed to pass into a melting-furnace. My present invention, as it will be apparent, is a modification of the devices shown in the aforesaid patent, whereby the retorts and heating-flues are more easily and cheaply constructed and put together, and it will also be
130 apparent that this furnace may be extended

and its capacity practically increased indefinitely by increasing the number of retorts and their intervening feeding-flues; and in making up the clay retorts in this heating-furnace, as represented, it is only necessary to provide two or three forms in which the respective sections of the earthenware retorts are constructed, so that these retorts can be set together in building up the furnace and the projecting flanges form the intermediate flues, and it is only necessary to surround the earthenware retorts with sufficient brickwork to support and hold together such retorts.

It is to be understood that the retorts are preferably made of fire-clay, and so also the brickwork should be adapted to withstand the heat to which the furnace is exposed.

I do not limit myself to any particular character of reverberatory furnace or hearth upon which the ore is melted. It is, however, important that the granular deoxidized ore should be supplied into the furnace progressively and the slag and impurities drawn off in a melted state separately from the iron or steel that is melted or puddled in the said furnace.

In cases where the deoxidized material has passed directly into the melting-furnace, as in my Patent No. 457,352, there is risk of the melted metal or slag splashing and clogging up the apparatus or injuring the attendants. By causing the iron to pass into the melted material below the surface thereof this difficulty is prevented.

I claim as my invention—

1. In a deoxidizing-furnace a series of retorts each formed of sections of earthenware material set together and having projecting flanges that meet at their edges to form intervening heating-flues, in combination with brickwork surrounding and supporting such earthenware sections, substantially as set forth.

2. In a deoxidizing-furnace a series of retorts each formed of sections of earthenware material set together and having projecting flanges that meet at their edges to form intervening heating-flues, in combination with brickwork surrounding and supporting such earthenware sections, burners passing through openings in the side walls of the furnace and into the heating-flues, each burner having a supply-pipe and cock for liquid or gaseous fluid and a supply-pipe for air, substantially as set forth.

3. In a deoxidizing-furnace a series of retorts each formed of sections of earthenware material set together and having projecting flanges that meet at their edges to form intervening heating-flues, in combination with brickwork surrounding and supporting such earthenware sections, air-heating pipes within the brickwork and between the retorts and burners for supplying liquid or gaseous fluid and connections from the air-heating pipes

for supplying the air to the burners, substantially as set forth.

4. The combination in a deoxidizing-furnace, of a range of substantially vertical retorts having a zigzag conformation and intervening heating-flues, burners for supplying the material consumed, a hopper for the granular ore and carbon, a rotary mixer, tubes leading from the same to the respective retorts and slides for regulating the admission of the ore and carbon to the mixer, substantially as set forth.

5. The combination in a deoxidizing-furnace, of a range of substantially vertical retorts having a zigzag conformation and intervening heating-flues, burners for supplying the material consumed, a hopper for the granular ore and carbon, a rotary mixer, tubes leading from the same to the respective retorts and slides for regulating the admission of the ore and carbon to the mixer, a range of secondary retorts and connections thereto from the first retorts and slides for regulating the passage of the granular material from one set of retorts to the other, substantially as set forth.

6. The combination in a deoxidizing-furnace, of a range of substantially vertical retorts having a zigzag conformation and intervening heating-flues, burners for supplying the material consumed, a hopper for the granular ore and carbon, a rotary mixer, tubes leading from the same to the respective retorts and slides for regulating the admission of the ore and carbon to the mixer, a range of secondary retorts and connections thereto from the first retorts and slides for regulating the passage of the granular material from one set of retorts to the other, there being openings for the discharge of the gases from the respective retorts, and openings from the flues for the discharge of the products of combustion, substantially as set forth.

7. The combination in a deoxidizing-furnace, of a range of substantially vertical retorts having a zigzag conformation and intervening heating-flues, burners for supplying the material consumed, a hopper for the granular ore and carbon, a rotary mixer, tubes leading from the same to the respective retorts and slides for regulating the admission of the ore and carbon to the mixer, a range of secondary retorts and connections thereto from the first retorts, slides for regulating the passage of the granular material from one set of retorts to the other, a furnace for melting the ore and tubular connections and slides from the retorts to such furnace for allowing the ore to pass directly into the melting-furnace, substantially as set forth.

Signed by me this 26th day of August, 1895.

HENRY A. JONES.

Witnesses:

GEO. T. PINCKNEY,
WILLIAM G. MOTT.