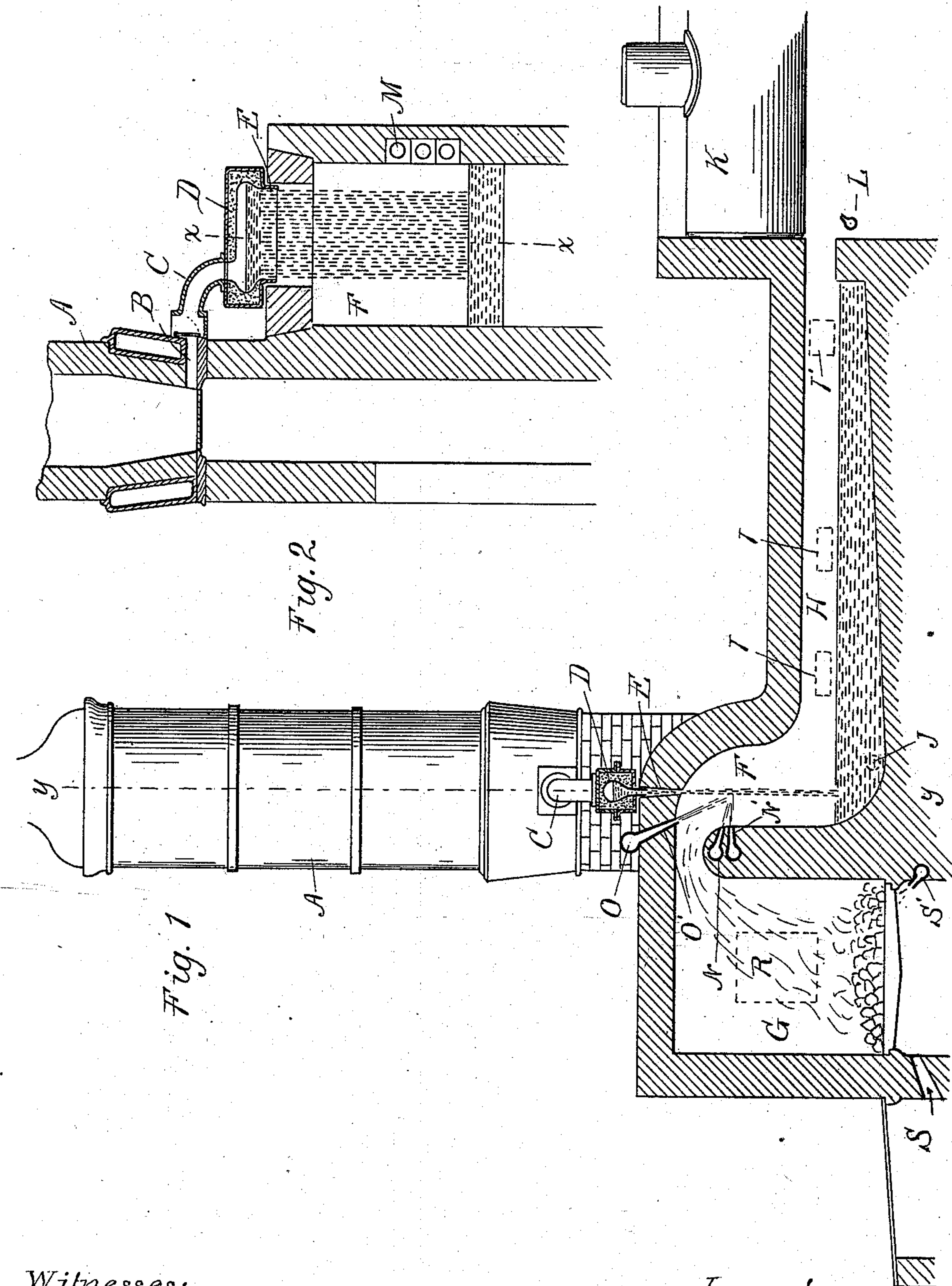


(No Model.)

F. W. HAWKINS.
PROCESS OF AND APPARATUS FOR MANUFACTURING STEEL CASTINGS.
No. 558,947.

Patented Apr. 28, 1896.



Witnesses:

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UNITED STATES PATENT OFFICE.

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PROCESS OF AND APPARATUS FOR MANUFACTURING STEEL CASTINGS.

SPECIFICATION forming part of Letters Patent No. 558,947, dated April 28, 1896.

Application filed August 7, 1895. Serial No. 558,494. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK W. HAWKINS, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Processes of and Apparatus for Manufacturing Steel Castings, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to a process and apparatus for purifying and refining iron and producing thereby the homogeneous metal having the properties of steel.

