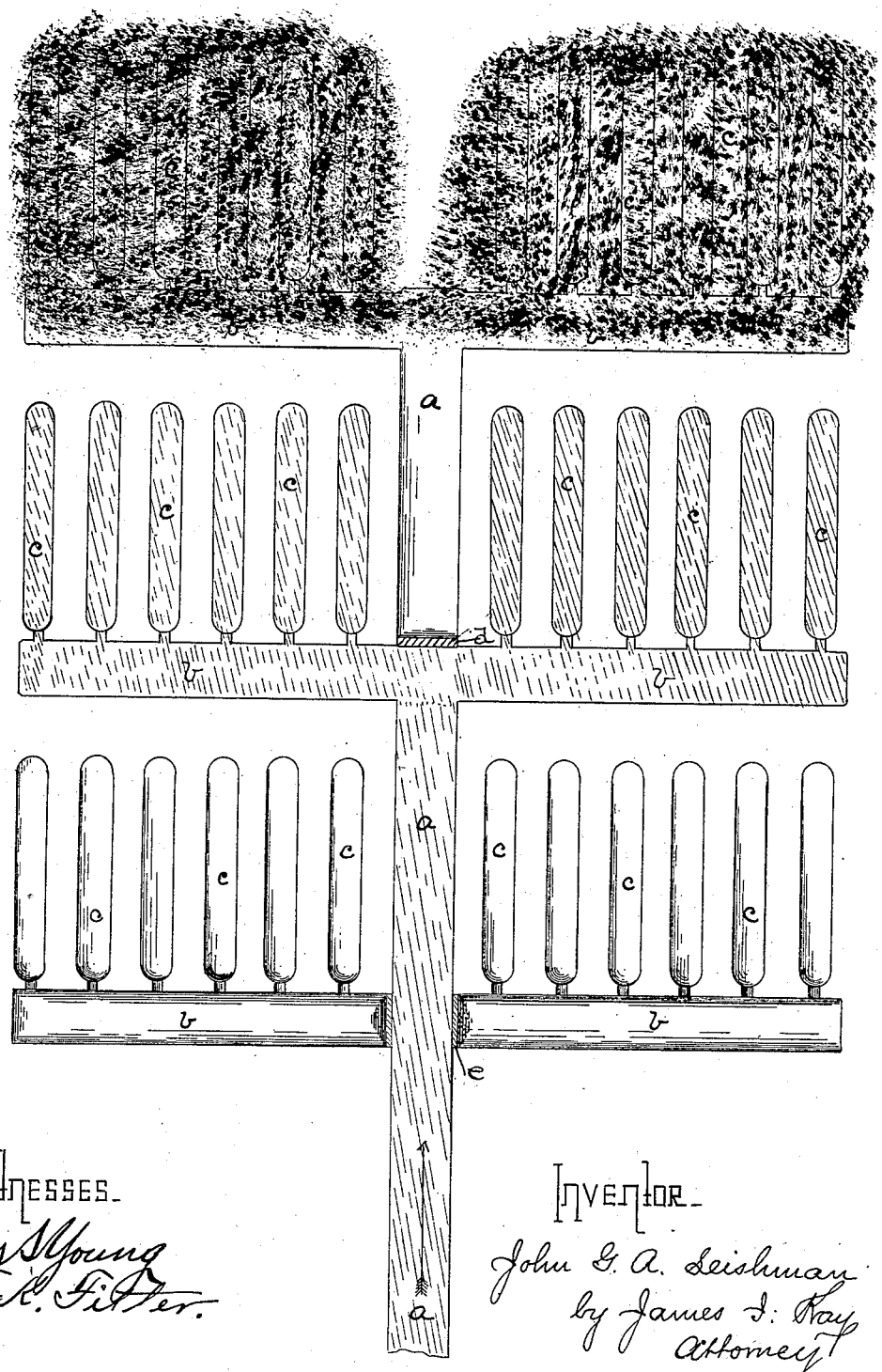
(No Model.)

J. G. A. LEISHMAN.

CASTING PIG METAL.

