(No Model.) 4 Sheets—Sheet 1.

H. W. PARKER.

HYDROCARBON BURNER.

No. 534,911. Patented Feb. 26, 1895.

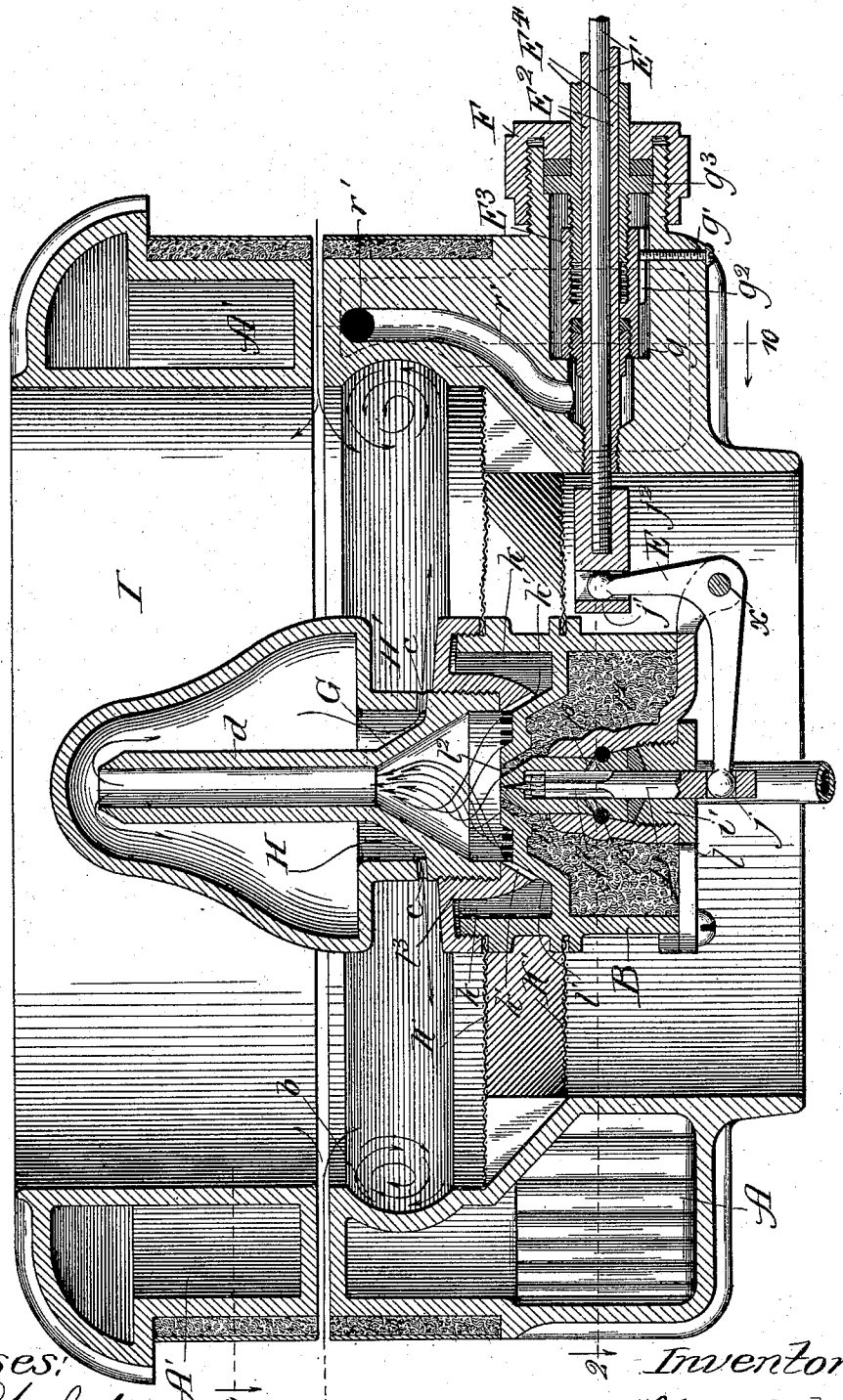

Fig. 1.

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(No Model.)

4 Sheets—Sheet 2.

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HYDROCARBON BURNER.

No. 534,911. Patented Feb. 26, 1895.

Fig. 2.