My process, broadly described, consists in conducting the molten metal as obtained from melting in a cupola, or as obtained directly from the blast-furnace, into a reverberatory flame-chamber and subjecting it therein in a divided state to the action of a concentrated jet or current formed of superheated steam, air, and the highly-heated carbonaceous products of combustion, then thoroughly eliminating the impurities and decarbonizing the metal by puddling the molten mass in a reverberating chamber to a point less than balling, all as more fully hereinafter described in connection with the drawings, in which—

Figure 1 is a longitudinal section on line $x x$, Fig. 2, through an apparatus designed to carry out my invention; and Fig. 2 is a cross-section thereof on line $y y$, Fig. 1.

A represents a cupola, (or furnace suitably organized for making cast-iron.)

B is the tap.

C is a lead or discharge pipe.

D is a hot-well, into which the molten iron from the cupola or furnace is discharged.

E is a contracted discharge-spout from the bottom of the well, arranged to discharge the molten metal in a spray or thin sheet.

F is a reverberatory chamber intervening between the bridge and the hearth of a puddling-furnace and forming a downtake for the products of combustion on their way from the furnace G to the puddling-chamber H and so arranged as to concentrate the heat as much as possible upon the molten stream of iron discharged into it from the spout.

I I are puddling-holes.

I' is a slag-door.

J is the furnace-tap.

K is a boiler for furnishing steam.

L is a supplementary oil-burner or other source of heat for the boiler.

M is a coil of steam-pipes suitably located in the walls of the furnace to superheat the steam from the boiler.

N is a steam-head in the bridge-wall and provided with one or more jets N' for discharging superheated steam into the reverberatory chamber F, and O is a like head above the chamber and provided with one or more jets O' for injecting air into the chamber F.

The furnace G is provided with a suitable feed-door R and with suitable air-feeding devices, as S, to promote active combustion of the fuel in the furnace. Preferably means for introducing superheated steam are also provided, as shown at S'.

In practice, the parts being arranged as shown and described, the operation is as follows: Molten iron of a desirable low percentage of carbon being produced from the furnace or cupola A and discharged therefrom into the well D, it is allowed to drip therefrom through the spout E into the reverberatory chamber F. Here the sheet or spray of molten metal passes directly across the path of the flaming products of combustion and by the reverberatory action of the chamber F its temperature is raised to and maintained at a white heat, while simultaneously therewith a concentrated current or jet of air and superheated steam are directed upon it. The molten metal after being subjected to this action collects on the hearth of the puddling-chamber H, and there it is worked (preferably using oak saplings) in such manner as to remove all the slag and secure thorough puddling to a point less than balling and until the desired condition of the metal is realized, which may be determined by removing test-spigots at intervals. The concentrated jets of steam and air decarbonize the metal and act upon the various impurities in a manner to permit their subsequent elimination in the form of slag, thereby leaving a homogeneous product, which is admirably adapted for producing articles for which steel is or may be adapted, and which may be obtained with any

desired percentage from the chemically-pure metal to the percentage in steel having the maximum chemical combination with carbon.

The difficulty in purifying and refining iron by similar processes heretofore has always proved a failure, mainly on account of the difficulty of preventing the metal from becoming chilled and thus limiting the refining action to certain impurities.

10 In my process I raise the metal to a white heat and maintain it so by letting it enter the chamber F at the hottest part and fall like a thin curtain across the path of the flaming gases, so that while it is exposed on one side
15 to the oxidizing action of air and steam it is exposed on the reverse side to the full reverberatory heat of the furnace, and it will continue to boil while being worked in the puddling-chamber, as the entire length of it is
20 filled with gaseous products in the state of combustion.

What I claim as my invention is—

1. The herein-described process for purifying and refining iron which consists in conducting the molten metal in a thin sheet into
25 a reverberatory chamber in which it is exposed to the products of combustion from a

furnace in a manner to heat the metal and maintain the same at a white heat, in subjecting it therein to the action of a concentrated
30 current of superheated steam and air and then thoroughly eliminating the impurities and decarbonizing the metal by puddling the molten mass to a point less than balling, substantially as described.

2. In an apparatus for purifying and refining iron, the combination with a cupola or furnace, of a puddling-furnace provided with the reverberatory heating-chamber F' intermediate between the bridge-wall and the hearth of
40 the puddling-chamber, and into which the heated products of combustion pass the hot-well D having a discharge-spout E into the reverberatory chamber and communicating
45 with the furnace or cupola and the steam and air twyers J, O for producing a concentrated current of superheated steam and air, substantially as described.

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

FREDERICK W. HAWKINS.

Witnesses:

M. B. O'DOHERTY,
S. M. HULBERT.