(No Model.)

4 Sheets—Sheet 1.

W. B. WRIGHT.

HYDROCARBON FURNACE.

No. 370,841. Patented Oct. 4, 1887.

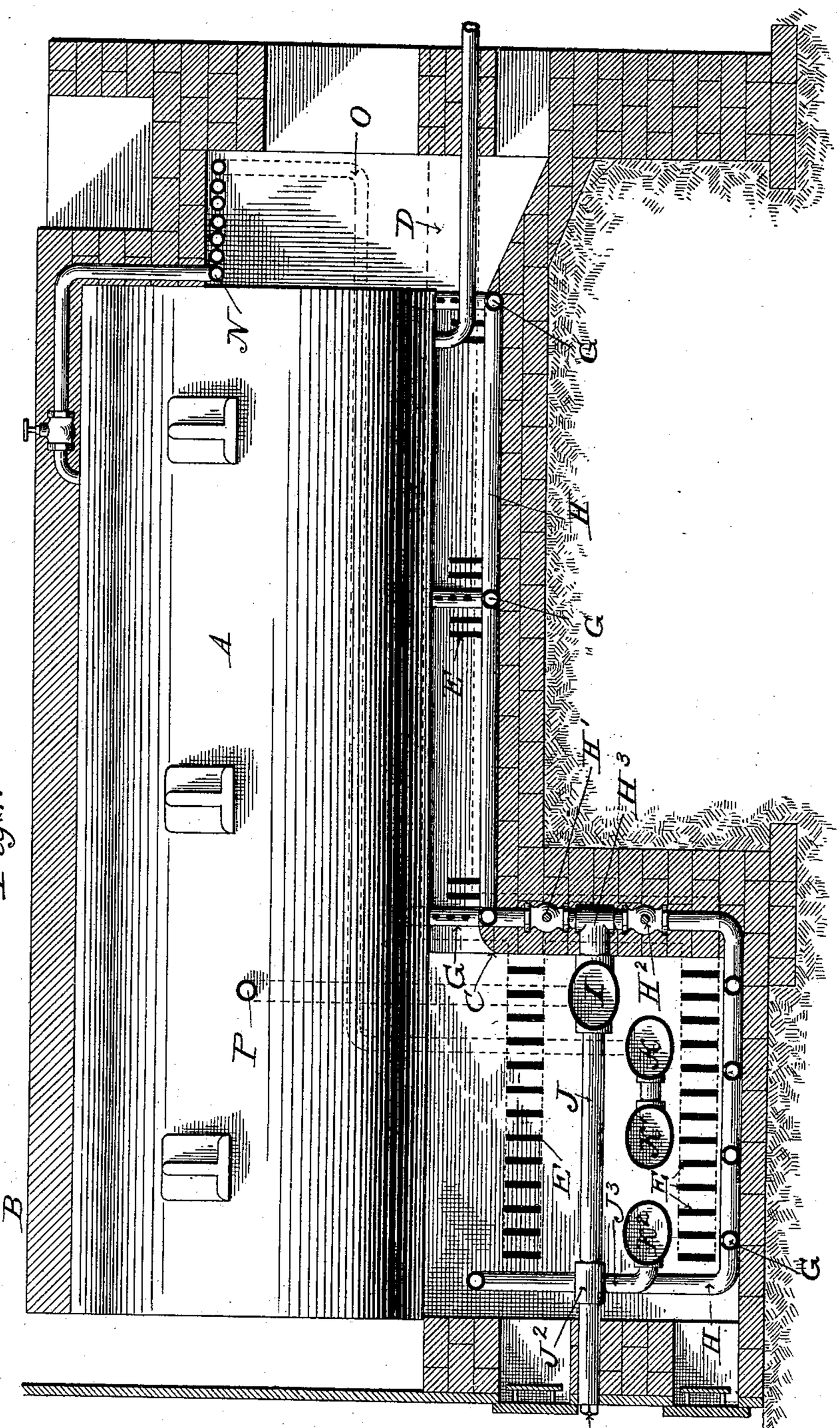

Fig. 1.

