(No Model.) 2 Sheets—Sheet 1.

F. W. MINSHALL.

HYDROCARBON OIL BURNER.

No. 405,219. Patented June 11, 1889.

Fig. 2.

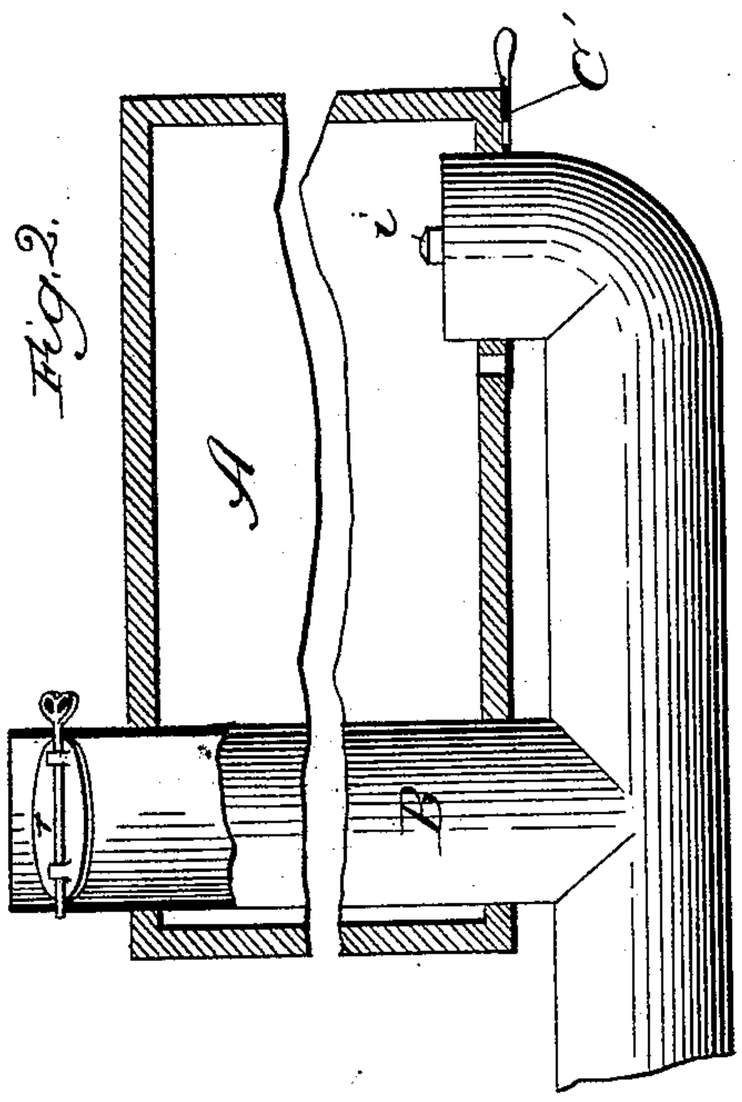


Fig. 1.

