(No Model.) 2 Sheets—Sheet 1.

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HYDROCARBON FURNACE.

No. 387,799. Patented Aug. 14, 1888.

Fig 2.

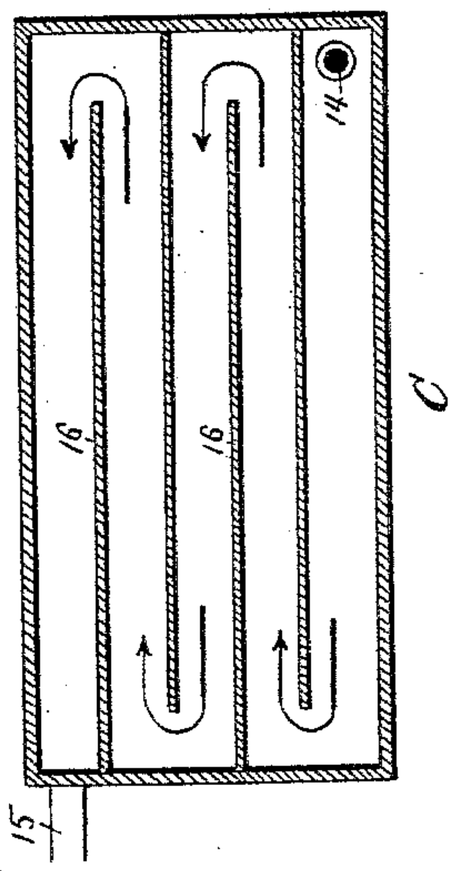

Fig 7.

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Fig. 3.