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(No Model.) 4 Sheets—Sheet 2.

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HYDROCARBON FURNACE.

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Fig. 2.

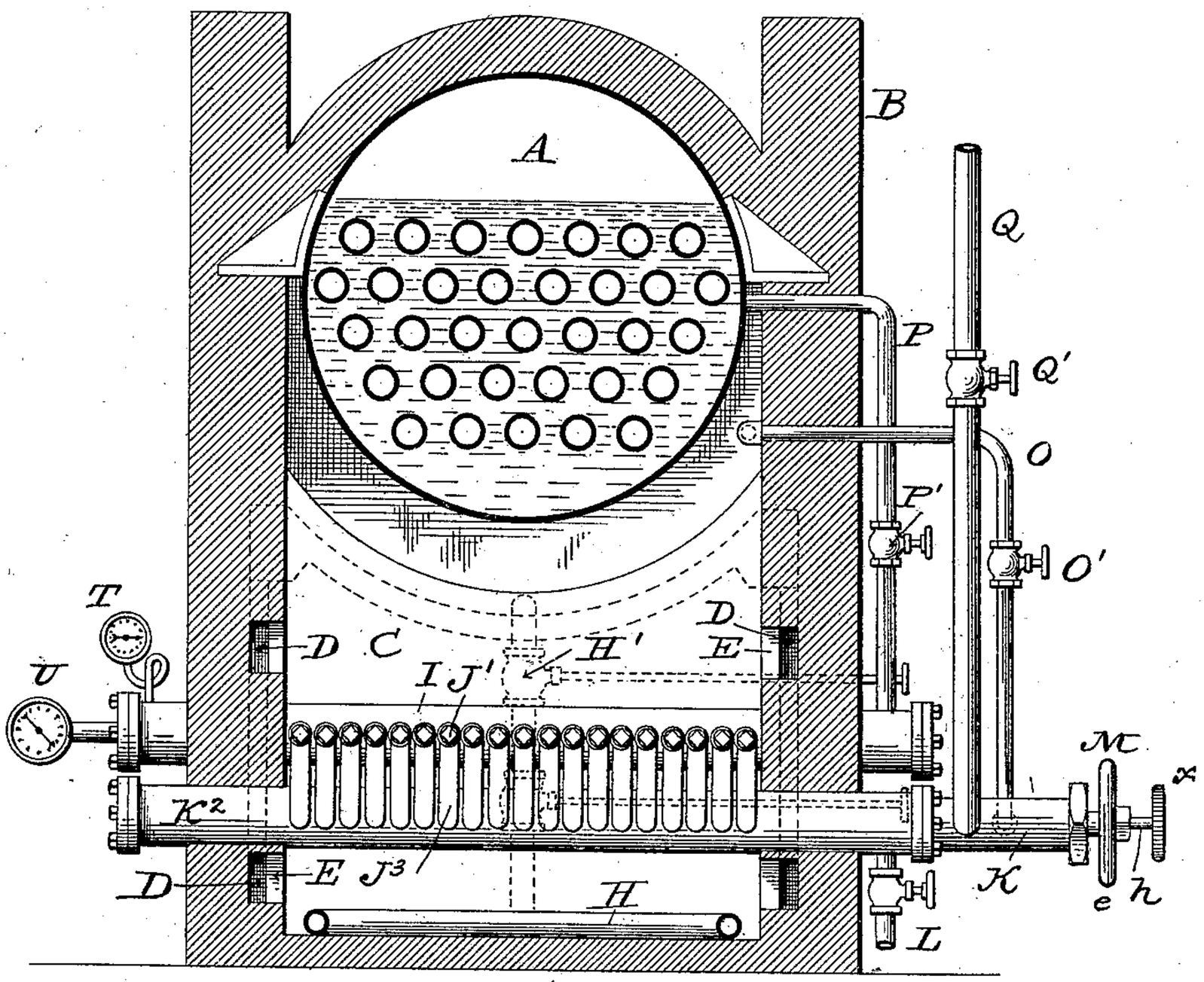
