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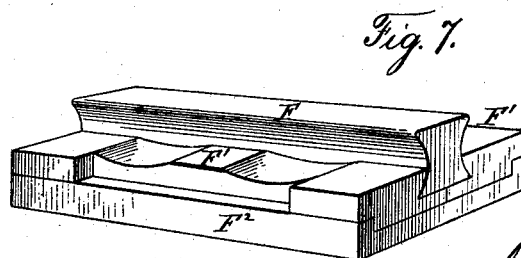
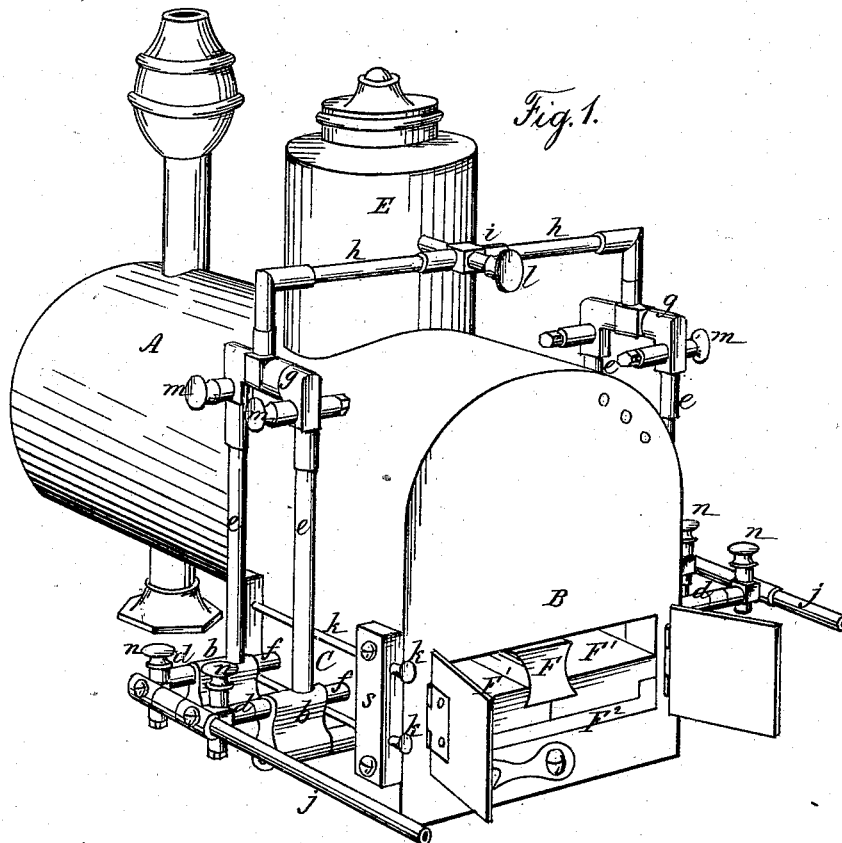
2 Sheets—Sheet 1.

J. MUNDELL & W. J. GORDON.

HYDROCARBON FURNACE.

No. 263,198.

Patented Aug. 22, 1882.



