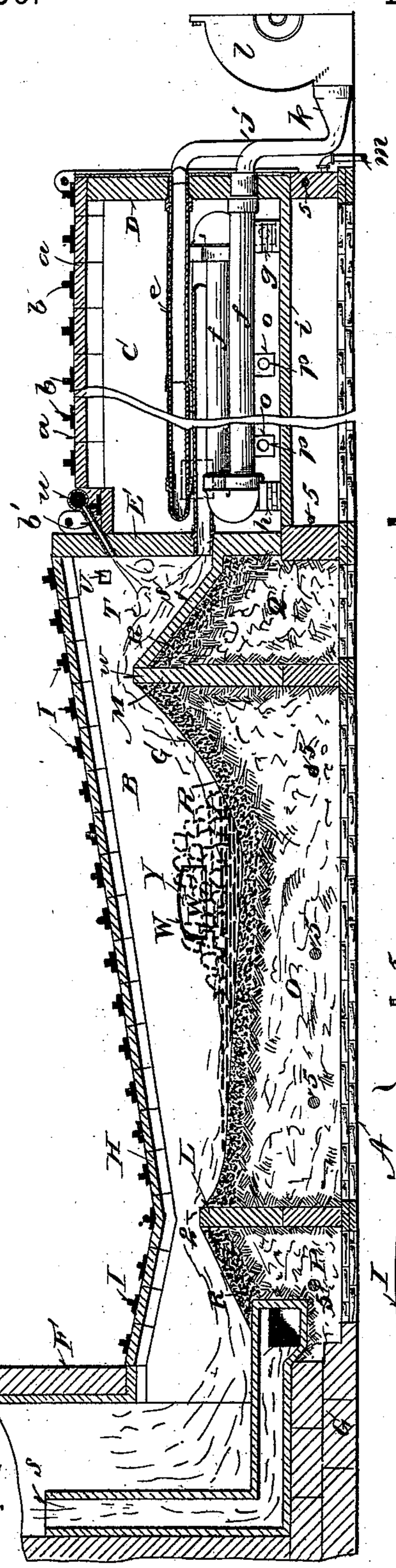
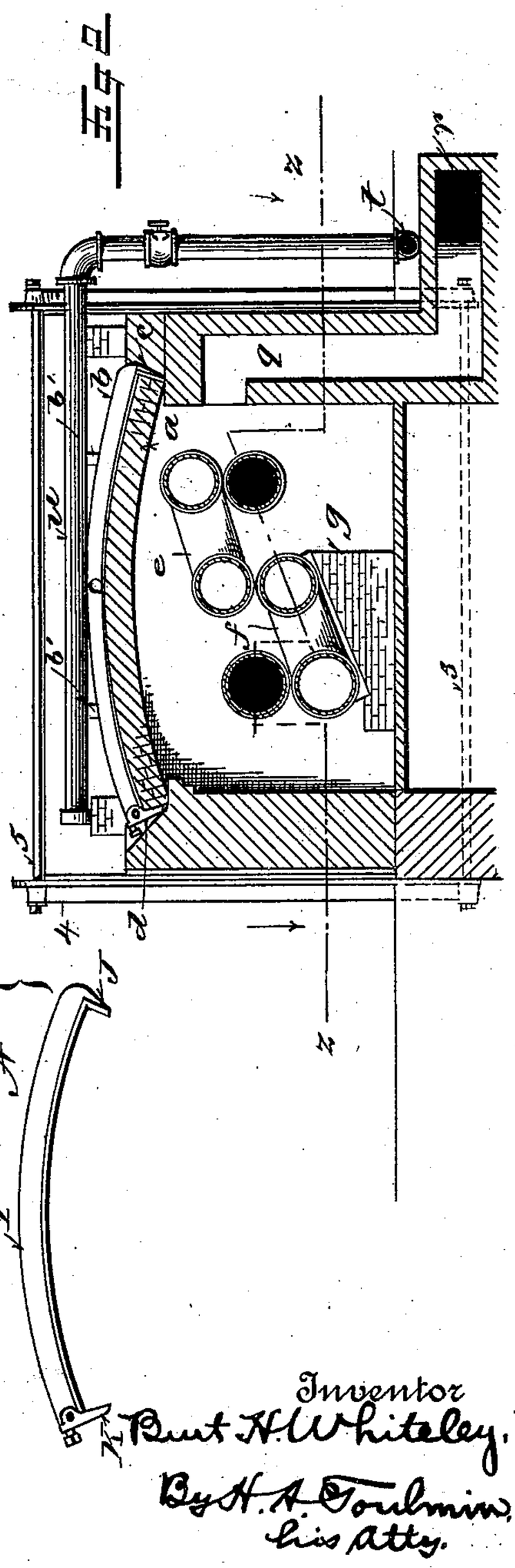
(No Model.) 2 Sheets—Sheet 1.

