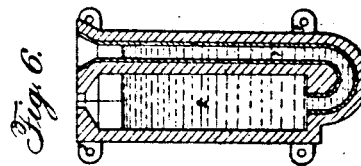
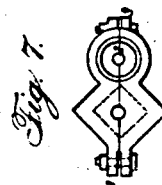
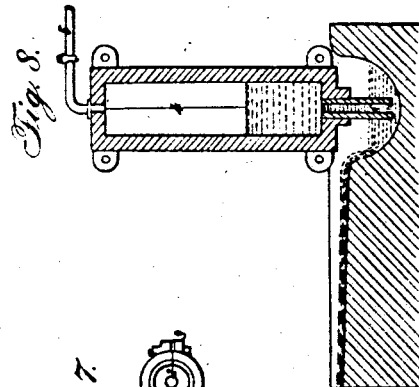
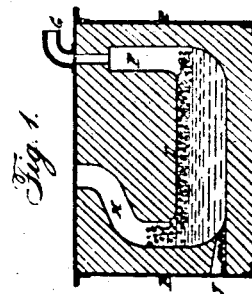
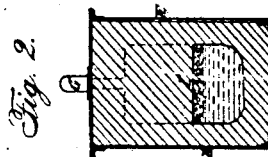
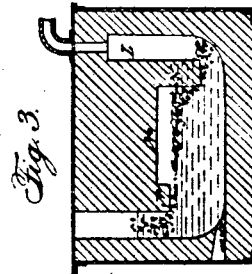
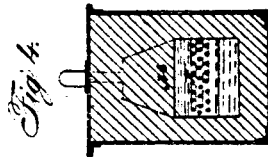
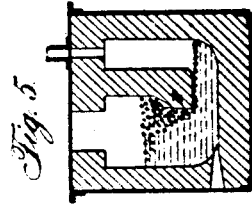


H. BESSEMER.
Making Bessemer Steel.

No. 49,051.

Patented July 25. 1865.



Witnesses:

J. Moore
J. D. Latham

Inventor,

Henry Bessemer.
By B. W. Latham.
Att'y.

UNITED STATES PATENT OFFICE.

HENRY BESSEMER, OF LONDON, ENGLAND.

IMPROVEMENT IN THE MANUFACTURE OF IRON AND STEEL.

Specification forming part of Letters Patent No. 49,051, dated July 25, 1865.

To all whom it may concern:

Be it known that I, HENRY BESSEMER, of Queen Street Place, New Cannon Street, in the city of London, in the Kingdom of Great Britain, have invented certain new and useful Improvements in the Manufacture of Iron and Steel; and I do hereby declare the following to be a full and exact description of the same, reference being had to the accompanying drawings.

In the specification of a patent granted to me for improvements in the manufacture of iron and steel, bearing date the 12th day of February, 1856, I have shown how by means of jets or currents of air or steam the process of decarbonization of crude or pig iron is made to produce a pure or nearly pure steel or malleable iron, and how I retain by such means the malleable metal in a fluid state, so as to allow of its being poured or run into ingots or masses capable of being afterward hammered or rolled.

My present invention relates, first, to peculiar modes by which the decarbonization or partial decarbonization and refinement of iron is effected by means of currents or jets of atmospheric air or steam, (alone or mixed,) which are made to impinge upon the surface or pass through or in contact with the metal while in a fluid state; secondly, in the manner in which the metal so treated is formed into ingots or masses suitable for being afterward made into bars, plates, or rods by the process of hammering or rolling.

For the process of decarbonizing and refinement of the iron without the use of additional fuel for that purpose, I construct a box or chamber of brick, fire-stone, or iron lined with loam or other slow conductor of heat. The chamber should be closed, except at one end, where there is a raised outlet for the escape of the air or steam and aeriform matters produced. At the opposite end the cover rises, so as to form a space for the admission of the air or steam above the surface of the metal. The metal in a fluid state is run into the box or chamber, which may be previously heated, so as to fill it up to the cover and at least a few inches up the raised parts. The air or steam is then forced into the space above the surface of the metal, which will be displaced therefrom and allow the air or steam to find its way along

the cover of the chamber and pass up through the metal in the raised outlet, where it will escape, and where the slag formed in the process will also be carried. The cover may be flat or corrugated, or it may have projecting ribs, with or without perforations, to obstruct the too easy passage of the air.

To enable others skilled in the art to more fully understand and construct and use my invention, I have shown three modifications of apparatus on the sheet of drawings hereunto annexed, suitable for carrying into practical operation this part of my said invention.

Figure 1 is a longitudinal section, and Fig. 2 a cross-section, of a rectangular box or chamber to be used for this purpose.

E is the outer casing of iron, lined with fire-brick or other suitable refractory substance.

F is a compartment, closed air-tight at the top, and into which air or steam, or a mixture of air and steam, may be conducted by means of the pipe G. At the opposite end of the apparatus there is a raised outlet, H, from which the flame and gaseous products may escape. Fluid crude iron is to be run or poured into the apparatus until it rises a few inches above the roof or cover I. The blast may then be let into the compartment F, the effect of which will be to disturb the level of the fluid metal by depressing that portion which occupies the compartment F and raising the level of the metal in the outlet-passage H. As soon, however, as the metal is lowered to the level of the cover I the air or steam under pressure will rush in a broad sheet along the surface of the molten iron and bubble up through the metal in the outlet-passage H. A rapid circulation will thus be produced, and every part of the metal will thus in turn come under the influence of the air or steam forced into the compartment F and become refined and decarbonized to the desired extent. The slag or scoria produced in the process will float on the surface of the metal in the outlet-passage H.

At J there is a tapping-hole stopped with loam, through which the metal may be run into suitable molds as soon as it has acquired by the process the proper degree of refinement and malleability.

