No. 674,545. Patented May 21, 1901.

B. H. WHITELEY.

PROCESS OR METHOD OF MELTING IRON BORINGS OR DRILLINGS.

(Application filed Jan. 29, 1900.)

(No Model.) 2 Sheets—Sheet 1.

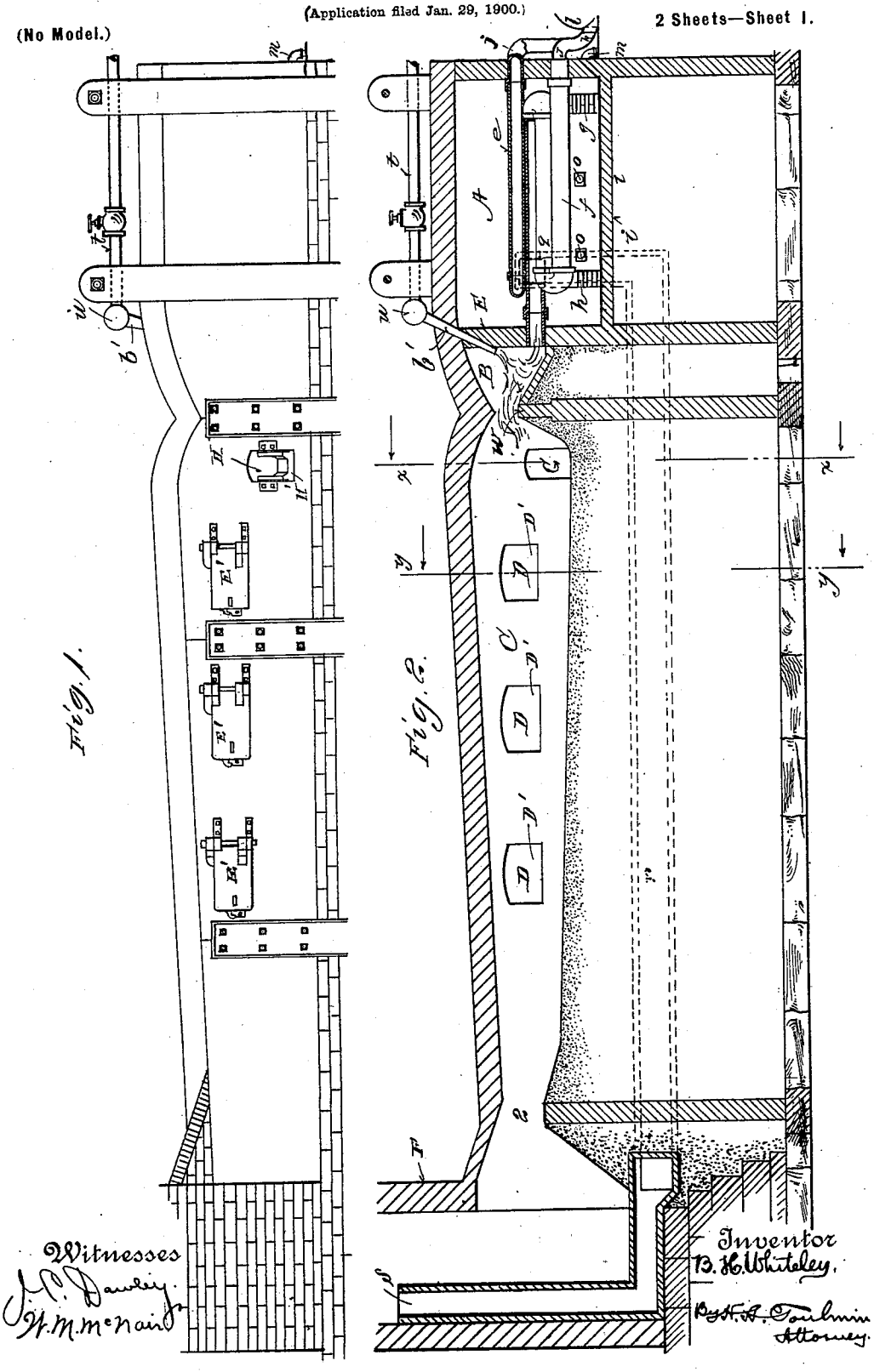


Fig. 1.

Fig. 2.

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Fig. 3.