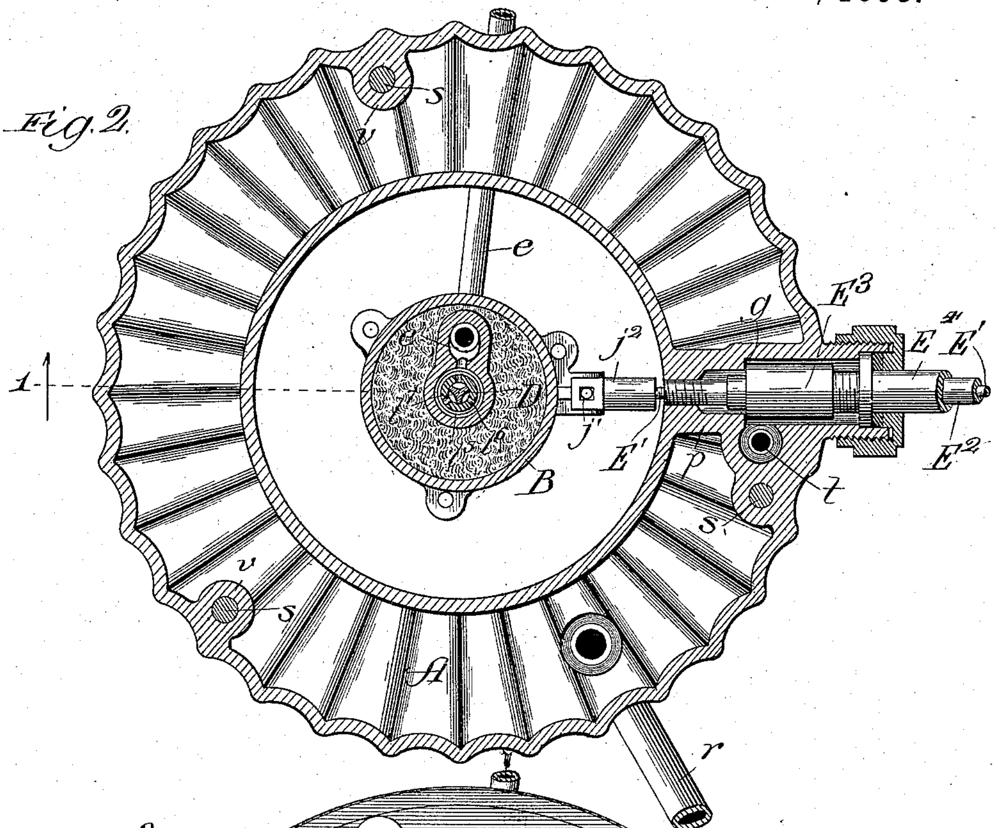
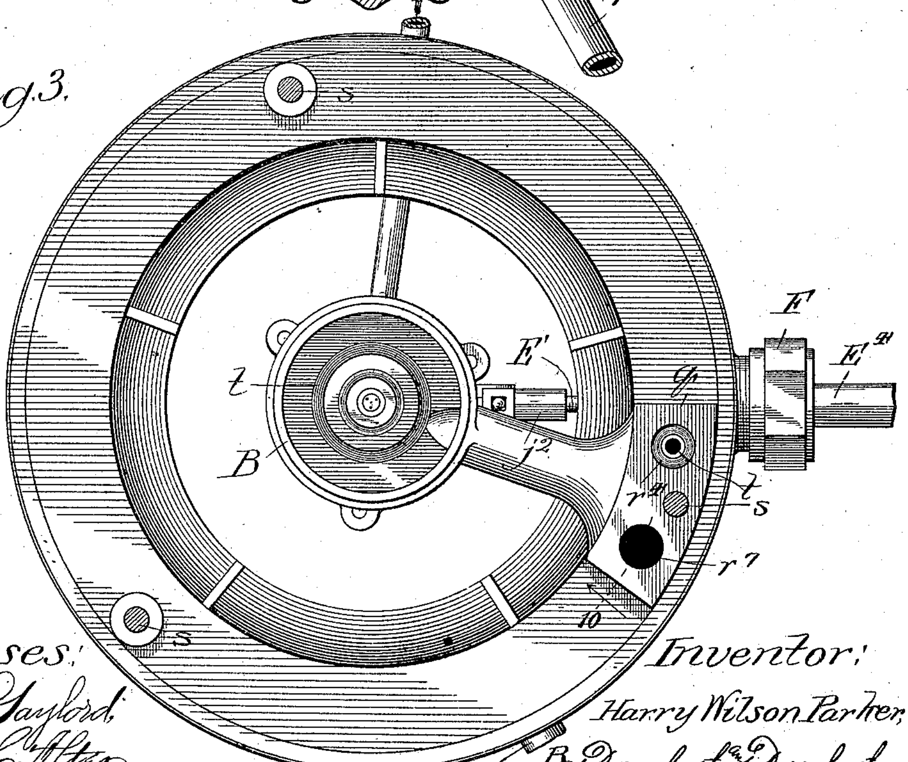


Fig. 3.



