

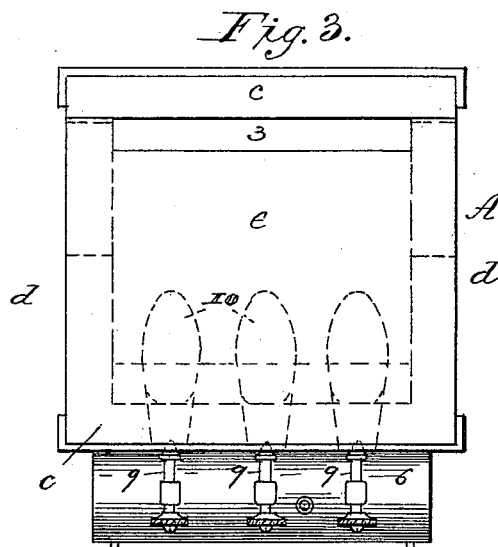
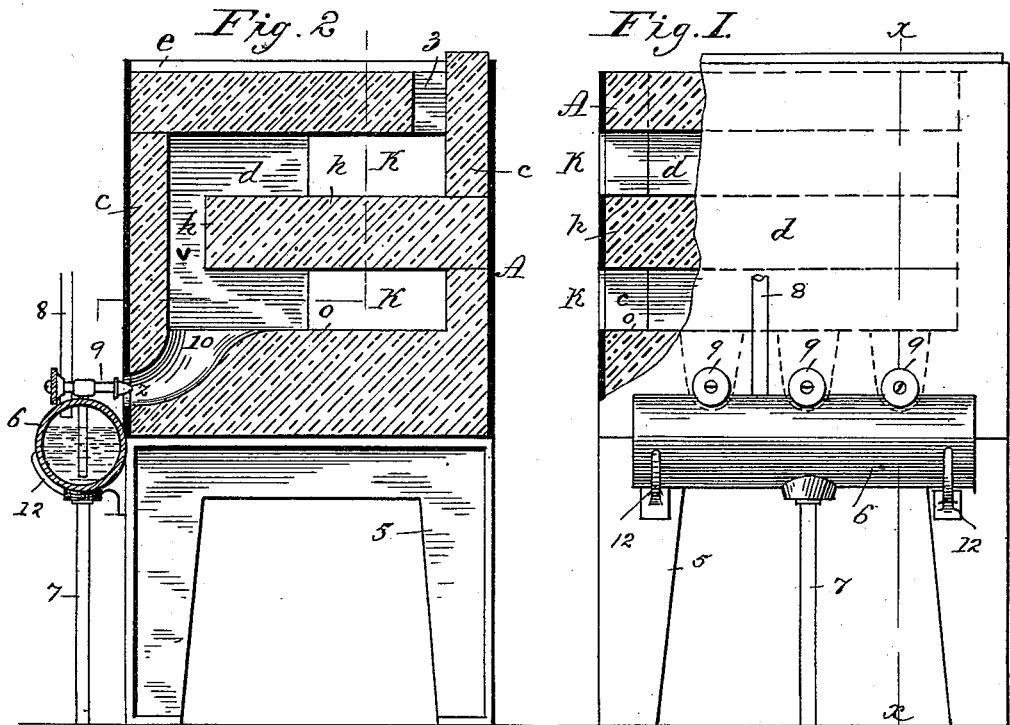
(No Model.)

J. H. BULLARD.

HYDROCARBON METAL HEATING AND MELTING FURNACE.

No. 419,406.

Patented Jan. 14, 1890



Witnesses

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UNITED STATES PATENT OFFICE.

JAMES H. BULLARD, OF SPRINGFIELD, MASSACHUSETTS, ASSIGNOR TO THE
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HYDROCARBON METAL HEATING AND MELTING FURNACE.

SPECIFICATION forming part of Letters Patent No. 419,406, dated January 14, 1890.

Application filed August 18, 1888. Serial No. 233,139. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. BULLARD, a citizen of the United States, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Hydrocarbon Metal Heating and Melting Furnaces, of which the following is a specification.