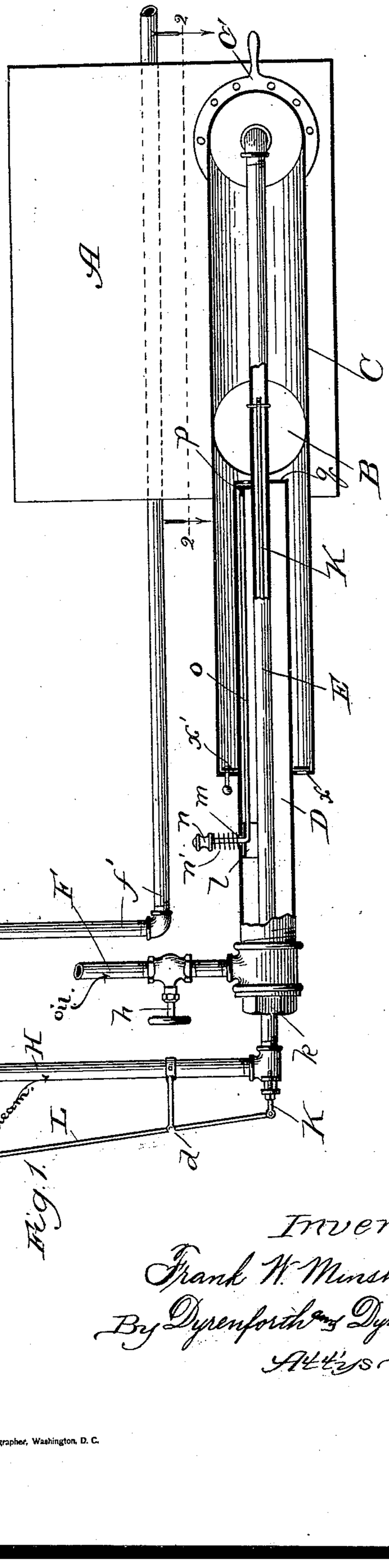


Fig. 4.

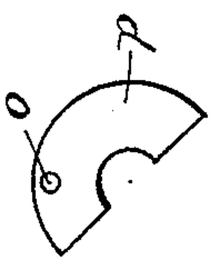
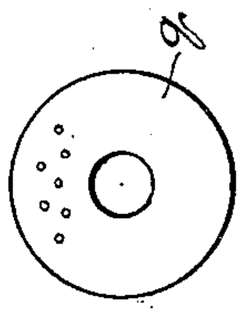


Fig. 3.



Witnesses:
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Clifford N. White.

Inventor:
Frank W. Minshall,
By Dyrenforth & Dyrenforth
Att'ys

(No Model.) 2 Sheets—Sheet 2.

F. W. MINSHALL.

HYDROCARBON OIL BURNER.

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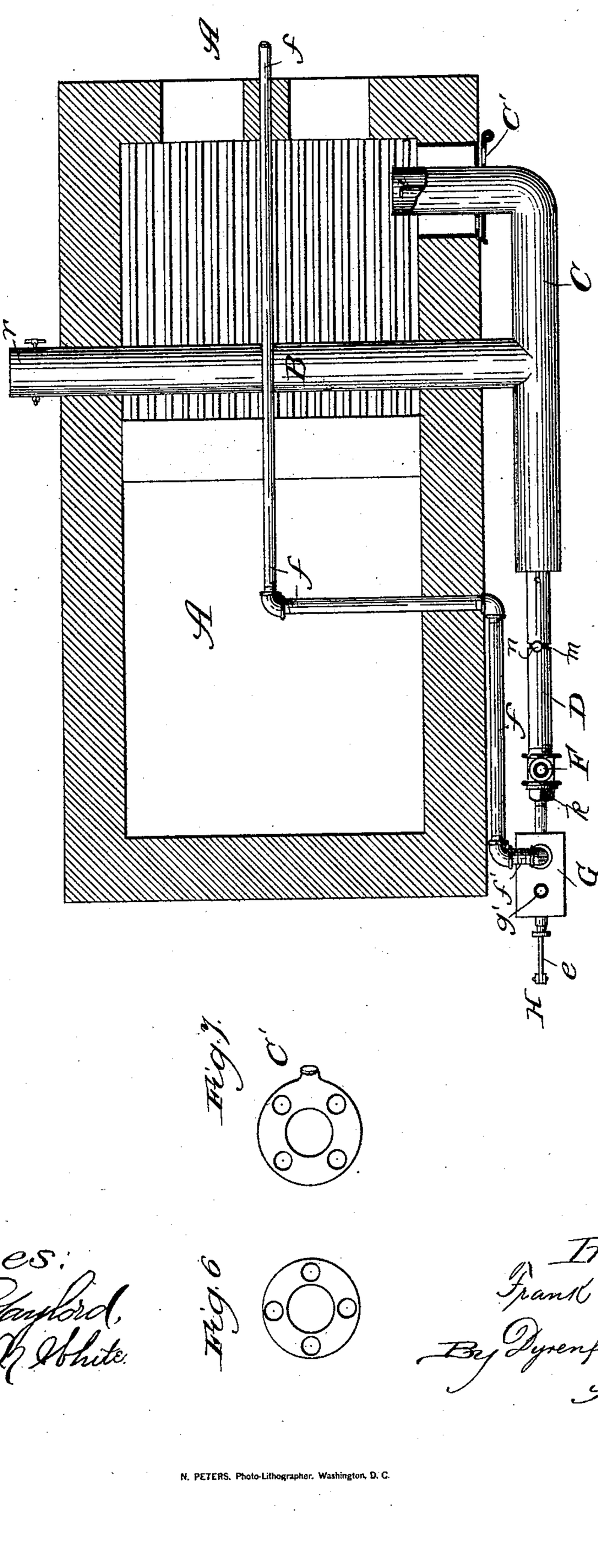

