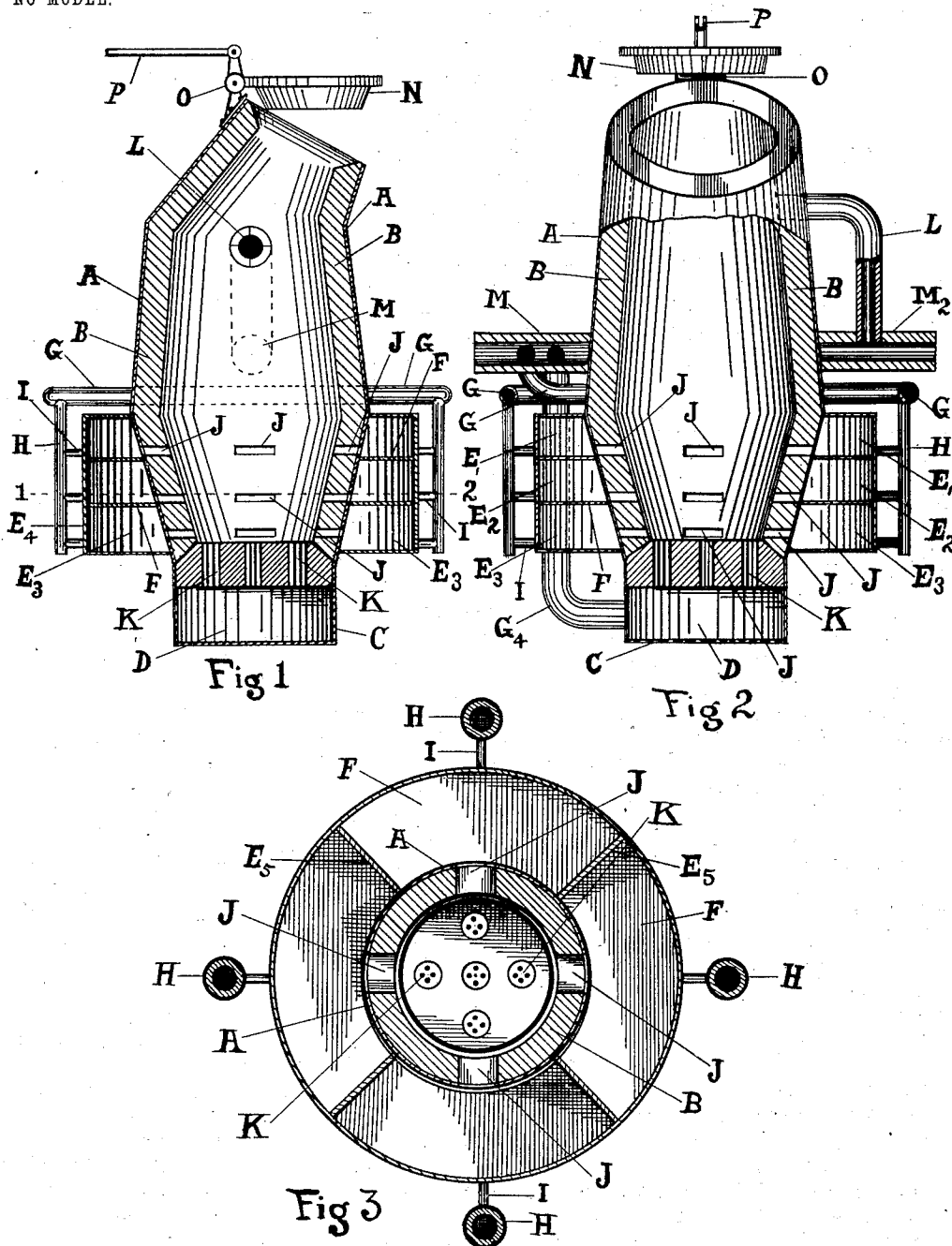


No. 757,803.

PATENTED APR. 19, 1904.