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(No Model.) 4 Sheets—Sheet 3.

H. W. PARKER.

HYDROCARBON BURNER.

No. 534,911. Patented Feb. 26, 1895.

Fig. 4.

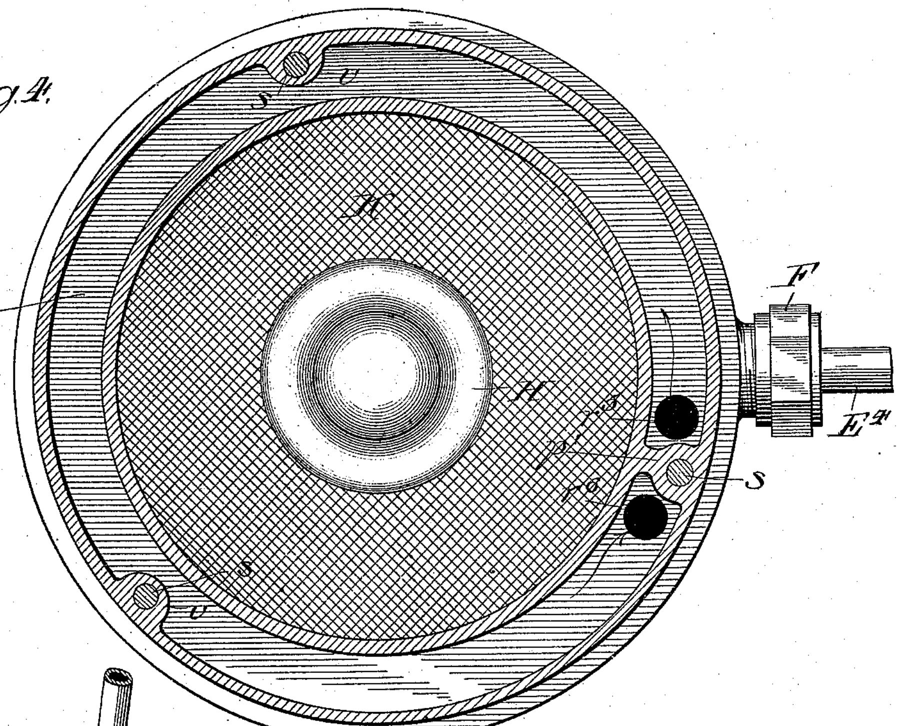


Fig. 6.

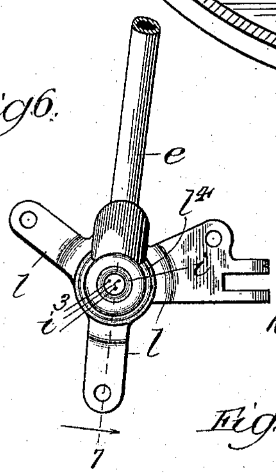


Fig. 5.

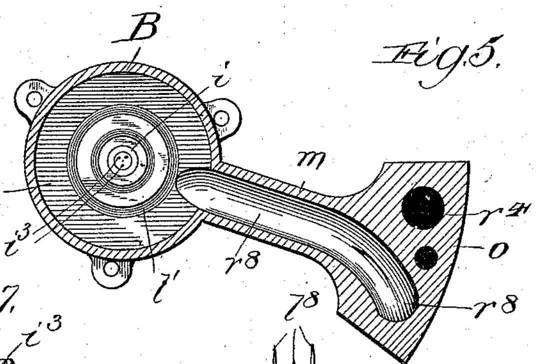


Fig. 7.

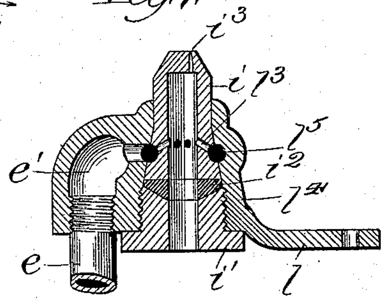
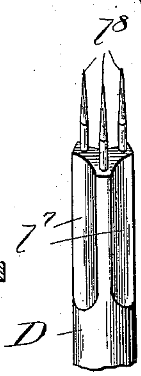


Fig. 8.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 4.

H. W. PARKER.

HYDROCARBON BURNER.