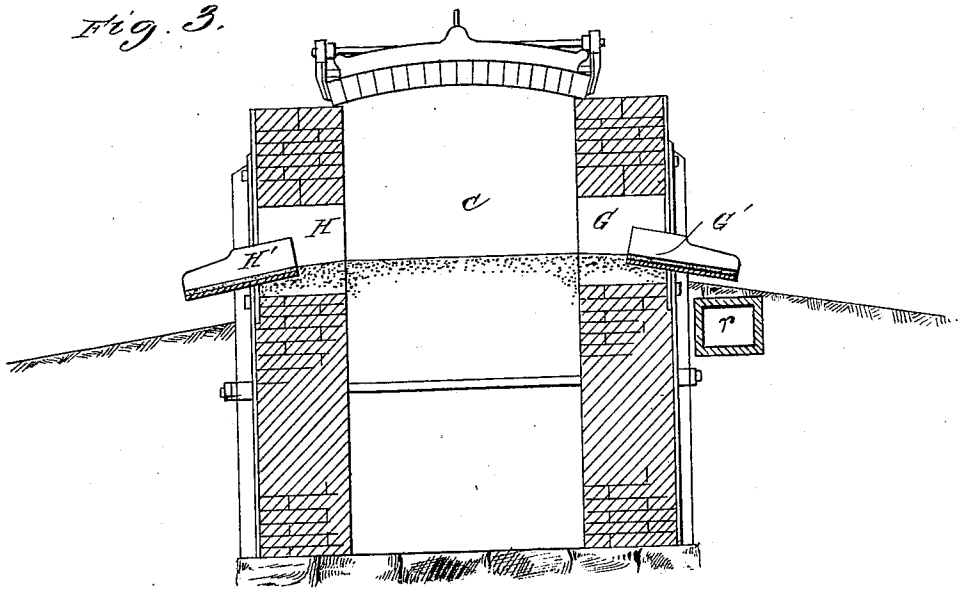
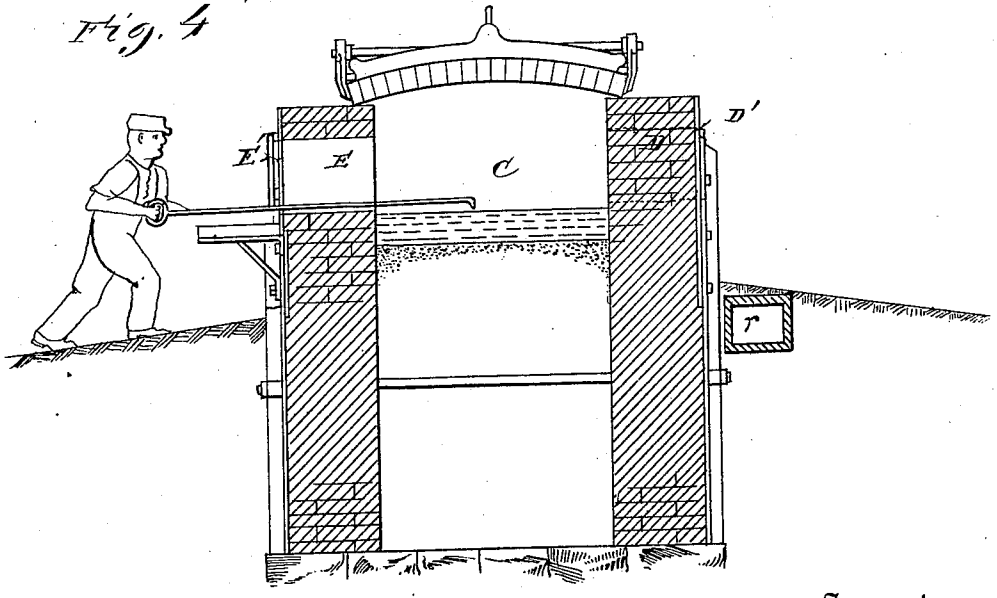


Fig. 4



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UNITED STATES PATENT OFFICE.

BURT H. WHITELEY, OF MUNCIE, INDIANA.

PROCESS OR METHOD OF MELTING IRON BORINGS OR DRILLINGS.

SPECIFICATION forming part of Letters Patent No. 674,545, dated May 21, 1901.

Application filed January 29, 1900. Serial No. 3,122. (No specimens.)

To all whom it may concern:

Be it known that I, BURT H. WHITELEY, a citizen of the United States, residing at Muncie, in the county of Delaware and State of Indiana, have invented certain new and useful Improvements in Processes or Methods of Melting Iron Borings or Drillings, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to an improved process or method of melting cast-iron borings or drillings, being small light fragments of iron that are produced in the various processes of working up cast-iron in the manufacture of articles.

