(No Model.)

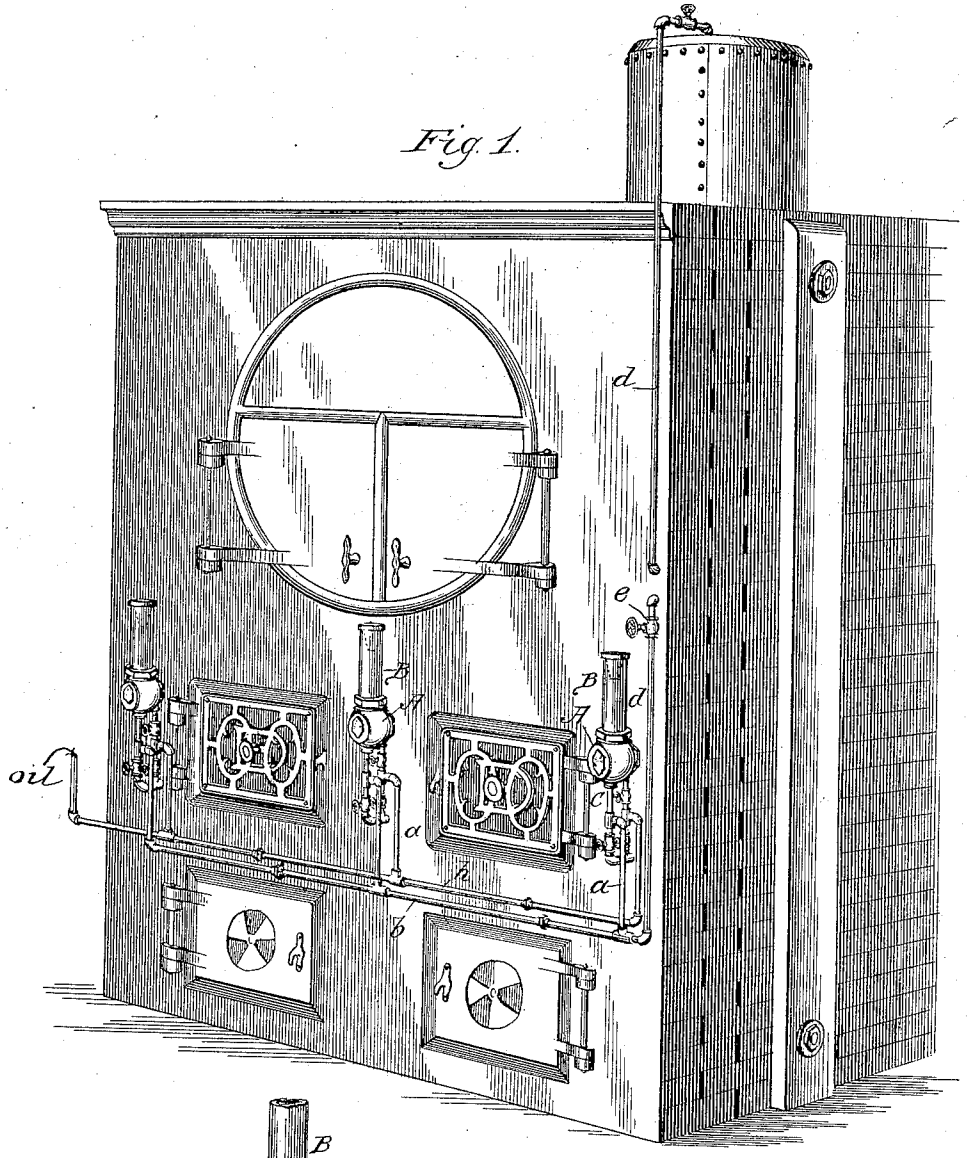
2 Sheets—Sheet 1.

O. D. ORVIS.

HYDROCARBON FURNACE.

No. 371,784. Patented Oct. 18, 1887.

Fig. 1.



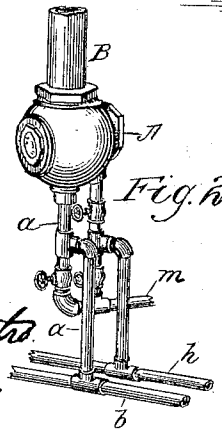


Fig. 2.

Witnesses.
Chas. C. Linthicum Jr.
W. W. Elliott

Inventor.
Orland D. Orvis
By, Jno. G. Elliott
Atty.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.)

