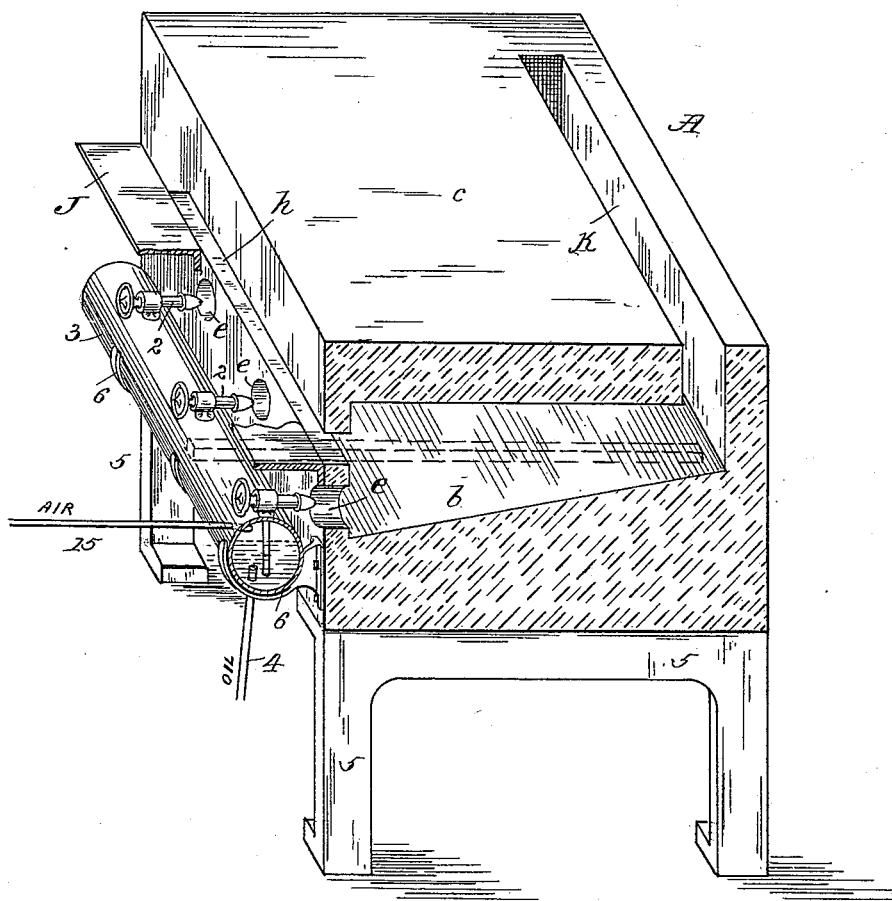


(No Model.)

J. H. BULLARD.
HYDROCARBON METAL HEATING FURNACE.

No. 419,407.

Patented Jan. 14, 1890.



Witnesses

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UNITED STATES PATENT OFFICE.

JAMES H. BULLARD, OF SPRINGFIELD, MASSACHUSETTS, ASSIGNOR TO THE
AERATED FUEL COMPANY, OF SAME PLACE.

HYDROCARBON METAL-HEATING FURNACE.

SPECIFICATION forming part of Letters Patent No. 419,407, dated January 14, 1890.

Application filed August 18, 1888. Serial No. 283,140. (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 Furnaces, of which the following is a specification.

This invention relates to furnaces for heating metal bars and similar pieces thereof preparatory to forging and shaping the same, the object being to provide an improved furnace for the above purpose 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.

The drawing forming part of this specification illustrates in perspective view and partly in section a metal-heating furnace and hydrocarbon-burning devices embodying my improvements.

The furnace herein described and shown is adapted to heat metal bars and similar pieces for forging and bending the same, the necessary fire therefor 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 drawing and below described. The advantageous use of 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 in-

tense 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 from 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 *b*, supported on suitable cast-iron legs or framework 5, and having suitable end and side walls, as shown, rising vertically from the borders of said bed, and a top *c*, supported on said walls, whereby a suitable heating-chamber is formed within the furnace.

Through one of the side walls of the furnace a slot-like opening *h* is formed, through which the ends of bars (one of which is indicated in dotted lines in the figure) or similar pieces of metal may be placed, reaching into and across the furnace and extending over the bed *b* thereof in the position there shown, the bars so placed to be heated resting partly by their outer ends on a horizontal laterally-extending table or shelf *J*, of suitable metallic construction, which is fixed to the outer side of said wall below said slot *h*, said table being shown partly broken away to disclose the hydrocarbon-burning devices directly under it. Beneath said slot *h* in said side wall of the furnace are formed one or more circular openings or perforations *e* through said wall.