My process or method consists, generally, in melting a quantity of pig-iron or iron in comparatively large pieces in a furnace, in thus providing what I term a "bath," being a quantity of molten iron, in then delivering the borings or drillings into this bath or quantity of molten iron and stirring or agitating the same so as to mix the borings or drillings with the bath or molten quantity, in then again applying the heating products and melting the borings or drillings while in this mixed state with the bath or molten quantity, and in then drawing off the run thus obtained, but leaving, if desired, a sufficient quantity to constitute a bath for the next supply of borings or drillings, this operation being repeated as often and as long as desired, whereby through the medium of such bath the borings or drillings, which are light and easily displaced, are prevented from being blown away and up the stack or out of the melting-chamber by the draft requisite for heating purposes. This bath constitutes a detaining or retaining medium by which these light particles of iron are detained in the furnace and are retained under control during the operation of melting the iron. Incidentally I can supply the product with the requisite quantity of silicon by using iron sufficiently high in silicon to produce the initial bath, or I can throw some of this iron sufficiently high in silicon into the subsequent baths formed by retaining portions of each run, this matter of silicon being left to the choice of the maker of the product, who will be guided by his wish for having iron containing this or that per cent. of silicon, this not being of the essence of my process.

I prefer to use in practicing this invention the natural-gas furnace patented to me by Letters Patent of the United States No. 554,558, dated February 11, 1896, for improvement in apparatus for melting iron. This is the preferred form of apparatus for practicing my improved process or method, as I have ascertained by actual use of such apparatus in the malleable-iron works with which I am connected; but other and different furnaces may be used in the practice of my said process or method.

In the accompanying drawings, forming a part of the specification and on which like reference-letters indicate corresponding parts, I have illustrated the said furnace built upon the plan embodied in my said patent, as stated above, with certain additional side doors or openings.

In the drawings, Figure 1 is a side elevation of such furnace; Fig. 2, a longitudinal sectional view of the same; Fig. 3, a transverse sectional view on the line $x\ x$ of Fig. 2, and Fig. 4 another transverse sectional view on the line $y\ y$ of Fig. 2.

I will generally describe this furnace and then describe my process or method, so that the manner of practicing the latter in the former will be understood by a mere statement of such process or method.

A is the heating-chamber, formed in what is termed the "advance structure" in said patent. Within this chamber I place pipes which form a passage or conduit. These consist of an upper set *e* and a lower set *f*, suitably supported, as by resting the latter upon the pillow-blocks *g h* of brickwork, themselves supported upon the floor *i*, and by resting the former set *e* upon the set *f*. Each set connects with the branch pipe *j*, extending from an air-blast pipe *k*, connected with a suitable blower *l*, by which the blast is supplied. Each set of air-pipes also enters through the cross-wall E into the ignition-chamber B. The object in making these air pipes or conduits tortuous is to increase their superficial surface within the heating-chamber, so that the air-blast will be more thoroughly and highly heated in passing through such pipes. I heat

this chamber for this purpose and preferably heat it with natural gas as the fuel, and to that end arrange the supply-pipe *m* with burners *o*. Flues *q*, *r*, and *s* are provided to carry off the products of combustion from the heating-chamber. The air pipes or conduits are thus subjected to a high heat, their outer surfaces being raised to a red or nearly red heat; but their inner surfaces are somewhat lower in temperature by reason of the cooling effects of the air-blast passing through them. Hence the air is not decomposed, though it might be, if desired. The natural-gas-supply pipe *t* connects with the burner-pipe *u*, having a suitable number of burners *b'*, which discharge into the ignition-chamber B. Thus the hot air and natural gas are brought together and thoroughly mixed at the point where they are ignited. The heat becomes intense from this point rearward. The bridge-wall *w* is above the throat 2, which causes the latter to naturally draw downward upon the flames and products of combustion, and as the iron charge in the melting-chamber C intervenes the flames and such products strike it with direct effect. Again, the inclined position of the top of the melting-chamber aids in this operation, and in practice the flames can be seen striking violently and sweeping along against the surface of the iron, causing the iron when it reaches a melting state to boil and to be rendered highly liquefied. Thus the preferred form of apparatus or furnace for practicing my process or method is like or substantially like that embodied in said Letters Patent. I come now to mention a slight additional change in the melting-chamber C, which change will be made in this or any other type of melting-furnace I may use—namely, one or more charging-openings D in one side of the furnace and a like number of stirring-openings E in the other side of the heating-chamber, these openings having, respectively, a suitable door D' and E' to close them when the flames are turned on. This change also includes one or more draw-off openings G and H, with spouts G' and H'. The bottoms of these draw-off openings and spouts are about on a level with the bed or floor of the melting-chamber, so that as much of the run or molten metal may be run off as desired.