2 Sheets—Sheet 2.

O. D. ORVIS.

HYDROCARBON FURNACE.

No. 371,784. Patented Oct. 18, 1887.

Fig. 3.

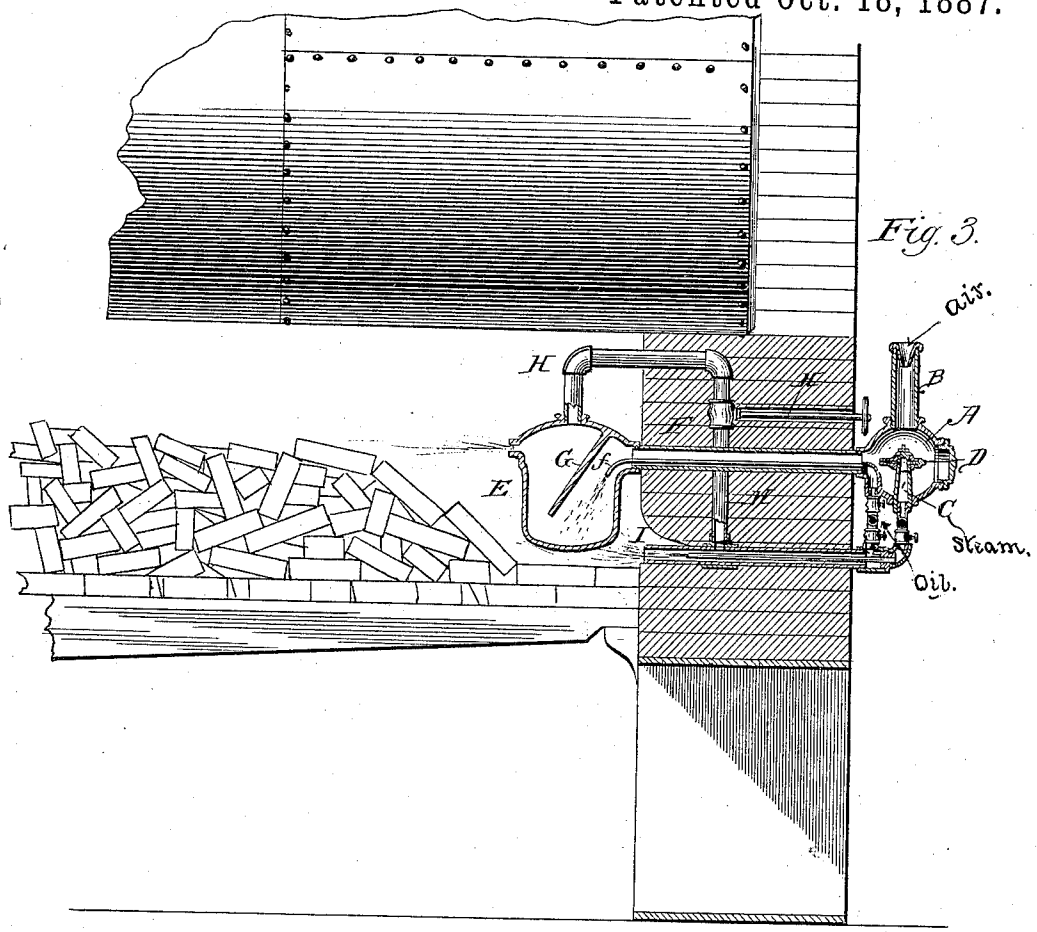
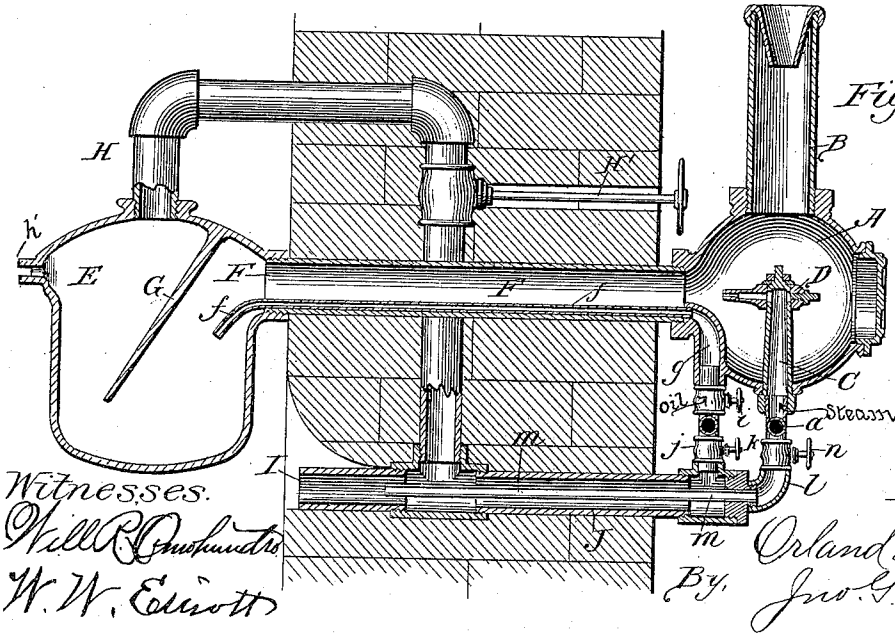


