(No Model.) 2 Sheets—Sheet 1.

J. W. BOOKWALTER.

CONVERTER.

No. 412,721. Patented Oct. 15, 1889.

Fig. 1.

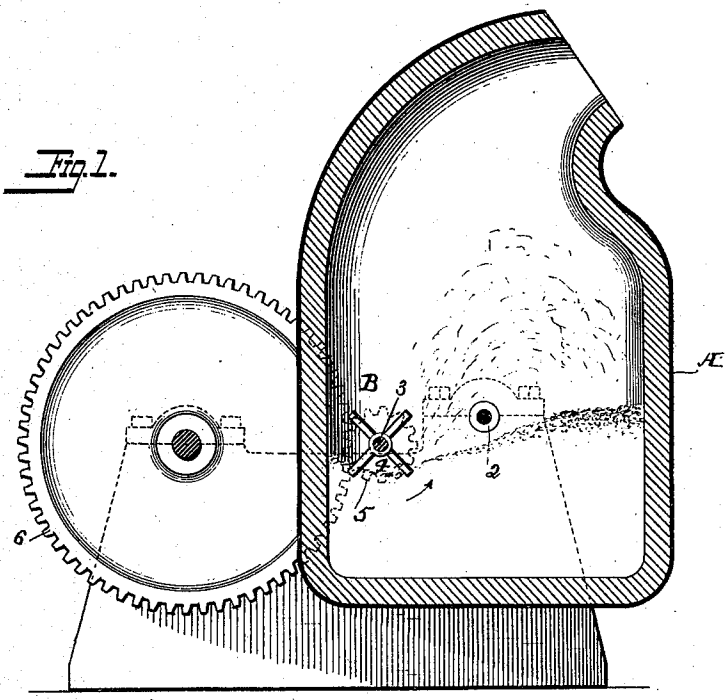
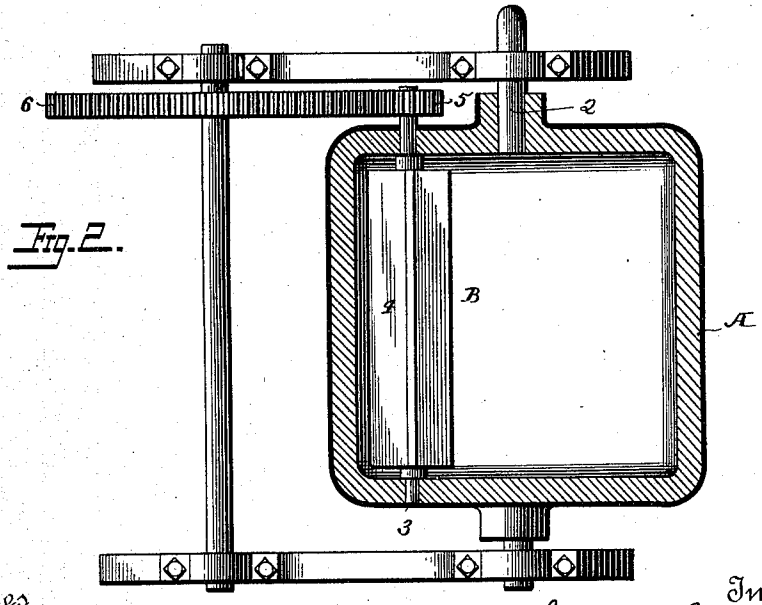


Fig. 2.



Witnesses
Jno. G. Hinkel, Jr.
W. S. McArthur

Inventor
John W. Bookwalter
By Dyrenforth & Dyrenforth
Attorneys

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

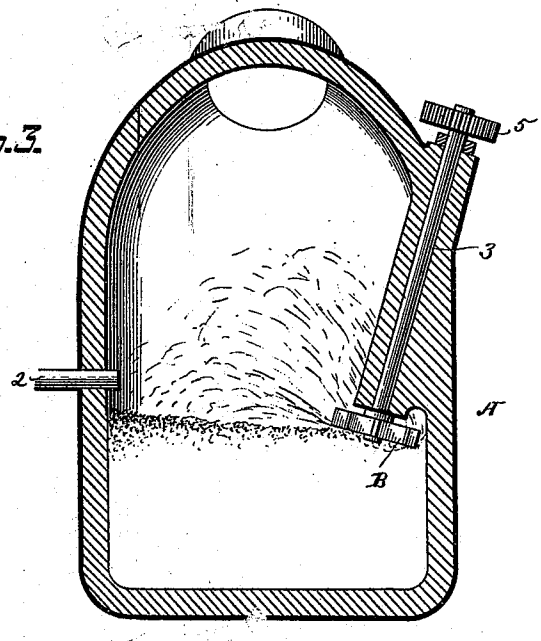


Fig. 4.