This invention relates to furnaces for forging and melting metals, the object being to provide an improved furnace for the above purposes which is adapted to use hydrocarbon as fuel instead of coal; and the invention consists in the construction and arrangement of parts of the furnace, in combination with a hydrocarbon-burner, all as hereinafter fully described, and pointed out in the claim.

In the drawings forming part of this specification, Figure 1 is a side elevation showing the side partly broken away; and Fig. 2, a vertical section of a hydrocarbon-burning furnace embodying my improvements, the said sectional view, Fig. 2, being taken about on line *x x*, Fig. 1. Fig. 3 is a plan view of the furnace.

The furnace herein described and shown is adapted to heat pieces of metal for forging purposes, and with a slight modification thereof, hereinafter to be described, to be used for melting metals in crucibles for the purpose of casting the same, the necessary fire for the said uses of the furnace being supplied by the combustion of a hydrocarbon, preferably crude petroleum, and so much of the apparatus pertaining to the hydrocarbon-burning devices as is necessary to the understanding of this invention is shown in the drawings and below described.

The advantageous use of the said hydrocarbon in a furnace for the above-mentioned purposes is dependent upon certain peculiarities of construction in the furnace, whereby the injected hydrocarbon is converted into a highly-inflammable gas immediately upon its entrance into the furnace and before said hydrocarbon shall have commenced to burn with the usual red smoky flame,

which, under ordinary circumstances, is produced by the ignition of the hydrocarbon.

The above-described conditions of combustion of the hydrocarbon, whereby the latter is converted into said highly-inflammable gas before the heat shall act upon metals, is essential to the production of the requisite intense degree of heat required, and to the production of forgings, the surface of which shall be free from oxidation or scale, those advantages being unattainable when the hydrocarbon is permitted to burn with said red smoky flame; and hence the furnace herein described is constructed and operates, as below described, in order to most advantageously utilize hydrocarbon as fuel in the above-mentioned treatment of metals.

The furnace A is constructed, preferably, of rectangular form, although it may be of circular or other shape, should the work for which it is constructed require it. The material from which the furnace is constructed is fire-brick or other highly-refractory material adapted to resist the effects of intense heat in its interior, and said furnace consists of a bed or floor *o*, supported on suitable cast-iron legs *b*, and having suitable side and end walls *c* and *d*, respectively, rising vertically from the borders thereof, and a top *e*, supported on said walls, whereby the usual heating-chamber is formed within the furnace.

For certain classes of heavy forgings the furnace is constructed with a horizontal partition *h*, extending partially across the furnace-chamber, leaving a fire-passage *v* between the end of said partition and the adjoining inner side of the furnace-wall. Openings *K K* are made in one or both opposite ends of the furnace when the latter is constructed with said horizontal partition *h*, through which pieces of metal are passed into the furnace, some lying upon the upper side of said partition and subject to the heat passing upward through the passage *v*, and moving thence in the direction of the upper opening *K*, or of a slot *3*, formed through the top *e* of the furnace. The said pieces of metal, which are first laid on said partition *h*, become

thus partially heated to the degree required, and are then placed under said partition in the lower part of the furnace-chamber, where they are subject to the most intense heat until they become hot enough to be worked, and other pieces of metal are placed upon said partition as fast as said partially-heated pieces are removed therefrom. In this way the heat of the furnace is best utilized for rapidly and continuously heating metal for forging and similar purposes.

The utilization of the furnace for heating metal for forging purposes, above described, appertains more particularly to the heating of large pieces of metal; but when the furnace is employed for heating small forgings the intermediate partition *h* and the upper opening or openings *K* are dispensed with, and the top *e* of the furnace is less elevated above the bed *o*, and the pieces of metal to be heated are placed directly on said bed, and, if desired, other pieces may be, for being partially heated, placed over the slot 3 on the top of the furnace, and when the furnace is so arranged it may be conveniently used for melting metals in crucibles by placing the latter on the bed *o* and temporarily closing the openings *K*.