Fig. 4.



Witnesses.
Will R. Dinsmore
W. W. Elliott

Inventor.
Orland D. Orvis
By Jno. G. Elliott
Atty.

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

ORLAND D. ORVIS, OF CHICAGO, ILLINOIS.

HYDROCARBON-FURNACE.

SPECIFICATION forming part of Letters Patent No. 371,784, dated October 18, 1887.

Application filed February 16, 1885. Renewed May 10, 1887. Serial No. 237,707. (No model.)

To all whom it may concern:

Be it known that I, ORLAND D. ORVIS, a citizen of the United States, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Hydrocarbon-Furnaces, of which the following is a specification.

This invention relates to improvements in hydrocarbon-furnaces for which United States Letters Patent No. 288,477 were granted me on the 13th day of November, 1883, and in which hydrocarbons are mixed with steam or air, or both, and vaporized in a retort located in the fire-chamber and operating in conjunction with a bed of burning fuel, heating the same to the degree required for vaporizing the hydrocarbons.

The essential objects of this invention are to dispense with the employment of coal or other similar fuel in the fire-chamber, and to utilize a portion of the hydrocarbon vapors generated in the retort to maintain the retort at the desired temperature, and to accomplish such utilization in such a manner that the heat-units of all the vapors generated in the retort, as well as the radiation of the retort itself, shall unite in raising the temperature of the fire-chamber.

Further objects are to first conduct the hydrocarbons into the retort before contact with the steam and air, whereby, and by a peculiar internal construction of the retort, the steam, air, and hydrocarbons are simultaneously combined and thoroughly mixed before escaping into the fire-chamber.

Finally, to provide for the inital heating of the retort in an effective manner by means of certain details of construction hereinafter described.

I attain these objects by devices illustrated in the accompanying drawings, in which—

Figure 1 represents a perspective view of a furnace embodying my invention; Fig. 2, a similar view of an enlarged detail of one of the injectors and the pipe-connections therewith for supplying steam, air, and hydrocarbons to the fire-chamber; Fig. 3, a detail longitudinal section of the furnace, illustrating more particularly the relative position of the retort to the grate-bars and the boiler, and the employment of radiating materials—such, for example, as fire-brick—placed upon the grate-bars; Fig. 4, an enlarged detail sectional view taken centrally through the injector, the inlet-pipe, the retort, and the pipes for supplying steam, air, and hydrocarbons to the retort, and for the initial heating of the same.

Similar letters of reference indicate the same parts in the several figures of the drawings.

The sets of injectors and retorts, with their pipe-connections, hereinafter described in detail, may be used in series at desired intervals in the front and sides of a furnace, although for present purposes they are only shown in use at the front of a furnace at points on each side of and between the doors of a fire-chamber, and in this connection it may be added that they may be applied to any ordinary construction of furnace—such, for example, as the one shown in Figs. 1 and 3, in which a horizontal boiler is arranged above grate-bars.

In practice I prefer to use an injector provided with a globe vacuum-chamber, A; but a T-coupling might be substituted without a departure from the essential features of my invention.

For convenience of arrangement on furnaces of the character shown, the air-supply pipe B is preferably projected through the top of the globe vacuum-chamber instead of through the bottom, as shown and described in former Letters Patent, and instead of having said air-pipes opening into the outside air, they may be connected with the breeching for returning waste products of combustion to the fire-chamber after they have passed into the combustion chamber or stack.

