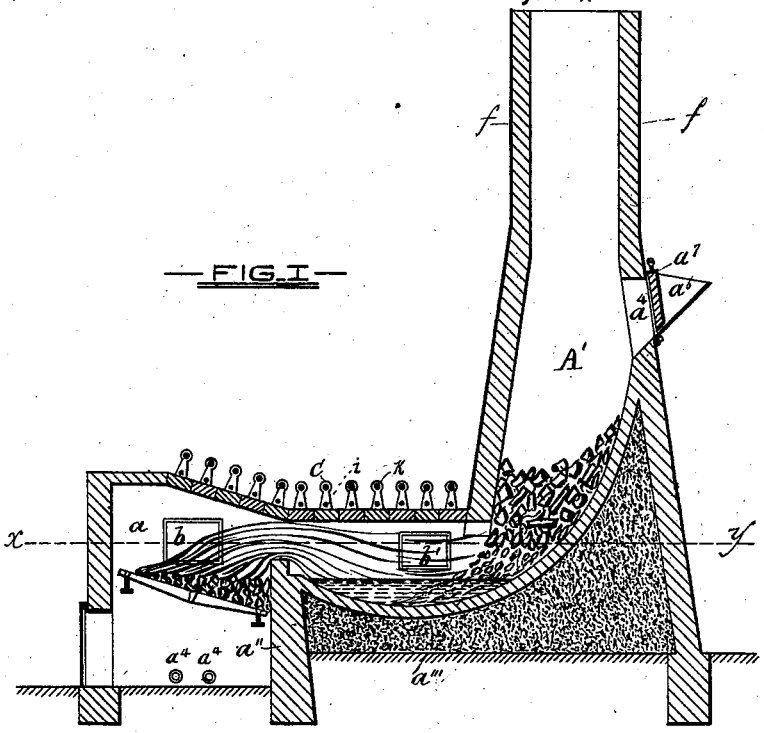
2 Sheets—Sheet 1.

W. SLEICHER. Jr.

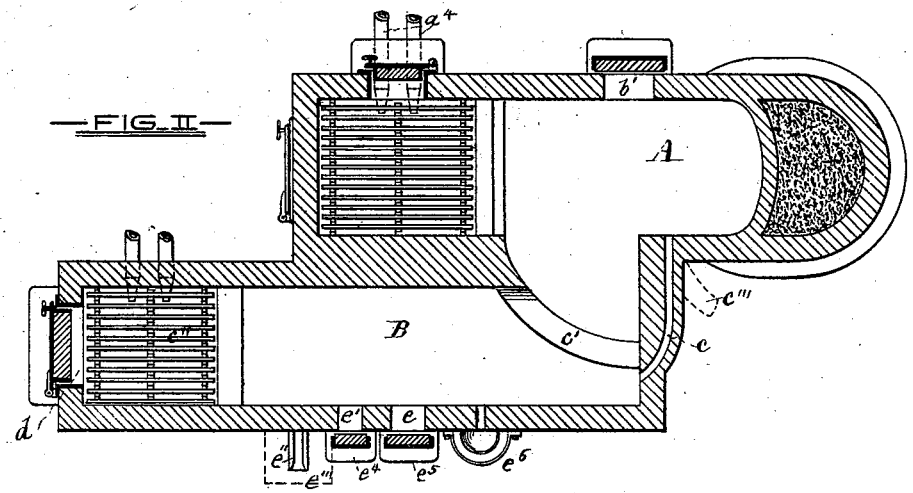
Melting and Refining Iron and Furnace Therefor.

No. 205,692. **Patented July 2, 1878.**

—FIG. I—



—FIG. II—



—WITNESSES—

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—INVENTOR—

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2 Sheets—Sheet 2.