No. 534,911. Patented Feb. 26, 1895.

Fig. 9.

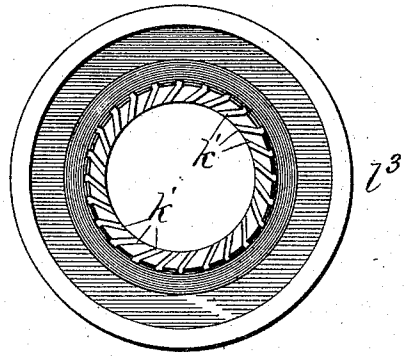


Fig. 10.

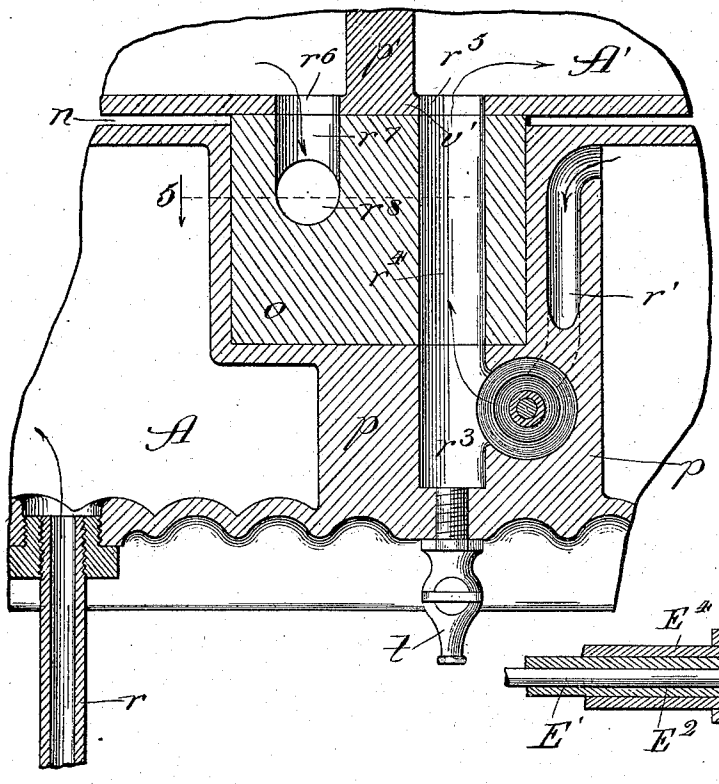
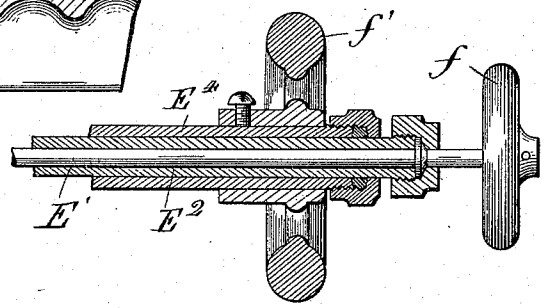


Fig. 11.



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UNITED STATES PATENT OFFICE.

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HYDROCARBON-BURNER.

SPECIFICATION forming part of Letters Patent No. 534,911, dated February 26, 1895.

Application filed March 22, 1894. Serial No. 504,618. (No model.)

To all whom it may concern:

Be it known that I, HARRY WILSON PARKER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Hydrocarbon-Burners, of which the following is a specification.

My invention relates to an improvement in the class of burners adapted for heating with gas produced from steam generated by the heat of the burner, air and either fuel-gas fed to the burner in that form, or liquid hydrocarbon vaporized by the heat of the generated steam.

Whichever of the two kinds of carbureting fluid is used with my device, my primary object is to provide a construction of burner which shall economically produce thorough combustion of the gases it generates and a great intensity of heat.

My object relates to the provision of particular details of construction and their co-operation toward attaining the ultimate result of complete combustion of the gases and generation of great heat, whichever of the aforementioned two varieties of carbureting material shall be employed.

