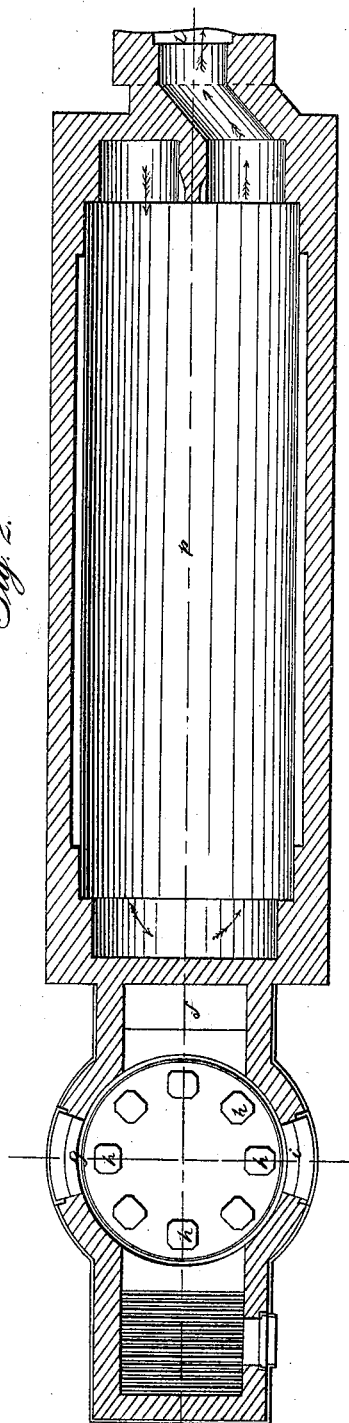
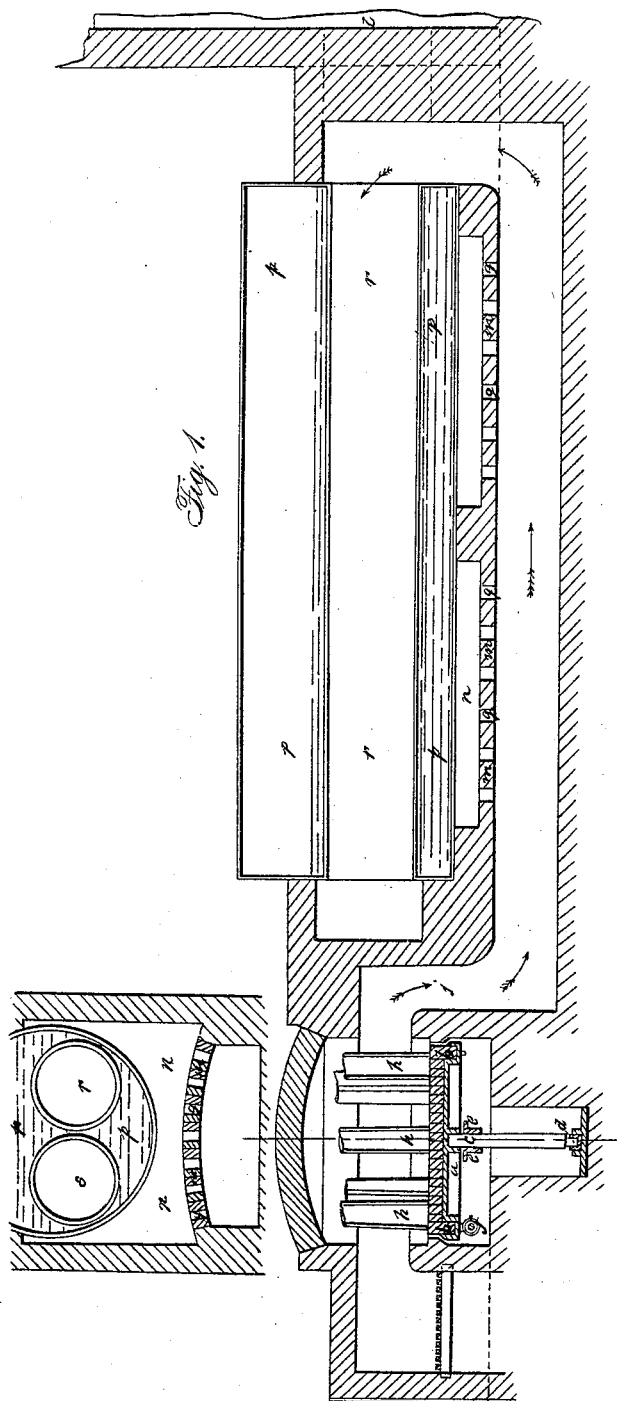