Fig. 5.

Fig. 7.

Fig. 6

Witnesses:
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Clifford R. White.

Inventor:
Frank W. Minshall,
By Dyrenforth and Dyrenforth.
Attys.

UNITED STATES PATENT OFFICE.

FRANK W. MINSHALL, OF MARIETTA, OHIO.

HYDROCARBON-OIL BURNER.

SPECIFICATION forming part of Letters Patent No. 405,219, dated June 11, 1889.

Application filed September 28, 1888. Serial No. 286,648. (No model.)

To all whom it may concern:

Be it known that I, FRANK W. MINSHALL, a citizen of the United States, residing at Marietta, in the county of Washington and State of Ohio, have invented a new and useful Improvement in Hydrocarbon-Oil Burners, of which the following is a specification.

My invention relates to improved means for producing thorough consumption of hydrocarbon oil as fuel.

So far as I am aware, nearly every device hitherto provided for burning liquid hydrocarbon as fuel has depended, for its operation in preparing the oil to facilitate its combustion, on breaking up or distributing the liquid into fine particles generally by direct impact against it of steam from a jet. I find, however, that the impact of steam directly upon the liquid does not insure such a division of it into particles as will effect its complete and ready combustion.

The objects of my invention are to provide a construction of hydrocarbon-oil burner that shall afford the greatest possible economy in the fuel used, and whereby the quantity of the fuel may be quickly and readily regulated according to varying requirements without losing the advantage of rapid and complete combustion, whereby there may be a steady delivery into the fire-box of any required quantity of the fuel, and whereby deposit of fixed carbon, smoke, or soot in flues shall be avoided.

In the drawings, Figure 1 shows a view in elevation, mainly sectional and partly broken, of my improved hydrocarbon-oil burner. Fig. 2 is a section taken on the line 2 2 of Fig. 1, and viewed in the direction of the arrows. Figs. 3 and 4 show details of construction. Fig. 5 presents my improved device applied to a furnace shown in plan section; and Figs. 6 and 7 show in detail the means for controlling the supply of air to the fire-chamber around the burner.

A is a fire-box of any suitable construction, and through a side of which extends horizontally, or nearly so, a pipe B, provided with a regulating-damper *r*.

C is a pipe outside of the fire-box, preferably of the same diameter as the pipe B, with which it communicates between the ends of the pipe C, one of which is provided with a perforated head *x*, the openings in which are controlled by means of a suitable damper *x'*, while the other leads at an angle into the fire-box through a side of the latter opposite that at which the pipe B enters, and which is provided around the pipe C with perforations, as shown, controlled by a suitable regulating-damper C'.

D is a pipe, preferably of about one-half the diameter of the pipe C, and extending into the latter through the end *x* about to the communication therewith of the pipe B, and the outer end of the latter is by preference somewhat lower than the inner end where it joins the pipe C.