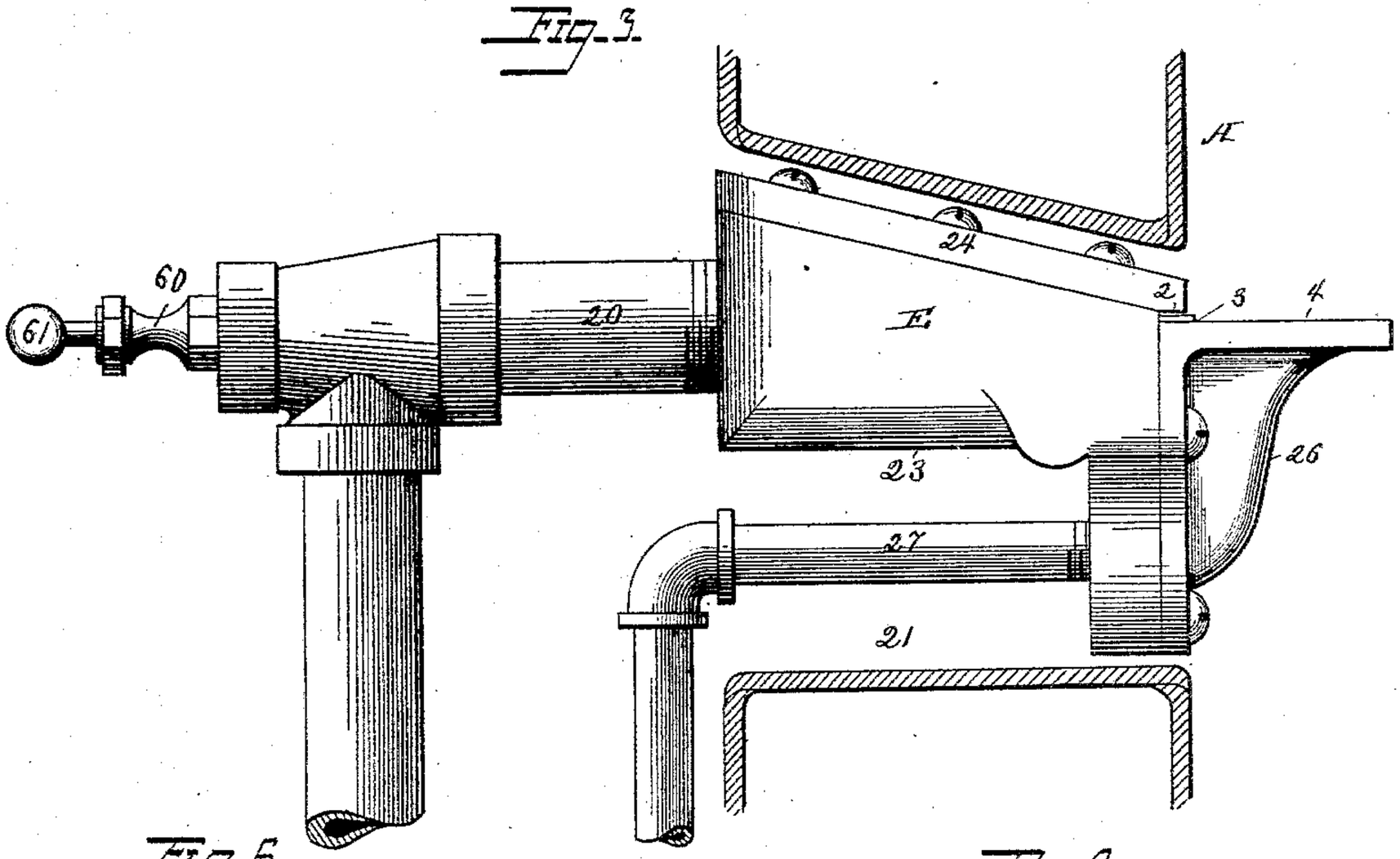


Fig. 6.

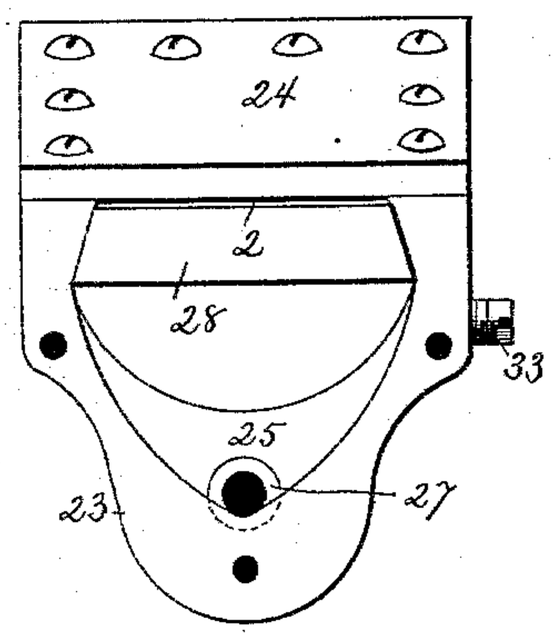


Fig. 4.