W. B. BURROW
PROCESS OF TREATING AND MANUFACTURING STEEL.
APPLICATION FILED MAY 17, 1902.

NO MODEL.



Witnesses
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UNITED STATES PATENT OFFICE.

WALTER B. BURROW, OF NORFOLK, VIRGINIA.

PROCESS OF TREATING AND MANUFACTURING STEEL.

SPECIFICATION forming part of Letters Patent No. 757,803, dated April 19, 1904.

Application filed May 17, 1902. Serial No. 107,817. (No specimens.)

To all whom it may concern:

Be it known that I, WALTER B. BURROW, a citizen of the United States, residing at Norfolk, in the county of Norfolk and State of Virginia, have invented a new and useful Process of Introducing Dephosphorizing and Desulfurizing Agents or Compounds into Molten Iron and Steel; and I do declare that the following is a full, clear, and exact description of the same.

My invention relates to the method of treatment and the manufacture of steel and similar products.

The process consists of injecting into the molten iron or steel finely-divided dephosphorizing and desulfurizing material into various depths or thickness of the molten metallic bath, carried in with the atmospheric air-blast at a greater or less pressure or volume.

Figure 1 is a sectional elevation at right angles to the axis of the converter. Fig. 2 is a sectional elevation parallel with the axis or trunnions. Fig. 3 is a sectional plan on the line 1 2 in Fig. 1.

In the drawings, in which like letters of reference indicate similar parts in all the views, A is the converter-shell. B is the refractory lining. G is the bottom or main wind-box. D is the air-space or reservoir for the main twyers or blast-orifices K.

E', E'', and E''' are the compartments into which the auxiliary wind-box or reservoir E⁴ is divided.

E⁵ represents division-plates which separate the wind-box E⁴ into as many parts as there are twyers in each circular row.

F represents division-plates, which are placed horizontally and form compartments in the direction of the height of the wind-box E⁴, as shown in Figs. 1, 2, and 3.

G is the main blast or bustle pipe surrounding the converter-body at or below the axis or trunnions and having one end connected to the blast-trunnion M.

H represents the branch pipes from the bustle-pipe G, conveying the blast to the wind-box E⁴ by means of the short nipples I, Fig. 3.

J represents the side twyers, through which the pulverulent purifying material is intro-

duced into the converter at different depths 50 of the molten bath.

L is the vacuum-pipe from the interior of the converter near its outlet and above the surface of the molten metal and its lower end connected to the vacuum-trunnion M², by which the products of combustion are withdrawn and a rarefied condition produced within the converter by suitable means.

N is a door or cover on the converter nose or outlet for closing same and making an airtight joint.

O is a hinge for the cover N, and P is a lever or rod for operating the same.

The air-blast is used alone or mixed with variable percentages of other suitable gases. Toward the last stage of the process a vacuum is produced within the converter or vessel by means of an air or vacuum-pump, and the rarefied condition thus produced draws in the remainder of the purifying agents and removes the occluded gases from the molten metal, as will be described hereinafter. The pulverulent purifying material is carried in with the blast and by suitable atomizers is sprayed into the iron or steel by means of rectangular twyers or blowpipes arranged one above the other in the sides or body of the converting vessel and are spaced vertically downward from the trunnion or axis to the hearth or bottom of the converter. Each vertical row of the side twyers is opposite another set and blow against each other and meeting the blast from the bottom twyers cause every particle of the purifying material to become intimately mixed with the molten metal. The side twyers are spaced a few inches apart from the bottom or hearth of the converter upward, so that the top ones are a fraction of an inch under the level of the metal, while the lowest ones are several inches from the bottom of the converter-lining. The converter is provided with a jacket around its circumference, divided into compartments downward, and each division is connected with one or more side twyers and controlled by a valve, so that any or all of the side twyers can be cut off and on as required. The purifying material in dry powder is placed in the compartments into which the jacket is

divided and by suitable atomizers, blowpipes, and deflecting-plates is blown into the molten bath, as described. When the period of blowing is or nearly finished, the remaining charge
 5 of the purifying agents is drawn in by closing the nose or outlet of the converter by a suitable cover and exhausting the air and gases from the vessel and maintaining the rarefied condition until the material is thoroughly dif-
 10 fused into the molten metal.