Attest;
C. H. Spward
Edmond Croshaw

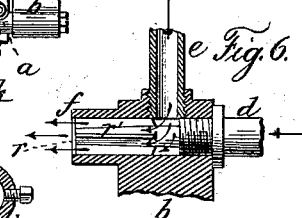
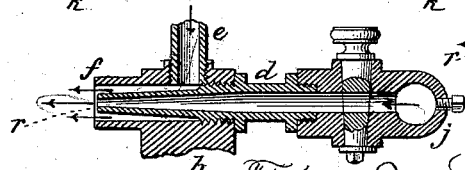
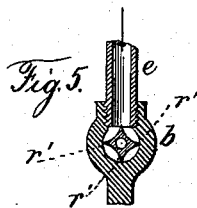
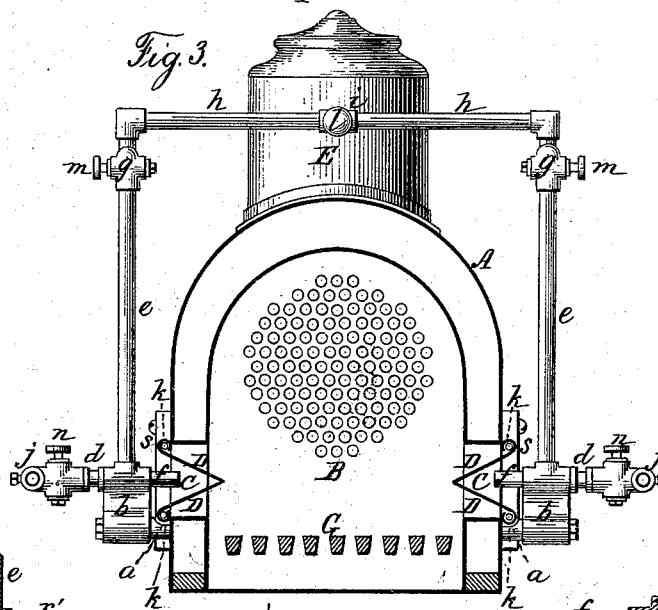
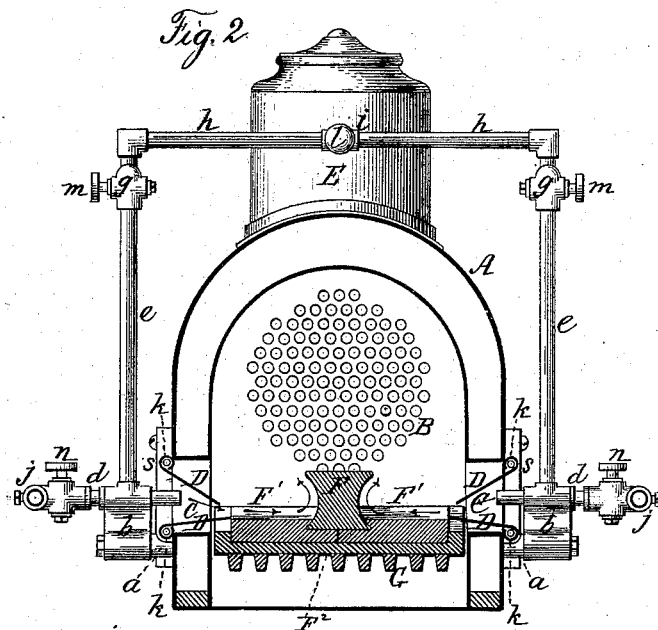
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J. MUNDELL & W. J. GORDON.

HYDROCARBON FURNACE.

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Patented Aug. 22, 1882.



Witnesses:
Edmond Brodhag
Howell Lattie.

Inventors:
James Mundell
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UNITED STATES PATENT OFFICE.

JAMES MUNDELL AND WILLIAM J. GORDON, OF PHILADELPHIA, PA., ASSIGN-
ORS OF ONE-THIRD TO JOHN MUNDELL, OF SAME PLACE.

HYDROCARBON-FURNACE.

SPECIFICATION forming part of Letters Patent No. 263,198, dated August 22, 1882.

Application filed March 27, 1882. (Model.)

To all whom it may concern:

Be it known that we, JAMES MUNDELL and WILLIAM J. GORDON, both citizens of the United States, residing at the city and county of Philadelphia, and State of Pennsylvania, have jointly invented new and useful Improvements in Hydrocarbon-Furnaces, of which the following is a specification.

Our invention relates to that class of furnaces in which a jet of liquid hydrocarbon is injected into the furnace as spray or vapor by steam for use as fuel.

Our improvements consist in means for injecting the hydrocarbon spray into the furnace, comprehending an opening in the furnace-wall provided with top and bottom adjustable spray-plates projecting within the furnace and an ejector, means for spreading and distributing the flame of the injected vapor in the combustion-chamber, means for preventing the flame from backing against the ejector and for regulating the quantity of flame, and in the construction of the furnace, whereby it may be adapted for the use of ordinary carbonaceous fuel, all of which will be hereinafter particularly described, and embraced in specific claims.

While our improvements are particularly designed for use with a steam-boiler furnace, and so hereinafter described, it is obvious that by making the necessary workshop changes they may be applied as means for producing combustion of hydrocarbons in any suitable furnace used for any purpose.