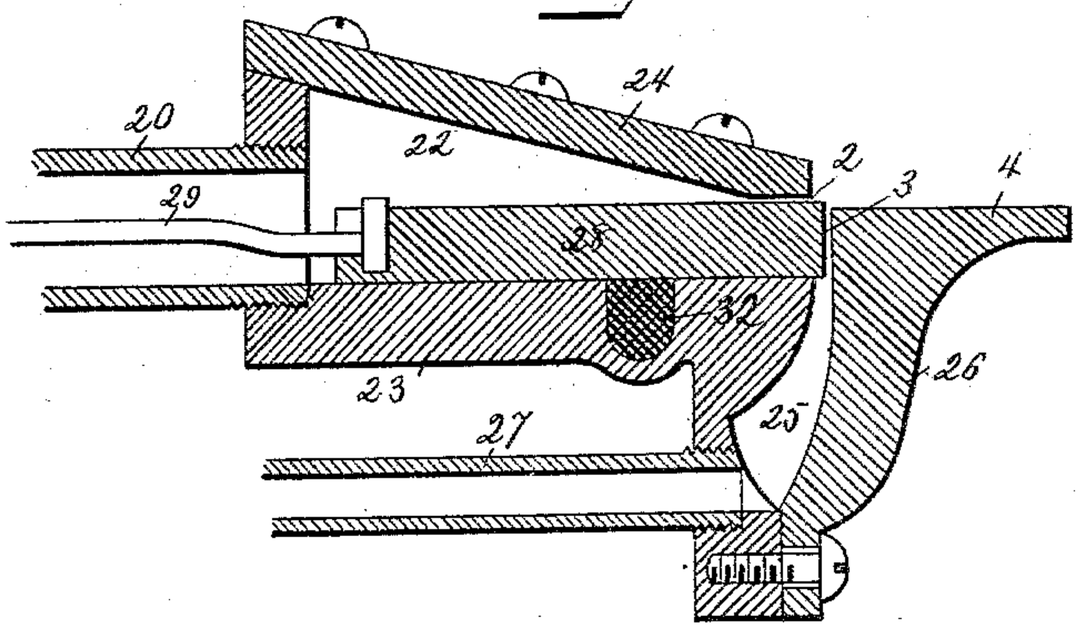
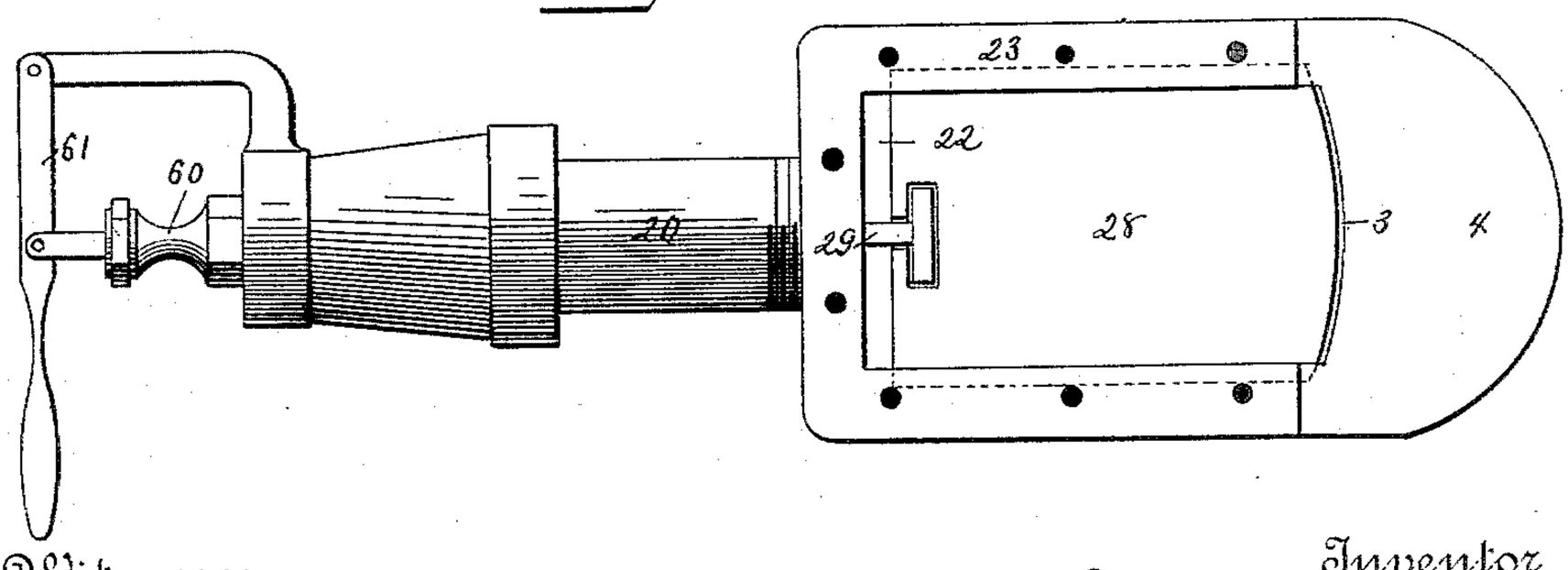


Fig. 5.



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UNITED STATES PATENT OFFICE.

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HYDROCARBON-FURNACE.

SPECIFICATION forming part of Letters Patent No. 387,799, dated August 14, 1888.

Application filed June 3, 1887. Serial No. 240,174. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN A. MOODY, a citizen of the United States, residing at Boston, Suffolk county, Massachusetts, have invented certain new and useful Improvements in Hydrocarbon-Furnaces, of which the following is a specification.