No. 265,926. Patented Oct. 10, 1882.



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CASTING PIG METAL.

SPECIFICATION forming part of Letters Patent No. 265,926, dated October 10, 1882.

Application filed September 2, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOHN G. A. LEISHMAN, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Casting Pig Metal; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the casting of pig metal produced from iron ore in blast-furnaces, and to the casting floor or bed on which the metal is cast; and it consists essentially in a casting floor or bed for casting the pig metal formed of dolomite sand, or other sand composed of equivalent basic calcareous material, so that the pig metal is cast clean and free from silicious sand, and is dephosphorized in passing over the dolomite sand and in cooling in the molds formed of it, and a stronger and more open or porous and homogeneous metal obtained.

It also consists in casting the pig metal in this dolomite or equivalent basic calcareous sand, and covering the pig metal so cast with such sand, thus entirely enveloping or surrounding the metal with it, and continuing the process or treatment during the cooling of the metal.

The usual casting bed or floor employed at blast-furnaces is formed of silicious sand, in which the main trough leading from the furnace and the molds composed of the "sows" and the "pigs" were molded, the molten metal running from the furnace down the trough and into the sows, and from them into the pigs, and the pig metal so cast being covered with sand to permit the workmen to walk over them in "breaking up" the pigs, and allowed to lie there until sufficiently set and cooled for removal. It is found that in running over the sand and cooling the molten metal burns into and takes up part of the sand, so that a crust of about one-half inch of combined metal and sand is formed around the pig, and an allowance for this sand and that adhering to the metal is necessarily made in selling, the usual allowance being about twenty-eight pounds to the ton. The sand so taken up of course increases the proportion of silica in the metal, which is very objectionable in certain classes of pig metal, such as Bessemer or foundry pig. The pig metal has also been cast in cast-iron molds arranged on the casting-floor; but these molds are going out of use in large casting-floors, as they chill or impart a temper to the outer surface of the pigs; and they absorb the heat from the metal and require too much time for cooling. The upper surface of the metal would also burn into the sand thrown over it, and a crust of combined metal and sand be formed on the top of the pigs. As a substitute for the silicious sand the casting floor or bed has been formed of furnace-slag reduced to the necessary degree of fineness; but this slag, being a flux formed principally of silicate of lime, had no chemical action on the pig metal cast in it, and did not wholly overcome the objections to the ordinary sand, as it adhered to the pig-metal and necessarily increased the proportion of silica carried into the furnace or cupola.

The objects of my invention are, first, to overcome these objections found in the silicious sand, chill, or slag casting-floors, and form a pig clean and free from silica adhering to it; second, to remove the phosphorus from the metal or reduce the proportion contained therein; third, to form the grain of the metal more open, and thus adapt the ordinary forge metal for foundry purposes, and also to improve the quality of the metal in other particulars.

To enable others skilled in the art to practice my invention, I will describe the same more fully, referring for that purpose to the accompanying drawing, which represents in plan view a casting-floor of a blast-furnace.

The material preferably employed by me for forming my improved casting-floor is a sand formed of what is termed "dolomite," being a magnesian limestone found in this and other

countries. The dolomite is found in crystals about the same size or slightly larger than common sand, and in good condition for use without grinding or treatment. It may also be formed by crushing and grinding dolomite rock or marble; but this adds to the expense of the casting-floor. The floor may also be formed of sand composed of other equivalent basic calcareous materials, by which term I include all such materials or compounds of a basic nature having the property of withdrawing the phosphorus or like impurities from the metal, such as limestone, carbonate of magnesia, and like substances containing lime or magnesia, or any of these compounded in the proper manner. I have, however, obtained the best results in a casting-bed formed of the natural dolomite sand, and found it the cheapest and best adapted for the purpose. Where the casting-bed is formed of the dolomite sand it is spread over the floor in the same manner as the sand has ordinarily been employed, and the main trough *a*, extending from the tap-hole of the blast-furnace, and the molds composed of the sows *b*, leading from the trough, and pigs *c*, are molded in the dolomite floor in the same manner as in the silicious-sand floor. It may also be employed with the ordinary sand floor by forming the molds in the sand and sifting a sufficiently thick covering of the dolomite sand over the molds; but no great saving will be effected in this way, as the cost of the dolomite sand is but little above the ordinary sand, and it can be used for some time without losing its beneficial effects, as hereinafter described.