In the accompanying drawings, Figure 1 represents a view in perspective of a steam-boiler furnace embracing our invention; Fig. 2, a vertical cross-section of the furnace, showing the jet from the spray plates or shutters and the means for receiving, spreading, and distributing the flame within the furnace; Fig. 3, a vertical cross-section of the furnace as adapted for ordinary carbonaceous fuel, the flame receiving and distributing abutment and its bed-plate being removed, and the spray plates or shutters closing the furnace-openings of the vaporizer; Fig. 4, a longitudinal section of the ejector and vaporizer; Fig. 5, a cross-section of the same; Fig. 6, the ejector-forming tube or point in elevation; and Fig. 7, Sheet 1, is a perspective of the flame receiving and distrib-

uting abutment, the bed-plate whereof forms the closed bottom of the furnace.

In these drawings, A is an ordinary steam-boiler, and B the furnace or fire-box. At one or preferably at both sides of the fire-box are openings C in its walls, through which the liquid hydrocarbon and steam are injected in spray or vapor into the combustion-chamber or fire-box B from the vaporizing apparatus against a refracting-abutment, and through which opening air is entrained as an aid to combustion. Projecting inwardly and attached to the furnace-wall at the top and bottom of said openings, to form a directing-mouth, are plates or shutters D D, adapted to be operated to converge or diverge to widen or narrow the mouth between which passes the jet of liquid fuel, spraying into vapor and flame as it is forced through the mouth into the combustion-chamber and tubes of the boiler. The functions of these plates or shutters are to prevent, by their convergence to a narrow mouth or exit, the backing of the flame out of said wall-openings and against the orifice of the vaporizer, which projects into or in close proximity to the opening C in the furnace, and to converge or diverge to make the throat narrower or wider in different degrees, or to close the mouth altogether, as hereinafter described. Such a furnace, when provided with a closed bottom, a suitable flame receiving and distributing abutment or surface, and a door or ignition-opening, comprehends our invention, broadly, in connection with a suitable vaporizing apparatus or device. A jet of steam to atomize a jet of the liquid and to inject the spray or vapor into the furnace is supplied, as shown, from the boiler; but such steam-supply may be from a pump or engine. The vaporizing apparatus shown is constructed, arranged, and supported in the following manner:

Contiguous to the jet-receiving opening C, and projecting from the outside of the furnace on both sides, (or one side in some cases,) are brackets or projections *a a*, which support couplings *b b*, constituting the ejector and vaporizing device proper. Within these couplings are tapped or otherwise connected the oil-supply pipe *d* and the steam-supply-pipe *e*, and a spray-nozzle, *f*, which may project within or

in close proximity to the furnace-opening C, as will be presently described. The steam branch pipes *e* rise vertically and are suitably connected with couplings *g*, which are connected with horizontal pipes *h*, having communication with the steam-dome E of the boiler by a coupling, *i*, provided with a regulating-cock. The branch oil-pipes *d* connect in a similar manner with the main oil-pipe *j*, which receive its supply of oil from a suitably-elevated tank or reservoir. A cock, *l*, admits steam from the boiler to the steam-pipe and shuts off or regulates the quantity to the steam-pipe, as may be desired. There are also suitable cocks, *m n*, to regulate the flow of steam and oil from the main or supply pipes above described into their branch pipes of one or more vaporizing devices, the engineer manipulating them to the proper adjustment required for the flow, in his discretion, to one or a series of vaporizing devices, all having the same relation to the furnace-opening. There should also be a cut-off cock (not shown) on the main oil-supply pipe. The oil branch pipe *d* terminates in an ejector tube or point, *r*, which passes into and through the coupling *b* and extends to or nearly to the end of the spraying-nozzle *f*, as shown in Figs. 5 6, and 7, which incloses the ejector tube or point *r*, leaving a space around it, which communicates with the vertical steam-pipe *e*, and which space forms the ejector-orifice for the steam-jet, while the tube *r* tapers to its point and forms the ejector for the oil. The ejector-tube is preferably a separate section screwed into the oil-pipe section, and the latter is preferably screwed into the coupling *b*, so that its end will leave uncovered the steam communication of the spraying-nozzle. While this construction is well adapted for the purpose, yet it may be varied. But, of whatever construction and joining of these parts, it is important that the oil-ejector section shall maintain a perfectly-central relation to the steam-spraying orifice, in order that the steam shall issue in a hollow column, enveloping the jet of oil, and both be projected in a manner to produce perfect atomization of the oil at the ejector-point and at a point where both the steam and the oil will be mixed with air and projected into the furnace. For this purpose the oil-ejector tube is formed with two or more longitudinal surface-edges, *r'*, which form bearings upon the inner walls of the spraying-section, and thus maintain a central position in the steamway, while giving free access for the steam all around the flattened or curved sides of the ejector-tube, so that it will issue with equal body and force upon the jet of oil, producing a perfect admixture of both with air, which will thereby be completely vaporized at the point of entrance into the furnace, producing a white and uniform heat in every part of the furnace, by reason of the arrest or interruption of the vapor, causing its spreading and distribution, so that the flame will rise and pass through the tubes of the boiler or against the walls to be heated.