B. H. WHITELEY.

APPARATUS FOR MELTING IRON.

No. 554,558. Patented Feb. 11, 1896.





Witnesses
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H. M. McNair.

Inventor
Burt H. Whiteley.
By H. A. Toulmin.
His Atty.

(No Model.) 2 Sheets—Sheet 2.

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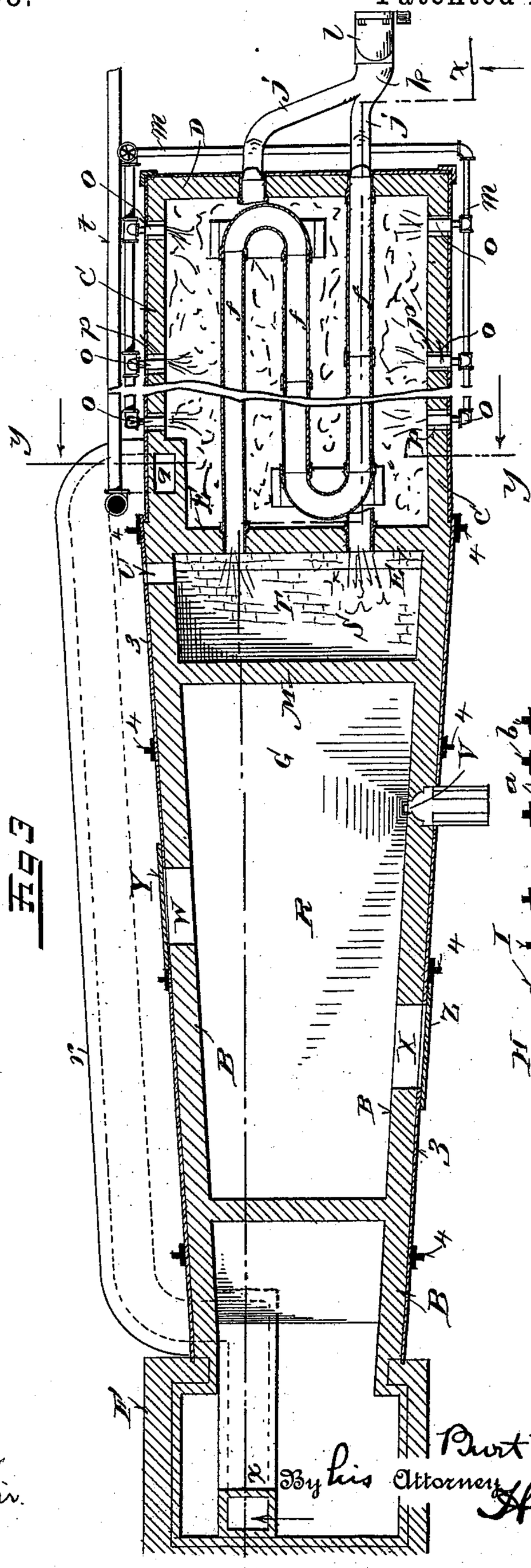

Fig. 3.

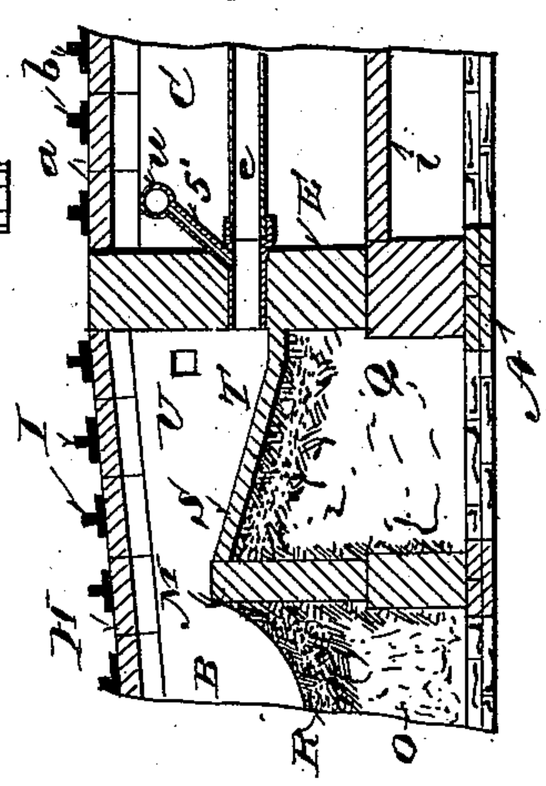

Fig. 4.