It will be observed that in this form of apparatus the process of forcing air or steam through the molten mass may be discontinued

and resumed, when desired, by means of a valve which may be placed on the pipe G, there being no tuyeres below the surface of the metal to become stopped up by a cessation of the blast. The workman may therefore discontinue the process from time to time, and test the quality of the metal by dipping out a small sample with a ladle from the outlet H. He may also allow the metal, when refined, to remain for a short time in the chamber, in order to cool a little, and thus enable him to form a sounder ingot or casting.

I have before mentioned that the too easy passage of the air may be prevented by a perforated screen, which will have the effect of more completely dividing the current and diffusing it throughout the metal.

The mode of constructing apparatus for this purpose will be better understood by reference to Fig. 3, which is a longitudinal section, and Fig. 4, which is a cross-section, of an apparatus similar to the one herein lastly described, except that there is a perforated fire-lump or perforated stone bridge at K, which prevents the air or steam forced into the space L from passing along the roof M without first passing through the perforations, which act as tuyeres and distribute the blast in jets, which rise up through the metal and collect under the roof until the metal is displaced therefrom sufficiently to allow the air or steam to force its way beneath the bridge N and rise up and escape through the outlet-passage O. It will be observed that in this form of outlet-passage there is a tendency for the air or steam to escape upward in contact with the brick-work, instead of passing up through the body of the metal. I therefore form in some cases a projecting part, so as to throw off the air or steam and cause it to rise through the fluid metal. In order to accomplish this result it is desirable that this projecting part should extend so far down into the vessel that the greater part of the air or steam shall tend to rise vertically through the metal. This modification will be better understood by reference to the longitudinal section, Fig. 5, where P is the projecting part referred to.

Many other modifications of this apparatus may be made and used with more or less advantage, the main object being to cause currents of air or steam to be forced through and in contact with molten iron without the use of tuyeres or nozzles situated below the surface of the fluid metal, and thus enable the process to be stopped and resumed when required, and prevent the wear and tear of tuyeres or nozzles.

The second part of my invention consists in constructing an ingot-mold having a runner or gate communicating with the bottom of the mold and extending upward to the top of it, so that the mold is filled from its lower end, the metal rising upward until it is filled. When the mold is of iron the runners should be lined with loam to prevent the metal from becoming

solidified therein before the ingot is completed; but I sometimes form such ingot-mold of porous fire-clay, fire-stone, or other slow conductor of heat, so that the metal will retain its fluidity sufficiently long to allow much of the gaseous matters to escape, which would otherwise render the casting cellular.

In order that the mode of forming ingots of malleable steel or malleable iron that has been converted direct from crude fluid iron may be fully understood, I have shown on the sheet of drawings hereunto annexed, in elevation, at Fig. 6, one half of an iron ingot-mold, and a plan of the entire mold at Fig. 7.

1 is the passage down which the fluid metal is poured, and 2 is the main body of the ingot. The passage or runner 1 is lined up with loam so as to prevent the chilling of the metal thereon. The two halves of the mold are secured together by bolts passing through the lugs 3, which retain the parts in position during the casting process, after which the bolts are unscrewed and the ingot removed from the mold.

Ingots cast of this metal are sometimes found to be cellular, and I will now explain how the tendency to this defect in cast ingots may be also lessened or removed by forming the mold as nearly air-tight as possible. It should be placed so that an opening in the lower part of the mold will dip into the fluid metal. A partial vacuum is then to be formed in the mold by opening a cock which communicates with a previously exhausted vessel, and by means of which the air occupying the mold will be removed and the fluid metal caused by atmospheric pressure to fill the mold, the metal rising upward into the vacuous space without producing that admixture of air which results from pouring in the metal from above, while the lessened pressure of the air above the surface of the metal will assist in the disengagement of any gaseous matters contained therein.

A mold suitable for forming ingots in this manner is represented in vertical section at Fig. 8 on the annexed sheet of drawings, where 4 is the mold, having an exhaust pipe and cock, 5, in connection with its upper end and a short piece of fire-clay pipe fixed into the lower end of it. A gutter, down which the metal is allowed to flow from the decarbonizing vessel or chamber, is shown at 7, having a hollow or recess at its lower end, in which the metal collects, and in which the fire-clay pipe is inserted, so that whenever the molten metal rises high enough to cover the lower end of the pipe C the cock leading to the exhaust-vessel may be opened, when the fluid metal will rise up and fill the mold without having been divided by the air, as in the act of falling into a mold, as usual, and whereby the tendency to form air-bubbles by the falling current of fluid metal is avoided.

I do not necessarily confine myself to the precise arrangement of parts herein shown, and details not herein laid down may be carried out in any manner known to the art, and which may be found applicable to my invention.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. Forcing currents of air or steam through and in contact with molten iron without the use of tuyeres or nozzles, substantially in the manner shown.

2. A converting-vessel divided into two chambers, so that air or steam forced upon the surface of the metal in one chamber may pass into the metal in the other chamber under or through the partition between the two chambers.

3. The projections N and P, either separately or in combination, in chambers or vessels for converting molten iron, for the purpose of more thoroughly diffusing the currents of air or steam through said molten iron.

4. The perforated screen K, either by itself or in combination with either or both of the projections N and P, in chambers or vessels for converting molten iron, for the purpose of more thoroughly diffusing the currents of air or steam through said molten iron.

5. A mold provided with a runner or runners lined with loam or other suitable non-conducting material, substantially as and for the purposes described.

6. A mold from which the atmosphere may be exhausted or partially exhausted, substantially as and for the purposes set forth.

HENRY BESSEMER.

Witnesses:

A. L. HOLLEY,
DAVD. LONGDON.