During the commencement of the operation small quantities of the purifying agents are allowed to enter, and as the process of decarbonization advances increasing amounts of
 15 the material are sprayed in with the air, and at the proper time or toward the end of the operation a large quantity is drawn in by the vacuum and allowed to remain in for a short time, so that the material injected becomes
 20 saturated with the impurities in the metal. Any occluded gases remaining in the molten bath at the conclusion or produced on the introduction of the larger amounts of the purifying agents into the iron or steel are with-
 25 drawn by the vacuum-pump and the rarefied condition kept up for several minutes according to the condition of the metal. The accumulation of slag is removed from the surface of the metal at intervals, the slag opening or
 30 door being near the level of the metal.

After the process is finished and should it be necessary the metal is poured into ladles and placed on a table and subjected to a rapid rotary motion in order to bring all the slag to
 35 the surface by centrifugal force, after which it is removed and the metal cast into suitable molds. The pressure of the blast at the lower twyers is greater than those nearer the sur-
 40 face of the metal. The different pressures are obtained by the use of reducing-valves supplied with the blast from a reservoir or from the axis or trunnions of the converter, as is the usual case in the ordinary movable or
 45 tilting converter. The air blown in by the side twyers and carrying the finely-divided purifying material is adjusted so that the proper volume of air is injected or blown in to effect decarbonization in conjunction with
 50 the main bottom twyers and the proper pressure is controlled by valves connected to the divisions of the jacket, which is the receptacle for the pulverulent material. All the twyers operate at the same time, but those that are
 55 desired to have less effect operate under reduced pressure sufficient to prevent the metal from running into the twyers if the construction of the vessel would cause the metal to run into the twyers backward, and consequently into the atomizer-boxes if the pres-
 60 sure should stop. Besides getting a homo-

geneous mixture of the molten metal and the purifying agents by injection through the side twyers the blowing of the air in all direc-
 65 tions into the body of metal, more particularly nearer the surface, will produce a tough and solid metal, as well as being free from undesirable elements. The operation of blowing in the finely-divided material is commenced at the lower side twyers and gradually works
 70 up as the contents of the carbon decreases, and toward the end all the side twyers are in use, though a larger quantity is injected by the twyers near the bottom or hearth. When the final stage arrives, the air-supply valves are
 75 partially closed and the cover or lid on the converter nose or outlet is nearly shut. The blast is continued gently until the proper vacuum is obtained in a reservoir situated between the converter and the vacuum-pump,
 80 and when such is the case the converter is reclined so as to clear the twyers, the lid or nose tightly shut, as are also the blast-valves, while the valves that control the atomizers are suddenly opened, which draws in the material, and after a few minutes the converter is
 85 emptied into ladles.

The process is carried out in special vessels and is subject to variations to suit conditions. The amount of air blown in and the quantity of the purifying agents introduced depends
 90 upon the grade of steel desired and the amount of impurities in the metal, and except where otherwise stated the operation is conducted in the ordinary manner.

Having described my invention, what I
 95 claim, and desire to secure by Letters Patent, is—

1. The introduction of purifying agents in a finely-divided state into molten iron and steel
 100 by means of the atmospheric air-blast at variable pressures into different depths of the metal in a refractory-lined converter or vessel, as described.

2. The introduction of dephosphorizing material in a pulverulent form, in the manufac-
 105 ture of steel, by means of the air-blast under pressure in different thickness or depths of the molten metal and by drawing in the dephosphorizing material at a certain stage of the process by means of a vacuum, and the expul-
 110 sion of the gases from the vessel on the introduction of the purifying material into the converter, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

WALTER B. BURROW.

Witnesses:

J. M. NEWBERN,
 JOHN L. FLETCHER.