W. SLEICHER, Jr.

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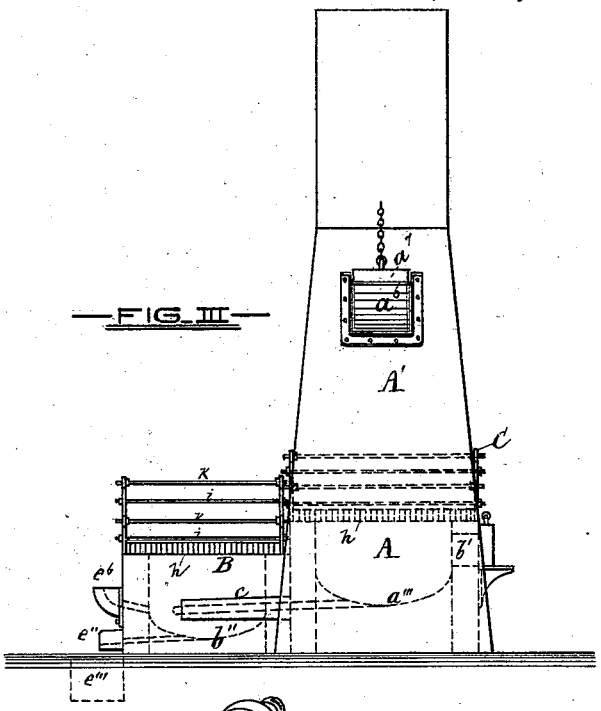
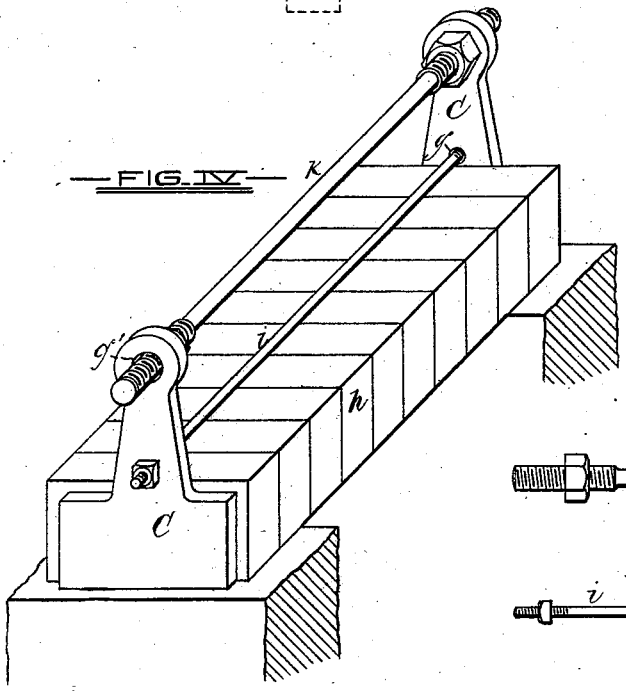
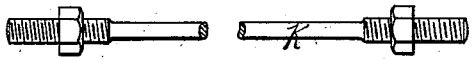
—FIG. III—



—FIG. IV—



—FIG. V—



—FIG. VI—

—WITNESSES—

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UNITED STATES PATENT OFFICE.

WILLIAM SLEICHER, JR., OF TROY, NEW YORK.

IMPROVEMENT IN MELTING AND REFINING IRON, AND FURNACES THEREFOR.

Specification forming part of Letters Patent No. **205,692**, dated July 2, 1878; application filed September 3, 1877.

To all whom it may concern:

Be it known that I, WILLIAM SLEICHER, Jr., of the city of Troy, in the county of Rensselaer and State of New York, have invented certain Improvements in Melting and Refining Iron, for purposes hereinafter named, of which invention the following is a specification; and I do hereby declare that the same is a full, clear, and exact description of the said invention, reference being had to the accompanying drawing, and to the letters of reference marked thereon.

Heretofore I have invented and claimed in Letters Patent a process, and the means for carrying into effect said process, whereby many of the advantages attending the use of my present invention are obtained, the said Letters Patent being numbered 168,293, dated September 28, 1875, and reissued under the No. 7,949 and date of November 13, 1877.

In the invention described in said reissued patent are employed, in connection with a cupola and stack, two reverberatory furnaces, both or one of which may be used in the melting and refining of the iron, designed more particularly for malleable castings.

My present invention, intended for the same purposes, aims to utilize the heat which, in ordinary reverberatory furnaces, is largely wasted in the stack, as it only passes over the iron, and to quicken the reduction of the iron to its molten condition, as well as to facilitate the refining thereof for the purposes of malleable castings, for which, as is known, the iron must be of a high grade and crystallized, or freed to a great extent from carbon.

My invention, however, is adaptable to general foundry purposes, and may be used simply as an apparatus for melting iron for miscellaneous kinds of castings which require refined iron.