Making Bessemer Steel.

No. 51,400.

Patented Dec. 5, 1865.



Inventor:

Henry Bessemer,
By B. S. Cogswell
his atty.

UNITED STATES PATENT OFFICE.

HENRY BESSEMER, OF LONDON, ENGLAND.

IMPROVEMENT IN THE MANUFACTURE OF MALLEABLE IRON AND STEEL.

Specification forming part of Letters Patent No. 51,400, dated December 5, 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 Malleable Iron and Steel, and in Furnaces and Apparatus employed in such Manufacture; and I do hereby declare the following to be a full and exact description of the same, reference being had to the accompanying drawings.

My invention consists in improvements in furnaces for heating and retaining the heat of ingots or other masses of iron or steel, and in setting boilers in connection with heating and melting furnaces employed in the manufacture of malleable iron and steel.

To enable others skilled in the art to more fully understand and construct and use my invention, I will proceed to describe the structure and operation of the same.

In constructing furnaces for the purpose of retaining the heat of cast ingots until they can be conveniently operated upon by the hammer-pressing machine or rolls, and also for the purpose of reheating cold ingots so to be treated, I construct a furnace with a circular hearth or bed formed on an iron frame having a central vertical spindle, on which it may be slowly made to revolve. The fire-place or admission for gas (where gas is employed as a heating medium) is made on one side of the hearth, and a chimney or flue is formed in connection with the opposite side of the hearth. One or two doors are also provided for the purpose of putting in or taking out the ingots, which I prefer to stand on end in a circle on the revolving bed. The bed may be formed in a manner similar to the beds or hearths of puddling-furnaces, or it may be paved with fire-bricks or stone, a little fuel being distributed over its surface, as usual, if desired.

The mode of constructing these circular heating-furnaces is represented in the drawings hereunto annexed, Figure 1 being a vertical section through the heating-furnace, and also through a steam-boiler employed in connection therewith. Fig. 2 is a horizontal section of the same, and Fig. 3 is a cross-section through the steam boiler and flues.

a is a cast-iron plate having a deep channel

around its outer edge, in which fire-bricks *b* are placed upon end, the central part being also covered with fire-bricks. The plate *a* is supported on a vertical spindle, *c*, resting in a foot-step, *d*. The upper part of the spindle is kept in place by passing through a girder, *e*, which rests on the side walls of the furnace. The circular bed of the furnace is made to revolve by means of a worm-wheel, *f*, acting on a ring of cogs formed on the under side of the plate. A door, *g*, is provided at one side for the admission of the ingots *h*, and a door, *i*, is made on the opposite side for their removal. A flue, *j*, is made, either to conduct the heated matters direct to the chimney, or the heat so escaping from the furnace may be utilized by applying the same for the generation of steam for driving the blast-engine or for working other apparatus to be employed in forging, rolling, or shaping the ingots of iron or steel.

When employing boilers in connection with the heating-furnace before described I prefer not to bring the heated products of combustion immediately on its escape from the furnace into direct contact with the steam-boiler, but I prefer to pass such highly-heated matters along a flue having a brick arch, either perforated or solid, and I place the boiler above the arch or diaphragm, so that the heated brick-work may transmit a portion of the heat to the boiler. The heated vapors, after traversing this flue and being thereby reduced in temperature, may be passed through flues or otherwise applied direct to the metallic surface of the boiler. The brick arch before referred to may be perforated, so as to allow a still further application of heat to the underside of the boiler by reason of some of the vapors passing up through such perforations, but nevertheless so that no direct draft or current of vapors may pass along and in contact with the boiler.