This invention relates to furnaces adapted to the use of liquid hydrocarbons as fuel, and has for its object the insuring of the perfect combustion of the fuel, and to provide an efficient mode of regulating the flow of the hydrocarbons so that the heat may be controlled.

To this end the present invention consists in a novel construction of furnace and in the manner of connecting the liquid fuel and steam-supply with the same; and it also consists in a novel form of sprayer for feeding and regulating the liquid hydrocarbon and steam, all of which will be fully hereinafter described and claimed.

The accompanying drawings illustrate a mode by which my invention has been practically carried out in connection with a locomotive-boiler, it being of course understood that so far as the particular arrangement and details of the parts are concerned they may be departed from within wide limits, as the requirements of the particular furnace with which it is desired to employ the improvements necessitate.

In said drawings, Figure 1 illustrates a sectional elevation of the fire-box and portion of the boiler of a locomotive provided with the present improvements. Fig. 2 is a sectional elevation of the superheater. Fig. 3 is an enlarged side elevation of the burner, showing its connections with the steam and hydrocarbon supply pipes. Fig. 4 is a central sectional elevation thereof. Fig. 5 is a plan view of the same, one of its covering-plates being removed. Fig. 6 is an end view thereof, the covering-plate of the oil-chamber being removed; and Fig. 7 is a view illustrating a mode of regulating the valves of the steam and oil supply pipes.

Referring particularly to Fig. 1, it is to be understood that A represents a portion of a locomotive or other boiler, and B the fire-box thereof, of the ordinary construction. In applying the present improvements thereto it is preferred to remove the ordinary grate-bars and substitute in lieu thereof a series of bars, 10, supported just below the bottom of the water-legs by flanges secured to their opposite sides. Upon these bars rest an iron plate, 12, leaving an air-passage, 11, near the rear water-leg, which plate supports layers of fire-brick or tile, 13. The layers of fire-brick confine the heat to the fire-box and protect the supporting-plate and the bars. Upon the fire-brick is arranged a superheater, C, of any suitable construction, as herein shown. (See Fig. 2.) It consists of a stout cast-iron closed structure, of sufficient area to superheat all the steam required by the hydrocarbon-burner, having induction and eduction openings 14 15, and provided with a series of partition-walls, 16, which cause the steam passing therethrough to take a circuitous direction. This superheater is connected at its induction-orifice 14 by a pipe, 17, with the steam-space of the boiler, and preferably the steam-dome D, which pipe is provided with an equalizing-valve, 18, and a controlling-valve, 19. The eduction-orifice of the superheater is connected by a steam-pipe, 20, to an oil and steam feed and regulating device or burner, E. Over this superheater and the foundation of layers of brick or tile there is provided a bed of loose or broken fire-brick or other suitable refractory material, F, either whole or broken in such quantity that the bed extends, preferably, to about level with the lower row of boiler-tubes. This mass of loose refractory material is held in place and from falling into the air-passage 11 by the rear fire-bricks, which are extended upward somewhat higher than those constituting the bed 13, thereby forming a wall, 13′, adjacent to opening 11.

The regulating device or burner E is contained in an opening, 21, extending through the rear water-leg into the fire box, as best shown in Figs. 1 and 3, in such position that the hydrocarbon flame from it strikes about midway of the height of the refractory material therein. This burner consists of a casing having an oil and a steam chamber having outlets converging into one elongated orifice, wherein is mounted a sliding valve, whereby