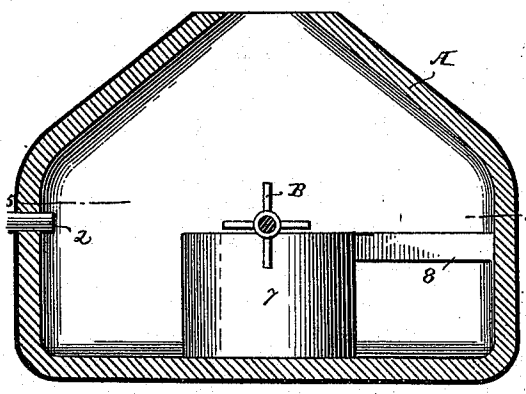
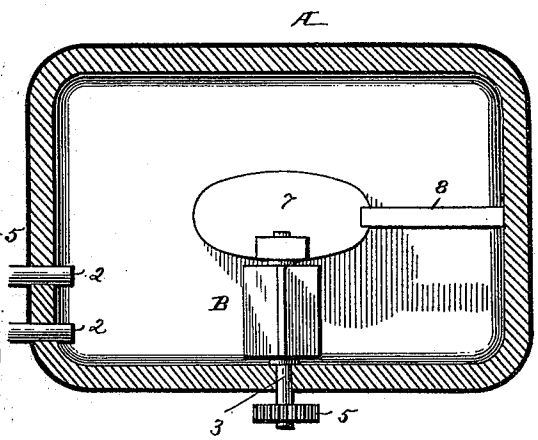


Fig. 5.



Witnesses
Jno. G. Hinkel Jr.
W. S. McArthur

Inventor
John W. Bookwalter
By Foster & Freeman
Attorneys

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

JOHN W. BOOKWALTER, OF SPRINGFIELD, OHIO, ASSIGNOR TO THE BOOKWALTER STEEL AND IRON COMPANY, OF JERSEY CITY, NEW JERSEY.

CONVERTER.

SPECIFICATION forming part of Letters Patent No. 412,721, dated October 15, 1889.

Application filed October 30, 1888. Serial No. 289,500. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. BOOKWALTER, a citizen of the United States, and a resident of Springfield, Clark county, Ohio, have invented certain new and useful Improvements in Converters, of which the following is a specification.

My invention relates to that process in the conversion of crude iron and malleable iron or steel in which a portion of the bath of molten metal at the surface is subjected to violent atomic action for the purpose of separating the impurities from the metal, while a gyratory motion is imparted to the body of the metal to bring every portion thereof successively and repeatedly into position to be agitated; and my invention consists of an apparatus for effecting these results, constructed as fully set forth hereinafter and as illustrated in the accompanying drawings, in which—

Figure 1 is a sectional elevation of an apparatus embodying my invention. Fig. 2 is a sectional plan of the apparatus shown in Fig. 1. Fig. 3 is a sectional elevation of an apparatus illustrating a modification. Fig. 4 is a sectional elevation illustrating another modification. Fig. 5 is a sectional plan on the line 5 5, Fig. 4.

The converter A is of any suitable form and dimensions, and may be fixed as shown in Figs. 3, 4, and 5, or it may be provided with trunnions upon which to swing it. The converter is also provided with one or more tuyeres or nozzles 2, communicating with a pipe through which is admitted any suitable aeriform oxidizing agent, as air. In the construction shown in Figs. 1 and 2 the tuyere is formed in and by the hollow trunnion of the converter. In the other figures independent tuyeres extending through the walls of the converters are shown, and the converting gas is introduced cold or hot, as may be required.