Referring to the accompanying drawings, Figure 1 shows my improved burner by a view in sectional elevation, the section being taken at the line 1 on Fig. 2 and viewed in the direction of the arrow. Fig. 2 is a section taken at the line 2 on Fig. 1 and viewed in the direction of the arrow. Fig. 3 is a section taken at the line 3 on Fig. 1 and viewed in the direction of the arrow, the receiving-chamber for the steam and carbureting material and the mixing chamber being removed. Fig. 4 is a section taken at the line 4 on Fig. 1 and viewed in the direction of the arrow, with the shell forming the mixing chamber shown in plan. Fig. 5 is a section taken at the line 5 on Fig. 10 and viewed in the direction of the arrow. Fig. 6 is a plan view of the valve-device for controlling the admission of liquid hydrocarbon into the burner. Fig. 7 is an enlarged section taken at the line 7 on Fig. 6 and viewed in the direction of the arrow. Fig. 8 is a broken perspective view showing the upper portion of the liquid hydrocarbon valve detached. Fig. 9 is a bottom plan view of the annular head of the steam accumulating chamber, showing it detached to display the series of spirally arranged ducts about its upwardly tapering annular base, through which to torsionally introduce superheated steam into the receiving-chamber for the steam and carbureting material. Fig. 10 is a broken section taken at the line 10 on Fig. 1 and viewed in the direction of the arrow; and Fig. 11 is a broken section of the valve-operating mechanism for controlling the supply to the burner of steam and carburetting material, the view being a continuation of the valve-mechanism represented as broken away in Fig. 1.

Generally stated my improved burner involves a lower annular steam-generating chamber surmounting an open-base air-chamber, and upper steam-superheating chamber, a centrally located chamber to receive the superheated steam introduced in tortuous jets converging toward an apex and the carbureting material injected into the apex; a mixing-chamber into which the receiving-chamber leads and opening into the combustion-chamber which surrounds it and wherein the gases in an intimately mixed condition are supplied with air to support combustion and are controlled in a manner to force the hydrogen from the oxygen and force thorough combustion of the gases before allowing them to escape.

As illustrated my improved device is arranged for the employment of liquid hydrocarbon as the carbureting material; and the detailed description hereinafter contained relates to that particular arrangement, though the manner of adapting the burner to operate with the carbureting material introduced primarily in a gaseous form will be explained.

A is the annular steam-generating chamber, into which, preferably at its base, water, either in cold or slightly warmed condition, is fed through an inlet *r*, and the exterior portion of the shell of the chamber A may be corrugated, as shown, to increase the heating surface. To one side of the inlet *r* in the lower water-heating chamber is a transverse partition *p* bored out longitudinally and affording a bearing for valve-mechanism hereinafter described. At the opposite side of

the partition, in the upper edge of the chamber A, is provided a segmental recess q (see Fig. 3) to receive the block o which carries the burner-head B (Fig. 5), hereinafter described. In the side of the partition p near the end of the annular chamber A farthest removed from the inlet r, is a steam-outlet r' (Figs. 1 and 10) leading downward to the bore in the partition, which bore opens into recess r^3 in the partition to receive the condensation and whence its escape is controlled by a pet-cock t; and the recess r^3 communicates at its upper end with a port r^4 extending vertically through the block o.

A′ is the annular steam-superheating chamber, which should be corrugated like the water-heating chamber and is adapted to seat on the annular shell of the chamber A preferably in a manner to afford an air-space n between them, interrupted only by the projecting upper portion of the block o and bosses v on both shells extending to the same height as the block and affording with it the seating-points for the steam-superheating chamber, which is firmly fastened in place by means of bolts s passed vertically through the two chambers at the bosses and block o. The chamber A′ contains a transverse partition p' coincident with the upper side of the block o; and to one side of the partition, in the base of the chamber A′ is a steam-inlet r^5, while through the base at the opposite side of the partition p' leads the superheated-steam outlet r^6 into a passage r^7 in the block o whence there leads horizontally a hollow neck m, affording the superheated-steam discharge-passage r^8, and which carries at its inner end the burner-head B at the center of the annulus formed by the chambers A and A′, the head B affording an injector for the carburetting material.