Projecting through the bottom of the vacuum-chamber is a steam-supply pipe, C, on the upper end of which, and communicating therewith, is a revolving jet, D, such as is fully described and claimed in Letters Patent No. 310,162, granted me the 30th day of December, 1884; but any other form of jet may be used—as, for instance, by making a right-angular or curved bend in the pipe C, which has a suitable connection with the boiler.

Pipe C, as shown, is connected by a short vertical section of pipe, *a*, with a header, *b*, which may supply steam to any number of jets employed, and is connected with the dome of the boiler by a pipe, *d*, which at some in-

termediate point may be and is preferably attached to a superheater, below which point, as indicated in Fig. 1, the pipe is provided with an ordinary globe-valve, *e*, for regulating the supply of steam. Connecting the injector with the retort E, upon the inside of the fire-chamber, is an inlet-pipe, F, to the ends of which the retort and injector are respectively secured.

Projecting downwardly into the retort is a pipe, *f*, which passes through the inlet-pipe and constitutes a combination of a passage, *g*, preferably cast with, but may be separate from, the globe vacuum-chamber, which passage in turn is coupled and connected by suitable pipes with a header, *h*, extending to a hydrocarbon-reservoir, not necessary to be here illustrated, but which is preferably elevated above the plane of the inlet-pipe for the purpose of giving a head to the liquid hydrocarbon, a valve, *i*, in the pipe *h* serving to regulate the supply of oil to the retort.

The inner and outer configuration of the retort, its slit-opening *h'*, and its arrangement in the furnace are substantially the same as that in my aforesaid patent, except that it has an opening in its top for a pipe-connection, hereinafter described, and has cast with its top a deflecting plate or diaphragm, G, which projects downwardly at an oblique angle toward the front of and until within a short distance above the bottom of the retort. The purpose of this diaphragm is the same as that in my former application, in which it is shown, described, and claimed as projecting from the inlet-pipe—namely, to prevent the hydrocarbons escaping from the retort until they are fully vaporized and thoroughly mixed with the steam and air.

Opening into the top of the retort is a pipe, H, which passes into the wall of the furnace and thence downwardly, and connects at its lower end with a horizontal pipe or nozzle, I, opening into the fire-chamber in front of and in a plane with or just below the bottom of the retort, by means of which pipe a portion of the vapors, in a highly-heated state and mixed in the retort with steam and air, are permitted to escape from the retort and enter the fire-chamber at the point before indicated.

When the retort is in operation and in a heated condition, the vapors escaping through the pipe or nozzle I ignite and, coming in contact with the retort, steadily heat the same, and at the same time are utilized in heating the fire-chamber, the supply of said vapors being regulated by a slide-valve, H'', in the passage to the nozzle. By this means the retort is caused to generate the gases for and automatically heating it, and as a result I am enabled to entirely dispense with the use of coal upon the grate-bars, though by preference irregularly-arranged fire-brick or other desirable radiating material is used upon the grate-bars for the purpose of promoting a uniformity of heat and preventing sudden changes in the temperature of the furnace, as would otherwise result should the operation of the retort suddenly cease.

A temporary fire might be built under the retort for starting its operation; but in practice and for convenience it is preferred to connect the outer end of the pipe or nozzle I with the oil-supply pipe or header by a pipe, J, and an intermediate connection, *j*, in which there is a valve, *k*, for regulating and cutting off the supply of oil after the retort is sufficiently heated to vaporize hydrocarbons supplied thereto.

In order to facilitate the initial heating of the retort, it is found in practice that steam introduced with the hydrocarbons, conducted through the pipe J, may be used to good advantage, and to this end the steam-header is connected by means of a joint, *l*, with the pipe *j*, and continued beyond said pipe to the nozzle and beyond the vapor-supply pipe by a tube, *m*, a valve, *n*, serving to regulate or cut off the steam when desired.

In this connection it may be stated that any other means for producing the initial heating of the retort, or for preventing the hydrocarbons escaping in a liquid form from the retort, may be employed without a substantial departure from the essential features of my invention, which, broadly stated, are a retort opening into a fire-chamber and a nozzle or pipe connected with the retort by a passage or pipe adapted to conduct a portion of the vapors generated in the retort to such a point that when ignited they will serve to heat and maintain the retort in operation.