The inner end *q* of the pipe D is perforated by providing holes in a portion thereof, as shown in Fig. 3; or may comprise a cap so perforated, against the inside surface of which within the pipe is a non-perforated plate or semicircular disk *p*, and a rod *o* is connected at one end eccentrically with the plate *p*, extending therefrom backward in the pipe D, and is bent toward its opposite extremity to form a handle or lever *n*, which projects through a slot *m*, formed transversely in the pipe, the slot being covered inside the pipe D by a collar or ring *l*, through which the handle *n* passes, and a spring *n'* is confined around the handle *n* to hold the collar *l* against the slot to prevent leakage.

E is a pipe, preferably of about one-third the diameter of the pipe D, extending through the latter from its outer end (which may be closed by a nut *k*, through which the pipe E, as shown, passes) and through the semicircular disk *p* and inner end *q* to the communication of the pipe C with the fuel-chamber A, where it is provided with a jet *i*, which enters the fire-box. A pipe F, provided with a valve *h*, leads from the oil-supply (not shown) into the pipe D near the outer end of the latter.

G is a chest for steam, communicating with the pipe E near its end, which extends beyond the pipe D through a pipe H, and having ports *g* and *f* in a diaphragm I', and coincident with which enter, respectively, a steam-pipe *g'*, leading from a supply (not shown) of common steam, and a steam-pipe *f'*, leading through the fire-box (wherein the fire superheats the steam as it passes through the pipe *f'*) from a steam-supply. (Not shown.)

Within the box G above the diaphragm I′ is a slide-valve I, having openings g^2 and f^2, corresponding with the ports g and f, and which may, by sliding the valve I, be made to coincide alternately with the ports to close one and open the other, or simultaneously therewith to close partially both ports. A rod e is connected at one end with the slide-valve and projects therefrom beyond the box G.

K is a metal rod supported in the steam-pipe E and projecting beyond the outer end thereof, from which projecting end it is pivotally connected by a rod L with the rod e of the slide-valve, a fulcrum d being provided for the rod L between its pivoted extremities and by preference sufficiently near the rod K to afford long leverage between the fulcrum and slide-valve.

The operation of the device is as follows: The oil, which is admitted through the pipe F to the pipe D, is introduced as a finely-divided mixture of petroleum spray and vapor and hot air, produced by the mechanism in the manner hereinafter described, into the fire-chamber A, wherein it is consumed, generating the heat which heats air passing through the pipe B, in which the supply of air is regulated by the valve r, and superheats steam passing through the pipe f'. As the oil enters the pipe D, the lighter parts of the liquid are volatilized by the influence of the heat of the steam-pipe E, while the remaining parts are forced, by the expansion of the volatilized portions, with the latter through the perforations in the end or cap q into the pipe C, which forms the vapor-chamber, in the form of a fine spray. The perforations referred to (which are formed in a segmental portion of the end or cap q, preferably by drilling them from the outer side with a countersink until nearly through the metal and then entirely through with a very fine drill) may be controlled by turning the rod o at the handle n to cause the semicircular disk, which normally covers the perforations in order to retain the oil in the pipe D till it becomes thoroughly heated, to uncover them, or any desired portion of them, the rod and handle thus serving to regulate the amount of fuel discharged into the vapor-chamber by turning the plate p to gage the discharge-openings. The rod o, for operating the plate p, affords a very simple means for its purpose. Other means for accomplishing the same object may, however, readily suggest themselves to those skilled in the art to which my improvement relates; and I do not confine my invention to the use of the exact means for the purpose illustrated. Steam admitted to the pipe E discharges into the fire-box A at the jet i, and the suction effect of such discharge draws the mixture of hydrocarbon vapor and spray from the vaporizing-chamber C together with hot air, which enters it through the pipe B, and the regulating-damper C′ serves to control the supply of external air to the fire-chamber.

I regulate and maintain at any desired degree the temperature of the oil in the pipe D by the slide-valve I, which is actuated automatically to admit common or superheated steam, or both, simultaneously into the pipe E by way of the pipe H through the medium of a thermostat, composed of the metal rod K, and connected with the valve by means of the lever L. The expansion of the rod K by excess of heat in the pipe E moves the valve I to close or reduce the live-steam port f and open or enlarge the common-steam port g, while consequent eventual lowering of the temperature in the pipe E by contracting the thermostat-rod K actuates the valve in the opposite direction.