The head B is shown in the form of a hollow cylindrical shell having a spider-base l, an intermediate crown-like terraced diaphragm l' having a central apical opening l^2, and an annular cup-shaped cap l^3 screwed upon the upper end of the shell to surround, at its annular base, the base of the crown-portion of the diaphragm l', to the incline of which it conforms and affords an upwardly tapering intermediate annular space, the depending portion of the cap l^3 forming with the adjacent surface of the burner-shell a chamber k for the accumulation of superheated steam, which enters it from the passage r^8 in the neck m. In the annular inclined base of the cap l^3 is formed an endless series of spiral ducts k' (Fig. 9). The center of the spider-base l is in the form of an internally threaded sleeve l^4 converging slightly upward about its interior surface between the ends to afford a seat for the correspondingly formed base of a thimble i having a tapering head at which it conforms to the apical portion of the diaphragm l' surrounding it; and in the inner end of the thimble are formed one or more, and preferably three, minute apertures through which the liquid hydrocarbon is fed. The thimble is fastened in place by a plug i' screwed into the sleeve l^4, and between which and the thimble is shown a suitable packing material i^2. Just above the tapering contiguous surfaces of the sleeve l^4 and thimble, and formed one-half in each, is the circumferential channel l^5 from which proceed ducts l^6 into the interior of the thimble, wherein is contained the reciprocable valve D. This valve is shown in the form of a cylindrical metal bar or stem reciprocably confined in the thimble l^4, into which it extends through the bore in the plug i', and having formed in it, toward its upper end, a series of longitudinal channels l^7 to coincide with the ducts l^6 and leading to its extremity, from which project the needles l^8, shown as three in number, which is preferred, though they may be more or fewer, and they coincide, each, with a minute discharge-aperture i^3 in the end of the thimble.

The space in the shell of the burner-head B, surrounding the sleeve and thimble between the spider-base and diaphragm l' is packed with insulating material B′, such as magnesia, for the purpose of thoroughly shielding the liquid hydrocarbon against becoming heated in the head and until actually delivered to the superheated steam, thereby avoiding all danger of clogging the valve, which would necessarily ensue, if the oil were to become heated in the burner-head, by depositing gummy sediment from the oil. This feature I consider a most important one, since unless it be provided the discharge of oil will inevitably be choked by the deposit.

The valve D is shown to be connected from its lower end by a ball-and-socket joint j with one end of a bell-crank E, fulcrumed at x on the burner-head base, and connected at its opposite end, by a similar ball-and-socket joint j', with a head j^2 into which the inner end of an operating rod E′ is screwed, the rod passing thence through the bore of the partition p in which it is surrounded by a stationary sleeve E^2, the latter, in turn having about it the externally threaded sleeve E^4, rotatable on the sleeve E^2 and having screwed upon its thread a hollow cylindrical head forming the steam-valve E^3, in an expanded portion of the partition-bore and confined against rotation by a stop-pin g' (Fig. 1) extending between a pair of lugs g^2 on the base of the valve. A stuffing-box F surrounds the sleeve E^4 where it enters the bore of the partition p and engages a flange g^3 on the sleeve, which is rotatable, to confine it against longitudinal movement, whereby when the sleeve is rotated the threaded engagement with it of the valve E^3 moves the latter longitudinally with relation to its seat g afforded by a shoulder at the inner end of the expanded portion of the partition-bore. The rod E′ terminates at its outer end in a hand-wheel f (Fig. 11) by which to turn it; and being confined against longitudinal movement, rotating it turns its threaded end in the head j^2 and produces

longitudinal movement of the latter with the effect of working the bell-crank E on its fulcrum to force upward or downward (according to the direction of turning the rod) the valve D for the purpose of causing the needles l^8 thereon to penetrate more or less the apertures i^3. On the outer end of the cylindrical stem E^4 of the steam-valve E^3 is also provided a hand-wheel, f', by which to turn it.

As will be observed, particularly by reference to Figs. 1 and 10, the inlet r' for live steam connects with the bore in the partition p at the inner end of the valve E^3, whereby when the latter is against its seat g the steam-supply to the superheater A′ through the passages r^4 and r^5 is shut off; and the quantity of steam admitted, and accordingly that of the superheated steam supplied to the chamber k, is regulated by the extent to which the valve is unseated.

The supply of liquid hydrocarbon, which should be delivered under pressure, as from an elevated holder, is admitted to the burner-head B at its base through a pipe e leading to a chamber e' (see Fig. 7) provided in one side of the sleeve l^4 and from which the ducts l^6 proceed.

Into the vertical portion of the cup-shaped cap l^3, which is threaded internally, is screwed the externally cylindrical and threaded hood G shown in the shape of an inverted funnel affording a superheated steam and oil receiving chamber, and the spout d of which extends upward nearly to the top of the mixing-chamber H, formed with a metal shell preferably of the shape illustrated and connected at its neck H′ with the hood G, as by casting the two in one piece. Near the junction of the neck with the hood is provided a circumferential series of outlets c leading into the combustion-chamber I, which is surrounded by the steam-superheater A′ and by the upper portion of the steam-generating chamber A, and in the interior wall of which I form a groove or concavity b, shown as shaped in the arc of a circle in cross-section and performing a retarding and mixing function on the products of combustion as hereinafter described.