said orifice is closed or opened to the desired extent. As herein shown, (see Figs. 3 to 6,) it consists of an irregular casting, 23, having a chamber, 22, closed by a plate, 24, that communicates with the steam-supply pipe 20. This steam-chamber of the burner gradually tapers down to its mouth 2, the width of the chamber remaining unchanged, so that the steam will issue therefrom in a fine jet, but of considerable width. The casting 23 also provides a second chamber, 25, of smaller dimensions, closed by a cap, 26, that is connected by a pipe, 27, with the liquid-hydrocarbon reservoir or tank, (not shown,) which should be supported sufficiently high to allow the liquid hydrocarbon to flow to the top of the burner. This oil-chamber 25 is also contracted toward its mouth 3, that is arranged just beyond the mouth 2 of the steam-chamber, and preferably the slightest degree lower than said last-named mouth. The extent of opening of the mouth 3 of the oil-chamber is regulated by a valve, 28, that is contained in bearings in the steam-chamber 22, the stem 29 whereof extends through a portion of the steam-supply pipe and a stuffing-box, 30, and is operated by a lever or other handle, 31. The end of the upper face of this valve 28 provides one side of the mouth 2, and its end also provides one side of the mouth 3. This oil-chamber mouth 3 may be raised or lowered with respect to the mouth 2, to vary the effect of the jet of steam passing over said mouth 3, by adjusting the position of the cap 26 through its attaching-screws, so that its flat horizontal face 4, which is at substantially right angles to the oil-orifice and situated below and in line with the steam-orifice, is approached toward or from the said jet of steam. The quantity of oil rising to the level of the face 4 will be regulated to a nicety by adjusting laterally the position of the valve 28, so as to vary the size of the mouth 3. The position of the mouths 2 and 3 with respect to each other is exceedingly important, as I have found in practice that if the mouths are so arranged that the jet of steam issuing from its mouth acts as an oil-atomizer, in that it draws the oil from the oil-mouth faster than it will be naturally fed thereto, it results in producing a flame which is completely out of the control of the attendant, because the flow of oil in such a structure cannot be regulated to such a degree as to produce a small flame. This defective operation is wholly overcome in the improved structure hereinbefore described, in that the feeding of the oil and its being sprayed by the steam are not dependent upon the atomizer effect of the steam-jet, the action of the improved burner being such that the oil is permitted to rise to the top of its mouth and spread in a thin film over a portion of the face 4, so that the steam, its orifice being raised slightly above the oil-orifice, strikes the film of oil upon said face at a point removed from the orifice 3, thus permitting it to finely divide the oil thereon and carry it to the refractory material, and preventing the steam from drawing upon the oil faster than it is allowed to flow.

The escape of steam past the under face of the valve 28 is prevented by packing 32, held in a recess in the casting 23 and adjusted to exert more or less pressure upon said valve by a plug, 33. (See Figs. 4 and 6.)

The operation of the furnace as thus far described is as follows, it being understood that the boiler A is supplied with water and the oil-tank (not shown) with a liquid hydrocarbon: The chamber 22 of the burner E will, if there be no steam in the boiler, be connected with some independent steam-generator, (not shown,) the steam-valve whereof and the valve controlling the flow of oil through the pipe 27 being opened, so that the steam is allowed to issue in the form of a jet from the burner-mouth 2 and the oil to rise to the top of its mouth 3, level with its horizontal face 4, and so as to just flow thereon in the form of a thin film. The jet of steam striking the face 4 will take up the oil spread thereon and carry it in the form of spray upon the refractory material F in the fire-box, the sprayed hydrocarbon being ignited in any suitable manner and air supplied thereto by the opening 11. The flame of the burning hydrocarbon speedily brings the refractory material to a red heat, and then to incandescence, more or less, the heat therefrom soon generating steam in the boiler A. When this has been done, the independent steam-generator may be cut off from communication with the burner steam-chamber 22, and the steam from the boiler A used for spraying the hydrocarbon. In this case the valve 19 of the steam-pipe 17 will be opened to permit steam to enter the superheater C, which, being heated by the highly-heated refractory material, superheats the steam which issues therefrom by pipe 20 and passes to said steam-chamber 22, from whence it is sprayed with the oil onto the refractory material.

Any convenient means may be employed to regulate the flow of steam and oil to the burner E through their respective pipes, such as ordinary valves, 30 31. (Shown in Fig. 1.)