In the annexed drawing, forming a part of this specification, Figure 1 is a vertical longitudinal section of the first furnace and stack, hereinafter described. Fig. 2 is a sectional plan of the same upon line *x y*, together with a similar plan of the second furnace, hereinafter described, showing the relative arrangement of the two furnaces. Fig. 3 is a rear view of the apparatus. Figs. 4, 5, and 6 are enlarged views of certain details thereof, hereinafter described.

The same letters of reference indicate the same parts in all the views.

A is the first furnace, having direct communication with the stack A′, which forms a part thereof. The fire-chamber *a* is made roomy, and the bridge-wall *a″* high, to meet the upward curvature of the hearth *a‴* of the furnace. The stoke-hole *b* is placed, preferably, at the side of the fire-chamber, and a skimming-door, *b′*, is situated as shown. The stack A has a charging-door, a^4, through which door iron is thrown into the furnace.

The covers of the furnace are removable, and constructed in a manner hereinafter described.

B is the second furnace, having its hearth *b″* constructed substantially in the same manner as that of the first furnace, but situated about one foot lower, thus allowing the iron melted in the first furnace to flow by its own gravity to the second furnace through the spout *c*, connecting the two furnaces. The two furnaces are entirely separated when this means of communication and the opening above the bridge-wall *c′* of the second furnace are closed.

The opening of the bridge-wall may be readily closed by means of fire-brick, which can be inserted on removing the furnace-covers.

The fire-chamber *c″* of the second furnace is provided with a stoke-hole, *d*, at the front; but in all other respects it approaches the construction of the fire-chamber of the first furnace.

Both furnaces are provided with the usual cleaning or draft doors. Those of the first furnace are, however, kept closed when it is in use, as the draft of the furnace is supplied through blast-pipes a^4, which deliver air under the grates. The second furnace may also, if desired, be supplied with blast-pipes, which would be necessary in some cases. For intance, when the last heat had been melted in the first furnace and run into the second furnace the fire would be maintained only in the second furnace, and the blast would then be required unless the stack were of sufficient height. The second furnace is provided with a skimming-hole, *e*, a testing-hole, *e′*, and a tap-hole or spout, *e″*, which latter is situated over the

pit e'''. The skimming and testing holes are provided with rests e^4 e^5 and sliding doors raised by levers, the surfaces of doors exposed to the heat being coated with fire-clay or lined with fire-brick.

The first furnace A may have a supplemental tap-hole, (shown by e''' in dotted lines,) if desired, for use where the iron is drawn from it direct; or the trough leading to the second furnace could be used for the same purpose by diverting the stream of molten metal by the use of clay or other means.

Attached to the side of the second furnace is a bowl, e^6, of cast-iron, used for throwing back the first iron drawn from the furnace, which iron is used partly for the purpose of mixing, and also to heat up the ladles before they are called into requisition in molding.

Formerly the iron was returned to the furnace through a hole in the cover, as was any iron not used by the molders; but the present construction is more convenient. The bowl is bolted to the side of the furnace, a hole being cut in the wall. The surface of the bowl exposed to the action of the molten metal is coated with fire-clay.

The use to which the bowl is put requires that it shall be situated so that the inner end of the channel leading therefrom to the interior of the furnace shall be above the highest level reached by the molten metal on the hearth.

The covers are made of rows of fire-brick, held together between jaws C, Fig. 4, one jaw resting on each wall of the furnace at the end of each row of fire-brick. The method of clamping the brick between the jaws is shown in Fig. 4. The bolt *i*, Fig. 6, is run through the lower holes *g* of the jaws from one to the other across the furnace, and the nut tightened. The bolt *k*, Fig. 5, having been passed through the upper holes g^1 in the vertical members of the jaws, the nuts at the threaded ends being between the jaws, the nuts are turned so as to force them apart, thus clamping the fire-brick effectually.

The jaws are nearly the size of the fire-brick, as shown, the brick being represented by *h*. The entire covers of the two furnaces are made up of rows of fire-brick thus held together, and are readily removable for the examination of the interior of the furnaces or other purposes.