In the illustration I have given of the mode of working circular heating-furnaces in connection with a steam-boiler this mode of heating boilers is also represented.

In Figs. 1 and 3 the arch or diaphragm *m* is shown, under which the heated matters are conveyed to the farthest part of the boiler before coming in direct contact with it. *n* shows the space between the arch *m* and the boiler *p*. At

gare openings by which a still greater heat may be transmitted to the boiler without bringing the main current of heated matters in contact therewith. The products of combustion, after passing along the internal flue-tube, *r*, and returning in an opposite direction by the flue-tube *s*, escape into the chimney *t*.

The furnaces employed in remelting pig-iron for conversion into malleable iron or steel cannot utilize the whole of the heat generated therein, but allow a portion of such heat to escape up the chimney, the very high temperature of the escaping vapors being such as to render their immediate and direct application to the metal surface of a steam-boiler more or less unsafe.

Now, this part of my said improvements consists in conveying the said vapors or products of combustion (escaping from furnaces employed in melting iron for conversion into steel by passing atmospheric air into and through the fluid metal) along a horizontal bricked flue covered with a thin tile or brick arch, either perforated or otherwise. Above this arch I place horizontally a steam-boiler, by preference of the Cornish construction. The setting of the boiler and the arrangement of the flues may be the same as represented in Figs. 1, 2, and 3, Sheet D, where a steam-boiler is shown in connection with a heating-furnace. The heated matters escaping from the furnace, after passing along the horizontal flue and giving out a portion of their heat to the brick arch, and by radiation from it to the under side of the boiler, return in an opposite direction by way of the internal flue-tube of the boiler and ascend a tall chimney. When perforations or small openings are made in the arch a circulation of hot vapors will take place, although the main body of heated matters will pass rapidly along the flue, the steam so generated being afterward used to drive the blast-engine or other machinery employed in the manufacture of malleable iron or steel.

The furnaces employed in reheating ingots or forgings, or in retaining the heat of the recently cast ingots, may also be provided with a flue constructed as hereinbefore described as applicable to the furnaces employed in melting iron, and the escaping heat of such reheating-furnaces may be also utilized in the generation of steam to be employed in driving the blast-engine, and in working force-pumps for acting

with hydraulic pressure and giving motion to the converting apparatus, and to the cranes and lifts employed in connection therewith. In the construction of engines for this purpose I combine in one apparatus the blast-engine and the said force-pumps employed in moving the cranes and lifts, and the force-pumps employed for working hydraulic presses and hydraulic cutting apparatus used in pressing or "cogging" and shaping or cutting cast ingots of malleable iron or steel. For this purpose I prefer to employ the kind of blast-engine described in a patent granted to me in Great Britain on the 1st day of March, 1860, No. 578. I make an additional crank on the engine-shaft of such blast-engine, and so modify the shape of the bed or foundation-plate that a plumber-block may be secured thereto on each side of the said additional crank. I also employ a fly-wheel of greater diameter and weight than would be necessary for the blast-engine in its uncombined state. The additions to the bed-plate also form a secure holding for the force-pumps and guides, so that the whole may be combined in the same frame.

For working the smaller force-pumps used for cranes and lifts eccentrics may be formed on the engine-shaft, the pumps and valves fitted thereto being made in a manner well understood.

Having described the several parts of my invention, and the manner in which the same may be carried into practical operation, I desire it to be understood that I do not confine myself to the precise details herein given, provided the essential parts of my said improvements be retained; but

What I claim in the manufacture of malleable iron and steel is—

1. The employment of furnaces having a revolving hearth or bed for heating or retaining the heat of ingots, blooms, or other masses of malleable iron or steel.

2. Heating the whole or a portion of a boiler by means of causing the heated products of combustion from the furnace to pass or to be transmitted to the boiler through an arch or diaphragm, either solid or perforated, substantially as and for the purposes described.

HENRY BESSEMER.

Witnesses:

A. L. HOLLEY,
DAVID LONGSDON.