Access may be had to the orifice of the oil-ejector tube for the purpose of cleaning it and keeping it free from clogging by means of a screw-plug, *o*, screwed into the oil-pipe *j* at a point opposite its junction with the branch oil-pipe *d* and in line with the ejector-tube, so that by removing said screw-plug and inserting a wire into the pipe it may be extended into and through the oil-ejector tube. This facility for cleaning the parts liable to clog renders it unnecessary to separate the parts of the vaporizing apparatus or device.

The abutment F, which I have referred to as receiving and distributing the projected flame, is arranged centrally within the furnace-chamber upon a suitable bed or slabs of fire-brick, asbestos, or other suitable material. The abutment is made of similar material, with its sides concave, and is arranged in the direction of the length of the furnace or boiler, so as to receive the flame from both sides of the furnace, and, interrupting its forcible projection, cause it to spread upward and fill the chamber alike at every point from both sides of the abutment. The bed or slabs F' of the abutment is adjustably seated upon an iron bed-plate, F²—in the example shown is supported upon the usual furnace-grate, G—and forms a closed bottom for the furnace. This bed-plate is provided with hooks, and is otherwise adapted to be drawn out of the furnace to uncover the grate for use as an ordinary coal-furnace, in which case the openings in the furnace-walls are closed by the plates or shutters D D, the vaporizing device not being used. The abutment and the slabs may be suitably joined to facilitate their removal and replacement by others, and the slabs may be guttered or concaved on their upper surface from end to end, or in lines corresponding with the ejector or ejectors, so as to receive the impingement of the flame and give it the proper direction. This capacity for converting a hydrocarbon-furnace into an ordinary fuel-furnace is important in giving the advantage for general use, and especially in giving the advantage for using ordinary fuel with a grate for raising steam at the commencement.

The mouth-forming plates or shutters D D are operated from outside by pintle-rods *k*, having their bearings in clamps *s s*, bolted to the furnace-wall, and when said plates are brought to the proper adjustment or closed, as the case may be, said screw-bolts are driven home to force the clamps against the pintles *k*, and thus hold the plates in the desired position of adjustment; but any suitable clamping device might be used.

It may be in some cases important to adjust the shutters both upward or both downward, to give direction to the spray or vapor at its entrance into the furnace, and this capacity for adjustment and changing the position of the spray-plates gives many advantages in adapting their use for different forms of furnaces.

The number and location of the openings in the furnace will be governed by the form and character of the furnace. Nor is the form of the openings shown nor having the shutters of a single plate controlling points in these matters, as the openings may be of any suitable form and the shutters in sections adapted for use and adjustment with separate and independent openings and ejectors in the same line. So, also, the shutters may be corrugated to prevent their warping, and they may be made of fire-brick slabs, or of any suitable material, and hung in any suitable manner, so long as they are adapted for the functions and purposes stated, and are each provided with means whereby one may be adjusted and held independent of the other and in co-operation with it. Preferably the shutters are hung upon rods on the outer walls of the furnace, and they are of a width to project a short distance beyond the inner walls of the furnace, and when closed their inner edges are joined so as to form a V in cross-section and a close joint.

When the furnace is overcharged with flame and becomes too hot the flame seeks an exit back through the openings C; but our construction of protecting plates or shutters checks this tendency and guards the ejector from being unduly heated by or from contact with the flames, and by narrowing the mouth formed between the approaching ends of the plates this backing out of flame is checked. When the jets are in action the mouth is always, however, to be kept sufficiently wide to permit the exit of the spray into the combustion-chamber in its course from the ejector. When a high pressure of steam is (or in the beginning of combustion) full, jets of oil and steam are fed through the mouth somewhat widened, and vice versa for a low pressure. The smoke-stack serves as a vent to the boiler-flues; but no smoke, however, is thrown off, as there is an absolute combustion of the gases.