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UNITED STATES PATENT OFFICE.

BURT H. WHITELEY, OF MUNCIE, INDIANA, ASSIGNOR TO THE WHITELEY MALLEABLE CASTINGS COMPANY, OF SAME PLACE.

APPARATUS FOR MELTING IRON.

SPECIFICATION forming part of Letters Patent No. 554,558, dated February 11, 1896.

Application filed March 20, 1895. Serial No. 542,464. (No model.)

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 Apparatus for Melting Iron, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to certain new and useful improvements in an apparatus for melting iron by a fuel consisting of natural gas and atmospheric air. The iron so melted may be either the stock from which gray iron castings are to be made or from which malleable castings are to be made—that is, castings which are to be malleableized by the usual process in the usual malleable-iron furnace.

The leading characteristics of my improved furnace consist of a heating-chamber in which the air-pipes are located, an ignition-chamber into which the heated air is forced by pressure and the gas discharged by pressure, a melting-chamber, and a draft chimney or stack with a draft-throat between it and the melting-chamber.

In the accompanying drawings, on which like reference letters and numerals indicate corresponding parts, Figure 1 is a vertical sectional view of my improved furnace on the line *x x* of Fig. 3, looking in the direction of the arrows; Fig. 2, a transverse vertical sectional view taken through the heating-chamber on the line *y y* of Fig. 3, looking in the direction of the arrows; and Fig. 3, a horizontal sectional view taken on the line *z z* of Fig. 2, looking in the direction of the arrow.

In constructing this furnace I erect what I term the "second structure," and to that end provide a bottom A, built preferably of stone flags, as shown, though other material will answer. On this bottom I erect side walls B of the furnace proper and side walls and end walls D and E of the heating-chamber. Beneath the chimney or stack F, which is built of brick, I construct a heavier foundation G.

The top of the furnace is formed of fire-brick H built in a series of sections which rest upon the side walls B and are supported and held intact by heavy iron arch-bars I with ends J and clamp K, which bind the ends of the sections to maintain the union between the bricks of which each section is composed.

I further construct cross-walls L and M and fill in clay, as shown at O, P and Q, on each side of such cross-walls. Upon these sections of clay I place a bed of fire-sand R. Upon the sand of the section Q, I place a fire-brick bottom S inclined as shown and extending from the cross-wall E to the cross-wall M. The space T within the wall E, inclined bottom S and the sides B, forms what I term the "ignition-chamber." An inspection-hole U opens into this chamber. The sand bottom between the cross-walls L and M is of the contour shown, so as to form a basin in which the melted iron will gather and collect so as to be drawn off from the tap-hole V, while openings W and X permit inspection and also enable the dross to be skimmed off. Suitable doors Y and Z close these openings, which are high enough to stand slightly above the surface of the metal after it has become molten.

Referring now to the heating-chamber, which is formed within what I term the "advanced structure," it will be seen that it has a similar top to that of the furnace proper, consisting of the sections *a*, of fire-brick, with the arch-bars *b*, with the ends *c* and clamps *d* to maintain the bricks of which the sections *a* are composed. Within this chamber I place pipes which form a tortuous air-conduit. These pipes consist of an upper set, *e*, and the lower set, *f*, suitably supported, as by resting the latter upon pillar-blocks *g h*, of brick-work, 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-walls E into the ignition-chamber T, near the inclined bottom S, which deflects the current upward for a purpose hereinafter described. The object in making these air pipes or conduits tortuous is to increase their superficial surface within the heating-chamber, so that the air-blasts 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 ar-

range a supply-pipe *m* with burners *o*, which I project through the side walls C of said chamber, leaving air-spaces *p* around said burners for the introduction by draft of the necessary atmospheric air to mix with the gas. A flue *q* is formed in one of the walls C and leads downward to a flue *r*, preferably placed underground, and which extends thence alongside of the furnace and turns into it back of the cross-wall L and then passes across the bottom of the stack and up in the latter about the distance indicated, finally opening into the stack, as shown at *s*. Through this flue the products of combustion are carried off 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.