With the above description of the construction it will be understood that to practice my process or method with this apparatus I first introduce through the charge-openings D, (or other suitable means of access,) say, one ton of pig-iron, with such per cent. of silicon as the operator may desire the product to contain. This done the doors D' are closed and fastened and the apparatus started by lighting the gas issuing from the burners in the heating-chamber A and starting the blast apparatus and then igniting the gas issuing from the burners into the igniting-chamber B. As soon as this preliminary charge is melted I have obtained what I term the "bath" or retaining medium for the borings or drillings. Having melted this initial charge, the gas and blast are turned off, the charging-doors opened, and, say, two or three tons of cast-iron borings or drillings put into the melting-chamber and upon the bath. They settle and are mixed with the bath by stirring or agitating the mass by implements introduced through the stirring-openings E, the doors E' having been opened for such purpose. This step of stirring or agitating is quickly but thoroughly done, so that the light and small particles of iron called "borings" and "drillings" are thoroughly intermixed with the molten or liquefied mass called the "retaining-bath." This done the gas and blast are again turned on and ignited to resume the operation or step of melting. The powerful blast utilized will be found unable to dislodge the small light borings or drillings from the heating-chamber by reason of the retaining action of the molten quantity or bath. Herein I have overcome the long-standing and heretofore fatal difficulty in all attempts to reduce this valuable waste material called "borings" or "drillings" to a molten state by a heat involving blast operation. Moreover, the contained heat in the bath aids in quickly melting the charge of borings or drillings. In such a furnace as I have herein typified and selected for purposes of explanation and illustration, with a capacity of, say, six tons, I have in the practice of my process or method melted ten tons of borings or drillings in five hours in a bath of two tons of pig-iron, which bath I have melted in forty-five minutes. These facts I observe herein for the purpose of indicating the commercial success and the rapidity of my said process or method of melting in a furnace of the character described these borings or drillings. Having reduced the charge of borings or drillings to the requisite molten state, the blast and gas are again turned off and the tap-holes are opened and the product drawn off and run into pigs in any desired manner. These pigs may be used in place of scrap in the making of gray-iron castings, being much superior to such scrap, which generally contains wrought and malleable iron; or the product of my process may be used for making castings directly from the furnace in which it is produced. The tap-holes on either side or the tap-holes on one side may be opened at a time. The charge-openings or stirring-openings may be incidentally utilized in the matter of skimming of dross.

It is to be understood that other fuel than natural gas and other than the heated blast may be used and that other types of furnaces may be used in practicing my process or method; but it will be observed that the latter consists in reducing to a molten state a quantity of iron in unmelted pieces of such size as not to be displaced from the melting-chamber by the action of the blast used in creating the requisite heat, in mixing and in a sense immersing cast-iron borings or drill-

ings, being light pieces of iron, with or in this molten bath, in arresting the heating medium during the interval of mixing and immersing or so working the heating medium that it will not interfere with this step or interval, in subjecting the bath, with its contained charge of borings or drillings, to the action of the heating medium and maintaining such action until the requisite degree of liquidity of the entire charge is obtained, and in then drawing off all or less than all of such product, it being preferred to leave a portion in the melting-chamber as a bath for the next charge of borings or drillings.

I would observe that the resulting product is of standard commercial value and that many tons of borings or drillings have heretofore been and are now being practically wasted as refuse, there being no sufficient commercial uses of them or demands for them to equal the quantity produced incidentally to working up iron into market products in shops and factories.

In referring herein to a blast it is to be understood that it may be produced positively, as by blast apparatus, or it may be produced by a natural draft. I employ the term "blast" in this broad sense, for it is quite possible to produce a natural draft strong enough to assist in producing heat enough to melt the iron; but the process will be slow if produced in that way, because it would require some four hours or more after the furnace was fired before it would be hot enough to charge, and it would also require some six or seven hours to get the first heat of borings, and, furthermore, only about fifteen to twenty per cent. of the product produced with the positive or artificial blast could be produced with a natural draft. Still I wish to be understood as including a draft produced in either way, or, in fact, in any way. Of course it will further be understood that a natural draft strong enough to melt the iron even as slowly as above indicated would take up more or less of the borings and carry them away from the melting-place and more or less over the back wall and to some extent up the stack—hence the feature of the retaining-bath in connection with the draft, however produced.

One special advantage of using a hot blast in my process is that the borings are not oxidized to any considerable extent thereby as they are melted.

By the term "arresting the draft," employed in the claim hereof, I wish to be understood as designating such a stoppage of the draft as will prevent the oxidation or blowing away of the light particles of iron during the charging operation, it being manifestly desirable to maintain a sufficient blast during the charging operation to prevent the burning out of the blast-pipes and the chilling of the furnace.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

The hereinbefore-described process or method of utilizing iron borings or drillings or similar light particles of iron, the same consisting in creating by a heating medium underdraft of the character described a retaining-bath of molten iron; next arresting the draft; next charging the bath with iron borings or drillings or other light particles; next stirring the bath to intermix the same; next further applying the draft so as to heat the entire mass, the bath acting as a retaining means to prevent the draft from burning or blowing away the light and small particles of iron; and then drawing off more or less of the molten mass and casting it in pigs or molds, substantially as described.

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

BURT H. WHITELEY.

Witnesses:
EDW. P. KYLE,
WM. A. OVES.