The bed *o* of the furnace is made of considerable thickness, as shown, and has built or formed therein one or several fire-conduits 10, extending from the plane of the said floor downward and terminating in an opening *z* at the outside of the furnace, the number of said fire-conduits formed in the furnace-bed being determined by the number of hydrocarbon-burners which are to be used with the furnace. The said bed *o* is constructed from said refractory or heat-resisting material, and the inner walls of said fire-conduits consist of like material, and the form of said conduits is that shown in Fig. 2, being smallest at said opening *z* in the outer side of the furnace, and gradually enlarging up to the plane of the furnace-bed *o*.

The preferred description of hydrocarbon-burners to be used with said furnace are those shown and described in Letters Patent of the United States issued to me July 23, 1889, No. 407,639. The hydrocarbon-burners 9 above referred to and described in said application are fixed in a metallic tank 6, partially filled with hydrocarbon, and having an oil-supply pipe 7 and an air-supply pipe 8, communicating with the interior of said tank, the latter being hung or supported at one side of the furnace upon suitable brackets 12, secured to some part of the latter. The said oil-supply pipe 7 communicates with any suitable oil-reservoir from which oil is caused to pass through said pipe into the tank 6, and said air-pipe 8 is connected with any suitable air-compressing device, whereby a certain air-pressure is imparted to that portion of the interior of the tank 6 above the level of the oil therein, as shown in Fig. 2. The said

burner 9 communicates by a vertical tube, as shown, with said hydrocarbon in tank 6, and said vertical tube communicates with a horizontal tube within the burner, through which the hydrocarbon is conveyed to the interior of the burner-nozzle, and thence is injected into the fire-conduit 10. The said burner has a passage therein communicating with said air-space in the tank 6, and by means of the said air-pressure which is exerted in said tank the hydrocarbon and the air are caused to be ejected from the nozzle of said burner with such force as to atomize the hydrocarbon as it is blown into said fire-conduit, and, by reason of the incandescent heat which is constantly maintained within and upon the walls of said conduit the said atomized hydrocarbon immediately upon entering said conduit becomes converted into said inflammable gas, which is smokeless and produces a flame nearly colorless within the furnace. The said hydrocarbon-burners are shown so located in the drawings that the extremity of the nozzles thereof slightly enters the opening *z* at the lower end of the fire-conduit 10; but by preference the said nozzles are, in practice, so arranged that they terminate a little outside of the side of the furnace, and said burners are set in such relation to the ascending side of said fire-conduit that they inject the said hydrocarbon in atomized condition against said ascending wall and not directly into the heating-chamber of the furnace; and hence the rapid and immediate conversion of said hydrocarbon into said highly inflammable furnace-heating gas. No other blast is required to operate the within-described furnace than that supplied by the above-mentioned air, which is kept under a regulated pressure in said tank 6, and escapes from thence, as described, in conjunction with the hydrocarbon through the burner.

Upon starting the fire in the furnace after the latter has become cold, as is done in commencing the work of the day, the atomized hydrocarbon which escapes from the burner is lighted within the surface, and for a few moments burns with the usual red flame produced by crude petroleum; but almost immediately the inner surface of the fire-conduit 10 reaches a red heat, and then the hydrocarbon is converted into said gas, and so continues steadily and without variation through all the hours of the working-day, and, by reason of the said regulated air-pressure under which the air and the hydrocarbon are injected into said fire-conduit, (it being understood that the supply of hydrocarbon is uniform,) a substantially unvarying degree of heat can be maintained in said furnace during the time that it may be in use.

What I claim as my invention is—

A furnace for heating metal for forging and analogous purposes having a heating-chamber therein and a slot at the top thereof and fire-conduits leading into the lower por-

tion of said furnace, a horizontal partition in-
termediately of said chamber having the open-
ing therethrough, whereby the sub-chambers
communicate the one with the other, and side
5 or end openings K through the furnace-wall
leading to the upper and lower chambers, com-
bined with one or more injector-burners for

introducing hydrocarbon and air through
said fire-conduits into the furnace, substan-
tially as and for the purposes set forth.

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Witnesses:

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