In practice it is proposed to partially brick in the retort for the purpose of protecting it from cold blasts and promoting the uniformity of the heat, for which reasons the pipe H is run into the front wall of the furnace instead of being directly carried around and under the retort.

It is admitted that prior to my invention retorts have been heated by a portion of the hydrocarbon vapors pure and simple or combined with steam; but in both instances, whether the vapors are pure and simple or combined with steam, the portion so drawn from the retort is not that which is most perfectly vaporized, but the heavier vapors in the retort, which do not readily ignite or produce the best effects, for obvious reasons. Furthermore, in both the prior constructions the portions of vapor so drawn off are discharged at a right angle to the retorts, which retorts have no direct opening into the furnace, but have in the one instance a long convolute passage with a single opening at its end, and in the second instance a long angular passage provided with a series of nozzles, which nozzles discharge the vapors heating the retort and the furnace, and no effective combination of steam and hydrocarbon, or air and hydrocarbon, or all three of these elements, can be effected outside of the retort or in the fire-chamber. Hydrocarbon vapors rise and do not descend in a retort, and in the construc-

tion referred to this tendency is promoted by the steam admitted at the lower end of the retort, and hence the pipes connecting the inner side with the outside of the lower end of the retort are believed to be inoperative for the purpose intended, and at best can only draw off imperfectly-vaporized hydrocarbon or the liquid hydrocarbon when the latter shall have risen in the retort to the opening in the draw-off pipes, and in view of this imperfect construction, passages are necessarily required to conduct the smoke to and across the discharge-opening of the retort in order to decrease waste products rising from the bottom of the retort. By my invention no hydrocarbons can escape from the retort until fully vaporized and combined with both steam and air, and these vapors are not only discharged from the retort as constructed but are adapted for use in connection with a solid fuel, nor is it indicated that the first construction is designed to so be used.

It is also old to employ in the fire-chamber of a furnace a retort having discharge-orifices in its top end and at a right angle to the line of draft of the furnace, a supply-pipe for liquid hydrocarbon provided above the center of length of the retort, a float-valve in the retort to regulate the supply of liquid hydrocarbons to the retort, a steam-pipe in the retort between the liquid-hydrocarbon supply and the escape-orifices, and also another steam-supply pipe below the float of said valve, and pipes opening into the retort below the supply of liquid hydrocarbon to the retort and on the outside of the bottom of the retort.

A retort constructed as last above described, however, does not embody my invention, because it is not adapted for use in connection with solid fuel, does not either fully vaporize the hydrocarbons in the retort or successfully combine steam with the vapors, or combine air with the vapors before their discharge in a horizontal plane across the fuel and in a line with the draft of the fire-chamber; but this is also true of the pipe or passage which draws vapors from the top of the retort and discharges them across the bottom to heat the retort.

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

1. The combination, with a retort opening in a horizontal plane directly into a furnace and a supply-passage thereto, through which hydrocarbon, combined with steam and air, is introduced to the retort, of a nozzle, pipe, or passage connected with the top of the retort and opening at a point outside of the retort, where the ignited vapors escaping therefrom will be discharged into the furnace and at the same time heat and maintain the retort in operation, substantially as described.

2. The retort provided with an opening directing the vapors generated therein in a horizontal plane in the furnace, in combination with a pipe or passage connected with the retort, and opening on the same plane at a point outside of the retort, where the ignited vapors escaping from said passage will be discharged into the furnace and at the same time heat and maintain said retort in operation, substantially as described.

3. The retort opening directly into the furnace, means for supplying hydrocarbons to the retort, and a steam and air injector, in combination with a passage connected with the retort and adapted to conduct a portion only of the vapors generated and mixed with steam and air in the retort to a point outside of the retort, where, when injected, they will serve to heat the retort, substantially as described.

4. The retort, the injector, and the nozzle I, opening outside of the retort, in combination with a passage connected with the retort and injector and supplying liquid hydrocarbons to the nozzle for producing the initial heat of the retort, substantially as described.

5. A retort, means for supplying hydrocarbon thereto, the nozzle outside of the retort, and the passage connecting said retort and nozzle, in combination with a liquid-hydrocarbon-supply pipe forming an extension of the nozzle and a steam-supply pipe projecting in the nozzle, substantially as described.

ORLAND D. ORVIS.

Witnesses:
W. W. ELLIOTT,
JNO. G. ELLIOTT.