In the base-portion of the chamber I is the screen-like diaphragm K fitting about the shell of the burner-head B at which it is clamped to support it; and a second, similar, diaphragm K′ may be provided below, as shown, the better to effect uniform distribution and regularity of ingress of the air which enters the combustion-chamber I through the open base of the burner.

The operation is as follows: The device being located, say, in a furnace to occupy the position of the grate therein, and the pipe e being connected with the supply of liquid hydrocarbon, the pipe r may, as one way of starting the burner, be temporarily connected with some extraneous superheated-steam supply (not shown) until the start has been made, after which the connection of the pipe r may be made with a cold-water supply (not shown). The foregoing mention of a temporary connection is merely suggestive and sets forth an operative, if not the most practicable plan for providing for starting the operation of my improved burner. It may be stated, however, that other and more desirable means may be especially devised for the purpose, and that I have invented a particular attachment therefor, which it is my intention to patent separately. On then turning the valve-stem E^4 to open the valve E^3, the superheated steam passes from chamber A through the passages r, r^4 and r^5 into the chamber A′ and thence through the passages r^6, r^7 and r^8 into the chamber k, from which it discharges through the spiral ducts k' into the hood in tortuous streams converging toward a common center over the valve-openings i^3. The valve D is also opened by turning the rod E′ in the proper direction, to admit liquid hydrocarbon, which is constantly supplied to the channels l^7 from the chamber e' by way of the circumferential channel l^5, ducts l^6, to the apertures i^3, from which it is forced into the center of the spiral jets of superheated steam. The means for regulating the admission of steam to the superheater and oil to the burner-head, affords, therefore, a species of compound valve-mechanism. Thus the liquid hydrocarbon is vaporized and carried by the currents through the spout d into the mixing-chamber H, wherein the mixture descends to the outlets c, and passes through them into the combustion-chamber I, wherein it is ignited, and to which air is admitted through the diaphragms K and K′ and also, preferably, through the space n. The force of discharge of the mixed gases from the outlets c carries them horizontally to and impinges them against the groove b, and imparts to them therein a rolling or curling action which tends to retard their escape and thus maintain them the longer under subjection to the heat besides colliding them to produce their more thorough mixture. By these means the molecules of the gases are collided and the gases subjected to the flame long enough to raise their temperature to a degree which frees the hydrogen from the oxygen and consumes the former gas, thereby producing a very intense heat. As will be thus understood, when, after thus starting the operation of the burner, it is caused by its heat to generate steam from the water introduced into the chamber A, the valve E^3 serves to regulate the quantity of live steam admitted to the chamber A′ for superheating and, accordingly, the quantity of the superheated steam introduced into the receiving-chamber afforded by the hood G.

When the carbureting material employed is originally in gaseous form, any suitable form of injector may be substituted for that herein shown and described.

The introduction into the receiving-chamber G of the superheated steam in spiral jets converging toward an apical point, into which gas or liquid hydrocarbon is injected, effects such thorough carbureting of the steam that

when, after intermingling in the mixing-chamber H, the mixture emerges through the openings *c* into the combustion-chamber, it is highly inflammable gas, and is rendered thoroughly combustible by the treatment to which it is subjected in the chamber I.

The particular construction and mode of operation of the valve E are not vitally material to the purposes of this invention, though the arrangement thereof in connection with the means for operating the oil-controlling valve is novel and of especial utility in a device like the present, as otherwise the valve E might have to be operated from a point below the burner or to one side of the needle-valve, which would involve considerable complication in the structure of the burner, and materially increase the expense of construction. In various other respects, also, the construction may be changed without departing from the spirit of my invention, provided it involves an arrangement of steam generating and superheating chambers about an air-space containing a burner-head surmounted by the gas and superheated steam receiving and mixing chambers and the combustion-chamber, whereby water is converted into steam at the minimum expense and the steam is superheated and carbureted sufficiently to maintain a primary combustion, and the burning gas-mixture is subjected to such collision of its molecules and retention under the influence of the heat as ultimately to free the hydrogen from the oxygen while preventing the escape of the former, (notwithstanding its lightness due to the distension of its molecules and consequent tendency to escape before ignition, but which is prevented by the colliding action referred to) before it has undergone thorough ignition and final combustion under uniform and extended radiation without odor, smoke or refuse; the product of the gases generated thus closely resembling natural gas in its properties. It may also be suggested that air, subjected to the heat of the burner instead of steam, might be used without departure from my invention and is intended to be included therein. Moreover the term "annular" employed herein and in the appended claims is not intended to limit the parts it qualifies to being circular, as they may be of any other form whereby they afford an intermediate space.