A natural-gas-supply pipe *t* connects with a burner-pipe *u*, laid across the heating-chamber, as shown in Figs. 1 and 2, and provided with a suitable number of burners *b'*, which incline downward and discharge into the ignition-chamber T. Thus the hot air and natural gas are brought together and thoroughly mixed at the point where they are united. The heat becomes intense from this point rearward, and the flames and products of combustion are drawn essentially along the bottom R of the melting-chamber by reason of the elevation of the wall M and bottom G S, which at this point constitute a bridge-wall. This bridge-wall 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 intervenes the flames and such said 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 molten metal, causing it to boil and to be rendered highly liquefied. I would also observe that a casing of metal plates 3, held by bars 4 and cross-rods 5, is provided to insure sufficient strength.

I preferably mix the gas and hot air in the proportion of about one part of the former to twenty of the latter; but this may be varied.

I have represented the air pipes or conduits *e f* as made of iron; but it is obvious that any other suitable material may be used, and also that they may be made straight, or nearly so, except for a desire to economize in space and in the size of the heating-chamber.

As shown in Fig. 4, the natural-gas-burner pipes 5' discharge into the air pipes or conduits *e f* direct, instead of into the combustion-chamber, the result of which is that the gas becomes highly heated before ignition, and more or less completely intermixed with the air before that step occurs. Before the burners reach the air pipes or conduits the gas also becomes heated, according to how much length is given to the burners inside of such chamber. This heating of the natural gas preliminarily to its ignition is conducive to better results in combustion, as it gives a compound both of whose principal elements are hot during the mixing operation and preparatory to ignition. Thus my improved apparatus includes means and arrangements for burning either cool natural gas (gas in a normal state of temperature) or hot natural gas with hot air, and my improved process also includes burning cool natural gas (gas in a normal state of temperature) and hot natural gas with hot air, which process is hereinafter described.

Sundry specimens of this apparatus are in daily practical operation on a large and commercial scale in melting iron for gray iron castings and for castings which are afterward malleableized. These furnaces are so operating in the malleable-iron plant of my assignee, the Whitely Malleable Castings Co., located at Muncie, Indiana, and the observations herein made are based upon the facts as ascertained in extensive practical use.

It will be seen and understood that the advance structure, while abutting against or joining onto the second structure, is practically a separate and distinct structure from the second structure—to wit, for the purpose of constituting the chamber within which intense heat is created by the burning of fuel, so as to highly heat the air-pipes which are located therein and which are supplied with rapidly-moving currents of atmospheric air driven by a blast apparatus. This advanced structure is therefore the air heating and circulating structure, while the second structure is devoted to the two general purposes of constituting the ignition-chamber and the melting-chamber.

It will also be seen that with my apparatus the air which forms a part of the fuel is heated independently of radiation from the melting-chamber, which latter is unsatisfactory and deprives the operator of the furnace from the important matter of being able to raise or lower the temperature of the air as circumstances may require, wholly independently of the heat he may or may not be able to radiate from the melting-chamber for such purpose. In this apparatus the heating of the air in the advance structure, with its own heating appliances, gives the operator the ability to control the heat in the heating-chamber, instead of being deprived of this control, as is the case in furnaces where the air is heated by the heat radiating from the melting-chamber.

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

The combination with two abutting structures, one an advance structure forming a heating-chamber, and the second a melting-chamber, of natural-gas burners for the heat-

ing-chamber, tortuous air-pipes in said heating-chamber, a blast apparatus for said tortuous pipes, an ignition-chamber in the second structure, having an inclined bottom forming a bridge-wall, a melting-chamber in the said second structure, a smoke-stack leading from the melting-chamber through a throat lower than said bridge-wall, an inclined top to the melting-chamber, a gas-burner discharging into said ignition-chamber and essentially toward said inclined bridge-wall said air-pipes also discharging into said ignition-chamber and toward said bridge-wall, and an independent flue from the heating-chamber to the stack.

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

BURT H. WHITELEY.

Witnesses:
ED. J. WALLACE,
H. P. FOLKERTH.