It is many times desirable, especially when the hydrocarbon-burner is employed with a locomotive fire-box, as herein illustrated, to provide means whereby the valves in the pipes, which ordinarily will be led some distance removed from the cab of the locomotive, may be under the easy and direct control of the attendant therein. Such an arrangement is shown in Fig. 7, wherein 32 represents the floor of the locomotive-cab, and 33 a hollow standard securely bolted thereto. This standard supports a tubular rod, 34, the lower end of which, by suitable connections, 35, is connected to the stem of the valve 30. Its upper end above the standard has an operating-handle, 36, the spring-pawl of which engages with notches of a fixed segment, 37. Within the tubular rod 34 another rod, 38, is supported, connected by suitable levers and rod, 39, to the stem of the valve 31. This rod 38 also has an

operating-handle, 40, having a spring-pawl engaging with the notch of a second segment, 41, carried upon the handle 36, the arrangement of the operating-handles being such that in operating the single handle 36 the other handle, 40, will be carried thereby, and thus both valves 30 31 will be simultaneously controlled, and at the same time, as will be obvious, the handle 40, controlling the oil-valve 31, may be operated independently for controlling the flow of oil, from which it will be seen that the handles for operating the two valves are contiguous with each other, one capable of operating both valves, and both valves under direct control of the attendant.

While the improved furnace and liquid-hydrocarbon burner are illustrated in connection with a locomotive-boiler, it is of course obvious that the furnace may be of any kind, either for heating air, for heating water, or for generating steam. It may also be remarked that while only one hydrocarbon-burner has been described as employed with the furnace, two or more may be used, according to its size and the degree of heat desired.

I am aware that it is old in hydrocarbon-burning furnaces to deliver the liquid fuel upon an inclined plate, from which it dripped or flowed, being met as it fell from the plate by a blast of steam or air, by which it was more or less perfectly atomized; but it will be apparent that a substantially horizontal spreading-plate, upon which the steam is directed in front of the oil-orifice leading to said plate, will result in a much more perfect and uniform vaporization of the liquid fuel than in such older constructions, where the liquid will collect in drops which must be broken up by the blast as they fall from the drip-plates, whereas in my construction the oil will have spread out into an extremely thin film before being acted upon by the blast.

I claim—

1. A hydrocarbon-burner consisting of a casing having oil and steam chambers with their discharge-passages converging into one elongated orifice, and a sliding valve situated partly in said orifice and forming two independent contracted outlets at an angle to each other, one of which orifices the valve controls, substantially as described.

2. A hydrocarbon-burner consisting of a casing having separate oil and steam chambers with their discharge-passages at an angle to each other, and a sliding valve situated in one of the said chambers and fitting a flat seat terminating at the oil-outlet, the said valve separating the oil and steam outlets and being adjustable, substantially as set forth.

3. A hydrocarbon-burner having a casing provided with separate oil and steam chambers having outlets converging into one elongated orifice, a plate partially closing said orifice and forming separate steam and oil discharge outlets, and a flat horizontal spreading-plate adjacent to the oil-orifice, the steam-outlet being arranged to direct the steam upon the plate in front of the oil-outlet, substantially as described.

4. The combination, with a hydrocarbon-burner casing having steam and oil chambers, the outlet from the latter being entirely below the outlet from the former, of a flat extended plate situated at substantially right angles to and opposite the oil-orifice and below the steam-orifice, upon which plate the oil is adapted to flow and spread in a thin film before being met by the steam, and means for adjusting the said plate toward and from the oil-orifice, substantially as described.

5. A hydrocarbon-burner having a casing provided with a steam-chamber having an orifice leading therefrom, and an oil-chamber inclosed in part by the casing and in part by a plate attached to the casing, having a flat extended upper face in proximity to the orifice leading from the oil-chamber, substantially as described.

6. A hydrocarbon-burner provided with a steam-chamber, 22, contracted toward one end, and with a chamber, 25, inclosed in part by the burner and in part by a plate, 26, having a flat extended upper face, 4, and an adjustable sliding-valve plate, 28, lying in the contracted end of the steam-chamber, which it contracts to form a narrow orifice, 2, and having its end opposite the plate 26, thereby forming a contracted outlet from the chamber 25, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

BENJAMIN A. MOODY.

Witnesses:

CHARLES C. SANDERSON,

EDWARD NASON.