The bed *b* of the furnace is constructed at an incline downward from the side wall of the furnace opposite to that through which the ends of the bars of metal are passed to be heated, the bottom of said furnace having a degree of incline commencing on said opposite wall at a point as high or higher than the lower side of said apertures *e*, and descending therefrom toward the wall in which are said apertures to a point below the latter, as clearly shown in the drawing.

The top *c* of the furnace is provided with the longitudinal opening *K*, to provide an exit for a certain amount of the flame generated within the furnace and to prevent said flame from being driven out through the slot *h*.

The preferred description of hydrocarbon-burners to be used with said furnace are those shown and described in Letters Patent 10 of the United States granted to me July 23, 1889, No. 407,639.

The hydrocarbon-burners 2 above referred to are fixed in a metallic tank 3, partially filled with hydrocarbon, and having an oil-supply pipe 4 and an air-supply pipe 15, communicating with the interior of said tank, the latter being hung or supported at one side of the furnace below said slot *h* upon suitable brackets 6, suitably secured to the furnace or to some part thereof. The said oil-supply pipe 4 communicates with any suitable oil-reservoir, from which oil is caused to pass through said pipe into the tank 3, and said air-pipe 15 is connected with any suitable air-compressing device, whereby a certain air-pressure is imparted to that portion of the interior of the tank 3 above the level of the oil therein, as shown in the drawing. The said burner 2 communicates by a vertical tube, as shown, with said hydrocarbon in tank 3, 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 through the apertures *e* of the side of the furnace into the metal-heating chamber of the latter. The said burner has a passage therein communicating with the said air-space in the tank 3, and by means of 40 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 the furnace, and by reason of the incandescent heat which is constantly maintained within the heating-chamber of the furnace, and more especially upon the inclined bed thereof, the said atomized hydrocarbon immediately upon striking the inclined bed *b* becomes converted into said inflammable gas, which is smokeless and produces a flame nearly colorless within the furnace. The said inclination of the bed *b* of the furnace in front of the ejecting-nozzles of the hydrocarbon-burners is given thereto in order that the hydrocarbon in passing from said nozzles shall be brought immediately in contact with the incandescently-heated bed of the furnace, whereby the said hydrocarbon is converted instantaneously into the said inflammable gas and acts at once and directly upon the bar or bars of metal which extend over that portion of said bed against which 65 the atomized hydrocarbon is injected, as above described. The said inclination is

given to the bed of the furnace in order to produce the conversion of the atomized hydrocarbon into a gas, as aforesaid, because it is found in practice that if the hydrocarbon is injected through the side of the furnace in a line above the plane of the bed thereof and against the opposite side of the furnace the said gas is not produced in the efficient manner that it is when the hydrocarbon is injected against the bed of the furnace as above described, the result of which is (when the bed is not inclined as aforesaid) that the combustion of the hydrocarbon is very imperfect, and a much less intense heat is produced therefrom, thereby making the use of hydrocarbon as a fuel in such furnaces much more expensive than when it is converted into said inflammable gas, as above described. In order that the hydrocarbon ejected from said burners may strike the furnace-bed about midway between its upper and lower edges, the burners are fixed with their nozzles opposite the center of the apertures *e*, as shown.

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 3, 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 furnace and for a few moments burns with the usual red flame produced by crude petroleum: but almost immediately the surface of the bed *b* of the furnace 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 furnace, (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.

The within-described furnace may be constructed of such size as may be desired for the different classes of work required to be done—that is, for receiving at one time one or more bars of metal to be heated—and the number of hydrocarbon-burners operating therewith, as above set forth, may be one or more, according to the heat desired.

What I claim as my invention is—

A hydrocarbon-burning metal-heating furnace having its heating-chamber provided with a bed inclining forwardly and downwardly, and having through its front wall a horizontal and longitudinally-extending slot and provided below said slot with a series

of apertures through the front wall and directed across the furnace, said furnace being also provided with an opening leading out through its top, combined with a hydro-
5 carbon-burner for each of said apertures, provided with an oil and air passage therethrough for the injection of commingled oil and air

against said inclined bed, substantially as and for the purpose set forth.

JAMES H. BULLARD.

Witnesses:

G. M. CHAMBERLAIN,
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