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

1. A hydrocarbon burner having an annular steam-generating chamber and an annular steam-superheating chamber surmounting said generating-chamber and separated therefrom by an intervening space and communicating therewith, a combustion-chamber formed in the annular space above an air-chamber therein, a burner-head supported in the air-chamber and communicating with the supplies of carbureting material and superheated steam, and a mixing-chamber above the burner-head and opening into the combustion-chamber, substantially as described.

2. In a hydrocarbon burner which separates its heating-gas from carbureting fluid and superheated steam, an annular steam-generating chamber and an annular steam-superheating chamber communicating therewith, a combustion-chamber formed in the annular space surrounded by said steam-chambers and provided with a circumferential inner groove near its base, an air-chamber below the combustion-chamber and formed by the annular space surrounded by said steam-generating chamber, a burner-head supported in the air-chamber and communicating with the supplies of carbureting fluid and superheated steam, and a mixing chamber above the burner-head centrally within the combustion-chamber and opening laterally into the same, substantially as and for the purpose set forth.

3. In a hydrocarbon burner, intercommunicating annular steam-generating and superheating chambers surrounding a combustion-chamber and a lower air-chamber separated from the combustion-chamber by a perforated diaphragm, an injector supported in the air-chamber and communicating with the supply of carbureting fluid, a receiving-chamber above the injector and into which it discharges, an annular upwardly tapering inlet to the base of said receiving-chamber from the superheated steam supply and a mixing-chamber enveloping the receiving-chamber in the combustion-chamber and opening near its base laterally into said combustion-chamber, substantially as described.

4. In a hydrocarbon burner, intercommunicating steam-generating and superheating chambers surrounding a combustion-chamber and a lower air-chamber separated from the combustion-chamber by a perforated diaphragm, a circumferential inner groove about the combustion-chamber near its base, an injector supported in the air-chamber and communicating with the supply of carbureting-fluid, a receiving-chamber above the injector and into which it discharges, a superheated-steam accumulating chamber about the base of said receiving-chamber and opening into the latter through an annular series of upwardly and inwardly inclined spiral passages, and a mixing-chamber covering the receiving-chamber in the combustion-chamber and discharging into the latter near the plane of said groove, substantially as described.

5. A hydrocarbon burner comprising, in combination the annular chamber A containing the partition *p*, adjacent water-inlet *r* and inserted block *o* carrying the burner-head B on a hollow neck *m*, annular superheated-steam chamber A′ containing a partition *p′* and surmounting the chamber A and communicating therewith through said block at one side of the partition *p′*, a valve for regulating the passage of steam from chamber A into chamber A′, said hollow neck communicating with the superheated-steam chamber from

the opposite side of its partition, a burner-head B communicating with the supply of carbureting fluid and having an annular chamber *k* into which the said hollow neck discharges and a needle-valve device for regulating its discharge, a funnel-shaped receiving-chamber G extending at its spout *d* upward into the combustion-chamber and communicating with the chamber *k* through an annular series of spiral ducts *k'* converging toward a common center in the receiving-chamber above the discharge from the burner-head, a mixing-chamber H covering said spout and provided with openings *c*, a combustion-chamber I surrounding the mixing-chamber and having the circumferential groove *b* in its wall, and a perforated diaphragm K at the base of the combustion-chamber, the whole being constructed and arranged to operate substantially as described.

6. In a hydrocarbon burner, the combination with the burner-head having the superheated-steam passage leading from the steam-superheating chamber and communicating with the combustion-chamber, and the steam-generator communicating with the steam-superheater, of a needle-valve device having a vertically reciprocable stem, a bell-crank E connected at one arm with the stem, an operating-rod E' having a screw-connection with the other arm of the bell-crank and confined against longitudinal movement in a sleeve E^2, and a reciprocable valve E^3 in the passage from the steam-generator to the superheater, screwed upon a rotatably supported hollow valve-stem E^4 surrounding the said sleeve and confined against longitudinal movement, substantially as described.

7. In a hydrocarbon burner, the combination of the intercommunicating steam-generating chamber A and steam-superheating chamber A', affording the interposed air-space *n*, a combustion-chamber I having a circumferential groove *b* in its wall and a lower air-chamber covered by a perforated diaphragm, a mixing-chamber discharging into the combustion-chamber near the base thereof, and means for supplying gas to said mixing-chamber, substantially as described.

HARRY WILSON PARKER.

In presence of—
M. J. FROST,
W. N. WILLIAMS.