An auxiliary boiler may be used to supply steam for the jet at the beginning; or the abutment supporting the bed-plate may be drawn out of the furnace, so as to use the grate for a coal-fire to raise steam, and, when the requisite amount of steam is generated in the boiler, rake out the fire, put in the bed-plate, with its abutment, open the shutter-plates, turn on the cocks, as described, and ignite the sprayed vapor, when the steam in the boiler will continue the flow of jets; or, where another boiler is near, steam may be injected as the spraying-jet by suitable hose-connection with the main steam-pipe or otherwise.

It is obvious that the steam-pipes may be compactly arranged upon the boiler, and that the oil-supply pipe or pipes may be connected with the ejector or ejectors in any suitable manner; nor do we confine ourselves to the particular form and construction of the abutment shown.

I claim—

1. In a hydrocarbon-furnace, the combina-

tion, with a vaporizing apparatus and the fire-box, of wall-openings and inwardly-projecting adjustable shutters or plates, substantially as and for the purpose specified.

2. The combination, in a hydrocarbon-furnace, of a vaporizing apparatus, a fire-box having wall-openings, and inwardly-projecting shutters or plates, with means whereby said shutters or plates are adjusted in relation to each other and held in position when set, substantially as described, for the purpose specified.

3. The combination, in a hydrocarbon-furnace, of a vaporizing apparatus, a fire-box having wall-openings, and inwardly-projecting shutters or plates, with the pintle-rods and the clamps therefor, substantially as described, for the purpose specified.

4. In combination, the combustion-chamber provided with narrow horizontal openings in its opposite walls, hinged plates or shutters for said openings, and end doors, the boiler, the pipes *h e*, connected with the steam-chamber, the pipes *j* and *d*, the couplings *i i*, and the spraying-ejectors carried by said couplings, all constructed and arranged substantially as described, for the purpose specified.

5. In a hydrocarbon-furnace, the combination, with the wall-opening C, provided with shutters or plates adapted to be closed, as set forth, a vaporizing apparatus, and the grate of the furnace, of a removable bed-plate, F², whereby the furnace may be converted for the burning of ordinary carbonaceous fuels, substantially as described.

6. In a hydrocarbon-furnace, the combination, with the wall-openings C, provided with shutters or plates D D, adapted to be adjusted nearer to or farther from each other, of a removable abutment and bed-plate arranged upon the grate-bottom of the furnace, substantially as described, for the purpose specified.

7. In a hydrocarbon-furnace, the combination, with the wall-openings and their inwardly-projecting shutters or plates D D, of a bed-plate, F, having the curving abutment, for the purpose set forth.

8. The nozzle of the oil-ejector, having surface-edges, in combination with a steam-spraying tube, substantially as described, for the purpose specified.

9. The steam-spraying tube and the oil-ejector, having their orifices at or near the same point, one within the other, in combination with the fire-box having wall-openings, and the adjustable spray-directing plates or shutters, substantially as herein set forth.

10. A hydrocarbon-furnace provided with a grate and a removable grate-closing plate or bottom, in combination with a vaporizing apparatus, substantially as described, for the purpose specified.

11. The combination, in a hydrocarbon-furnace, of a combustion-chamber provided with narrow horizontal openings in its opposite walls and end doors, with an abutment ar-

ranged upon the grate and having its opposite sides concave, the vaporizing-ejectors, and the hinged plates, substantially as described.

12. The fire-box of a hydrocarbon-furnace
5 for steam-boilers, having opposite wall-openings, a centrally-arranged abutment, and plates or shutters for said wall-openings, in combination with one or more steam-spraying orifices connected with the dome of said boiler, and
10 one or more oil-ejectors connected with a single source of supply and arranged in relation

to the steam-spraying orifice or orifices, substantially as described, for the purpose specified.

In testimony whereof we have hereunto set 15
our hands in the presence of two subscribing witnesses.

JAMES MUNDELL.
WILLIAM J. GORDON.

Witnesses:

A. E. H. JOHNSON,
J. W. HAMILTON JOHNSON.