In suitable bearings in the walls of the converter turns a shaft 3, provided with blades 4, and constituting a revolving paddle B, which may be either horizontal, as shown in Figs. 1, 2, 4, and 5, or the shaft may be inclined to carry an inclined paddle, as shown in Fig. 3, and a pinion 5 upon the shaft engages with a driving toothed wheel 6 when the converter is in substantially an upright position, so that the revolution of the driving-wheel 6 in the direction of its arrow will rotate the shaft 3 with great rapidity, imparting rotation to the paddle in the direction of its arrow. The revolving paddle is preferably arranged adjacent to that side of the converter opposite to the mouth of the converter, so that when the latter is turned to pour out the converted charge the paddle may not be immersed in the metal, and the latter will not flow between the shaft and its bearing.

When the charge of molten crude metal has been poured into the converter and the latter has been brought to an upright position, if a tilting converter is used, a stream or current of converting gas is passed into the converter through the nozzle or tuyere and the paddle is put in rapid rotation. The amount of metal introduced is such that the surface thereof would be below the shaft 3, so that the blades of the paddle only will dip into the metal, and as they travel rapidly they are brought forcibly against limited portions of the metal at a limited area of the surface thereof, thereby subjecting such portions to a violent action that tends to separate the metal and impurities and direct the metal in sheets or spray of finely-pulverized or finely-divided particles away from the main body and into intimate contact with the converting agent, while the metal is skimmed off by the action of the blades, constantly exposing fresh surfaces to the converting action. Particles or impurities separated from the metal are deposited upon the comparatively quiescent surface of the body of metal, while a gyration is imparted to the latter in the direction of the arrows, which causes it to travel beneath the layer of scoria upon the surface and back into position to be operated upon by the paddle, but without any tendency to draw down the particles lying upon the surface. By this means every portion of the entire body of metal is brought repeatedly into position to be violently agitated by the paddle without violently agitating the

whole body of metal, and most extended surfaces of fresh metal are subjected to the action of the converting gas. After the conversion has been effected the supply of converting agent may be cut off and the action of the paddle may be continued until all the impurities are washed out of the metal onto the surface. As the process of conversion continues the level of the metal of the bath gradually sinks; but by tilting the converter, when a tilting converter is used, or by introducing displacing blocks when a fixed converter is used, the proper relative positions of the paddle and the surface of the metal may be maintained.

In the constructions shown in Figs. 3 and 4 the converter is fixed and supplied with a converting blast through tuyeres or nozzles 2, and has a central block 7, so as to form an annulus between the face of said block and the walls of the converter, and the paddle B is arranged at one side of the vertical axis of the converter, so as to act upon a limited area of the metal violently, as before described, and impart a flow to the body of the metal to and through the annulus that gradually brings every portion repeatedly under the action of the paddle. Across the converter extends one or more bars 8, so arranged as to intercept the flow of the metal at the surface and thereby arrest or skim off the floating particles of scoria, &c., thrown upon the surface by the action of the paddle, or formed thereon and carried with the current, so that the pure metal passes beneath the bars, exposing fresh surfaces constantly to the action of the converting gas. This I do not here claim, as it constitutes the subject of a separate application for Letters Patent, Serial No. 288,764.

When an inclined paddle is used, as illustrated in Fig. 3, the blades at one side only dip into and agitate the metal.

It will be evident that two or more revolving paddles may be employed where the converter is large in size and the body of the metal is so great as not to be effectively acted upon by a single paddle.

Without limiting myself to the precise construction and arrangement of parts shown and described, I claim—

1. A converter provided with one or more inlet-pipes or tuyeres, and with a paddle arranged above and in position to act upon limited portions of the bath of metal in the converter at the surface of the metal to separate such portions from the main body and expose them to the converting agent, substantially as and for the purpose set forth.

2. The combination, with a converter having a tuyere, of a revolving paddle arranged to act locally upon a part of the bath of metal in the converter at the surface thereof to throw the same upward from the main body, substantially as described.

3. The combination, with a tilting converter having a tuyere, of a revolving paddle arranged with its axis above the level of the surface of the bath of metal and at one side of the center of the converter, substantially as set forth.

4. The combination of a converter having a tuyere, a revolving paddle arranged with its transverse axis above the level of the surface of the metal in the converter in position for the blades to act only on a limited portion of metal at the surface of the bath, and a driving-shaft for imparting rapid rotation to the paddle-shaft, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN W. BOOKWALTER.

Witnesses:
J. S. BARKER,
W. S. MCARTHUR.