Thus, as will be seen, my improved device does not depend for its operation on forming the spray mechanically by the impact of the current of steam against the oil; but it forms a true vapor of the more volatile parts by heat transmitted to the oil, whereby the tension of the expanding vapor forces the liquid residue of the oil through small openings in the form of a spray.

It will be noticed that my improved burner is entirely outside the fire-chamber. This is essential to attain all the advantages of my improvement, since were the burner to be entirely or to project to a material extent inside the fire-chamber, as is the case with other oil-burners known to me, it would become heated to a degree of intensity sufficient to ignite in the vaporizing-chamber the hydrogen constituent of the hydrocarbon, and thereby cause a deposit of carbon inside the burner, which would tend to choke it. By providing my burner entirely outside of the fire-chamber I am enabled to maintain the vaporizing-chamber at a temperature below the igniting-point of hydrogen, and my automatic regulating mechanism serves to maintain this temperature fixed.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a hydrocarbon-oil burner, the combination, with a fire-chamber, of a vaporizing-chamber C, having one end at which it leads into the fire-chamber entirely open, thereby affording an unobstructed discharge-orifice, an oil-pipe D, extending part way through the chamber C longitudinally thereof and opening into the latter, and a steam-pipe E, extending through the oil-pipe and vaporizing-chamber to near the discharge end of the latter, substantially as described.

2. In a hydrocarbon-oil burner, the combination, with a fire-chamber, of a vaporizing-chamber C, communicating with the fire-chamber, an oil-pipe D, extending part way through the chamber C longitudinally thereof and opening into the latter, a hot-air pipe B, leading into the vaporizing-chamber near the discharge end of the oil-pipe, and a steam-pipe E, extending through the oil-pipe and vaporizing-chamber to near the discharge end of the latter, substantially as described.

3. In a hydrocarbon-oil burner, the combination, with a fire-chamber, of a vaporizing-chamber C, an oil-pipe D, leading into the vaporizing-chamber and provided with perforations at its discharge end, a revoluble plate *p*, means for rotating the plate *p*, and a steam-pipe E, extending through the oil-pipe and chamber C and terminating in a jet *i* near the entrance of the fire-chamber, substantially as described.

4. In a hydrocarbon-oil burner, the combination, with a fire-chamber, of a vaporizing-chamber C, an oil-pipe D, leading into the vaporizing-chamber, a steam-pipe E, extending through the oil-pipe and chamber C, a valve I in the steam-passage, and a thermostat connected with the valve, substantially as and for the purpose set forth.

5. In a hydrocarbon-oil burner, the combination, with a fire-chamber, of a vaporizing-chamber C, an oil-pipe D, leading into the vaporizing-chamber, a steam-pipe E, extending through the oil-pipe and chamber C, a metal rod K, supported in the steam-pipe, and a valve I in the steam-passage connected with and actuated by the expansion and contraction of the rod K, substantially as and for the purpose set forth.

6. In a hydrocarbon-oil burner, the combination, with a fire-chamber, of a vaporizing-chamber C, communicating with the fire-chamber, an air-pipe B, leading through the fire-chamber into the vaporizing-chamber, an oil-pipe D, leading into the vaporizing-chamber, a steam-pipe E, extending through the oil-pipe and chamber C and leading into the fire-chamber, a metal rod K, supported in the steam-pipe, a steam-box G, communicating with the pipe E and provided with a valve I, connected with the rod K, a steam-pipe *f'*, passing through the fire-chamber, and a steam-pipe *g'*, both steam-pipes *f'* and *g'* leading into the box G, substantially as described.

FRANK W. MINSHALL.

In presence of—
CATHARINE WHEATLEY,
O. M. STEEN.