The door covering the charging-opening is slid up and down, as may be required; and at the said opening is riveted permanently to the sheet-iron shell *f* of the stack an inclined bucket or hopper, a^6, into which the charge is placed when the sliding door a^7 is down, which charge, upon the raising of the door after the melted iron has been run to the second furnace, will descend the incline of said bucket and enter the stack. Thus much time is saved in the charging operation, which is almost instantly effected, and the cooling of the furnace prevented.

When it is desired to melt and refine iron for malleable or other castings, the operation is as follows: A heavy fire is built in the fire-chamber of the first furnace A, and a lighter fire, proportioned to the size of the furnace, in that of the furnace B, and the blast carried under the grates of the two furnaces. The iron, having been introduced through the charging-door a^4, is reduced to a molten condition and collected in the curve of the hearth, as shown. When sufficient iron has been melted, communication is established between the hearths of the two furnaces by removing the clay plug from the spout *c*, and the iron immediately flows by its own gravity to the hearth of the second furnace, which, as before stated, is situated in a lower plane than the hearth of the first furnace. The communication is then closed, the first furnace recharged as before, and the melting continues in the first furnace. The iron thus run to the second furnace is subjected to the action of heat until it is purified, refined, and deprived of such inherent qualities as would, if present, render it unfit for the purposes for which the iron thus treated is specially intended. The iron, having been subjected to the refining action of the second furnace for a sufficient length of time, may be ladled off for use at e''. In the meantime a second supply of iron has been melted in the first furnace, and is ready for admission to the second furnace, to be further refined. Thus the work of melting, refining, and using the refined iron proceeds without interruption.

It will be seen that this arrangement produces a perpetual melting-furnace, as the covers are not removed to place in the charge, which would require time and greatly cool down both furnaces and the stack and deaden the fires. In this arrangement the charge is instantly introduced on raising the charging-door.

By using a strong blast under the grate of the first furnace the flame is carried over the bridge-wall into the stack, and the iron is rapidly reduced. The stack must not, however, be overcharged with iron, the quantity to be introduced being a matter which must be left much to the experience and observation of the attendant.

In casting car-wheels, heavy ordnance, rolls, and other heavy work, which often requires refined iron, the second furnace would need to be larger than for smaller work, as a greater quantity of iron would be needed at one time.

The advantages possessed by my present invention arise chiefly from the ease and rapidity with which the furnaces are charged with iron and the proportionate dispatch with which the iron is melted and refined.

Where the first furnace is used alone, the iron directly tapped from it is superior in quality to that drawn from the ordinary cupola, first, because the iron taken from my first furnace does not come in contact with any fuel, but is melted by the flame from the fire-chamber.

It is well known that the use of any fuel on

a cupola, whether coke or anthracite coal, produces a more or less deleterious effect upon the iron, and the greater rapidity and cheapness of production effected by the use of the ordinary cupola is more than compensated for by the use of my invention: first, in the superior grade and quality of the iron yielded by it; and, secondly, because the iron is distributed over a wider area of hearth, and subjected to the purifying influence of the flame passing over its surface.

Having described my invention, what I claim as new, and wish to secure by Letters Patent of the United States, is—

1. Combined in one structure, a stack and a furnace the bed and hearth of which respectively are constructed practically in a continuous curve, the furnace being provided with a tap-hole for delivering molten metal, and the stack with a charging-opening in its wall, through which unmelted metal is placed in the stack, substantially as and for the purposes herein specified.

2. A furnace consisting of a fire-chamber, a vertical stack with charging-door, an incline to receive the charge, and a hearth, combined with a second furnace provided with a tap-hole and a spout or channel connecting the hearths of the two furnaces, whereby charges of unmelted iron may be introduced and melted during the work of further melting, refining, and tapping off, and the whole operation of the combined apparatus be conducted uninterruptedly, substantially as herein specified.

3. The removable top for the furnace, consisting of a series of separate rows of fire-brick, *h*, each clamped between jaws C, substantially as described, the separate series resting side by side on the respective walls of the furnace, as specified.

4. The first furnace A, having the stack A′, provided with an incline uniting with the curve of the hearth of the furnace, combined with the lower second furnace B, spout or channel *c*, and bridge-wall *c′*, substantially as set forth.

The foregoing specification of my invention signed by me this 14th day of August, A. D. 1877.

WM. SLEICHER, JR.

Witnesses:
THEO. E. HASLEHURST,
J. H. HUNTINGTON.