In casting the pig metal the molten metal flows from the tap-hole down the trough *a*, and it is then directed into the sows *b* and pigs *c* in the usual manner, the pigs farthest from the furnace being generally cast first, and the metal in the trough being checked by means of an iron paddle, *d*, pressed into the dolomite bed, just below the next sow, as soon as sufficient metal has passed to fill the lowest sow and pigs. It is then directed into the next sow by removing the paddle *e* at its entrance, and the casting so continued until the entire melt is cast. As the molten metal in flowing through the trough and the molds rolls over and over, it is evident that almost every particle of the metal is brought into contact with the dolomite sand, and as soon as it passes into the dolomite trough it commences to work or "breathe," showing that the chemical action takes place immediately, and the phosphorus contained in the metal is absorbed or withdrawn by the basic calcareous sand of the trough and molds, which takes up a large portion of the phosphorus and silica, its action being apparently instantaneous. As soon as one sow, with its pigs, is filled with the metal the dolomite or other basic calcareous sand employed is spread over it with an ordinary shovel, and the pig metal is thus enveloped in the sand until sufficiently set and cool for removal. During the entire time of casting and cooling the molten metal and the pigs cast continue this working or breathing, before referred to instead of lying dead, as in the silicious-sand molds, showing that the effect of the dolomite in the molds and covering extends throughout the entire mass. As the phosphorus is thus withdrawn while the metal is in a molten state, and the metal remains in contact with the basic material until cooled, there is not the liability of the phosphorus returning to the metal which occurs when the metal is treated at the high heats in a converter or furnace. The molten metal does not burn into the dolomite sand, and the sand does not adhere to any extent to the surface of the pigs cast, so that they are comparatively free and clean from foreign matter, and any of the material carried into the furnace or cupola will aid in the dephosphorizing and desiliconizing of the metal.

The pig metal cast and treated as above described is found to be largely reduced in phosphorus and silica. It is clean and free from the crust of silicious sand formed when cast in the ordinary sand molds, and the metal is homogeneous clear through the pig. It has no temper or chilled surface, as when cast in chill-molds. It is more open than that cast in common sand, so that the ordinary gray forge-metal is formed into the darker more open metal suitable for foundry purposes, and on account of the reduction of the phosphorus and silica it is greatly strengthened and toughened.

I am aware that the dolomite or equivalent basic calcareous material has been employed as a lining for Bessemer converters, that it might wear off and unite with the phosphorus in the metal treated and carry it into the slag produced. I am also aware that a dolomite wash or lining has been used on the interior surface of ingot and like molds for the purpose of preventing any chemical action of the silica of the mold upon the carbon of the steel by interposing a material containing carbon between the steel and the mold, and thus prevent the "piping" of the steel. I employ the dolomite sand, however, for the purpose of causing, instead of preventing, chemical action upon the metal when cast, and in the treatment of the crude pig metal, which, on account of the impurities contained in it, has at this stage in its manufacture entirely different properties from the finished metal, and I obtain from the casting of the crude pig-metal therein the beneficial effects hereinbefore fully set forth, and which, on account of the quantity and form of the material in the ingot-molds, could not be obtained.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A blast-furnace casting bed or floor for casting pig metal, formed of dolomite sand or

other sand composed of eqivalent basic calcareous material, substantially as and for the purposes set forth.

2. The method herein described of casting the pig metal produced in blast-furnaces, consisting in casting the molten metal in dolomite sand or other sand composed of equivalent basic calcareous material, and covering the pig metal so cast with such sand, substantially as and for the purposes set forth.

In testimony whereof I, the said JOHN G. A. LEISHMAN, have hereunto set my hand.

JOHN G. A. LEISHMAN.

Witnesses:

JOS. M. LIPPINCOTT,

JAMES I. KAY.