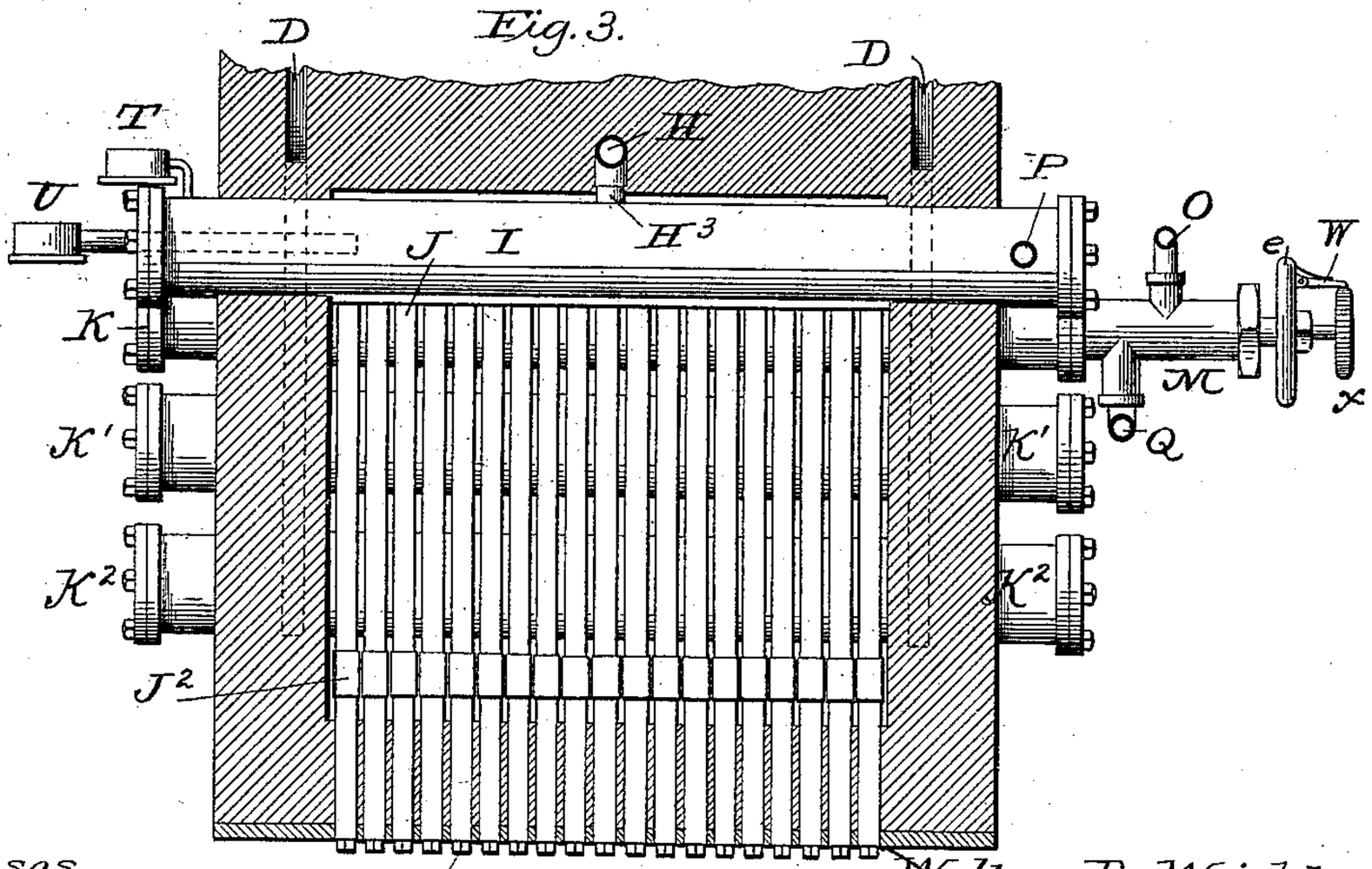


Fig. 3.



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4 Sheets—Sheet 3.

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HYDROCARBON FURNACE.

No. 370,841. Patented Oct. 4, 1887.

Fig. 4.

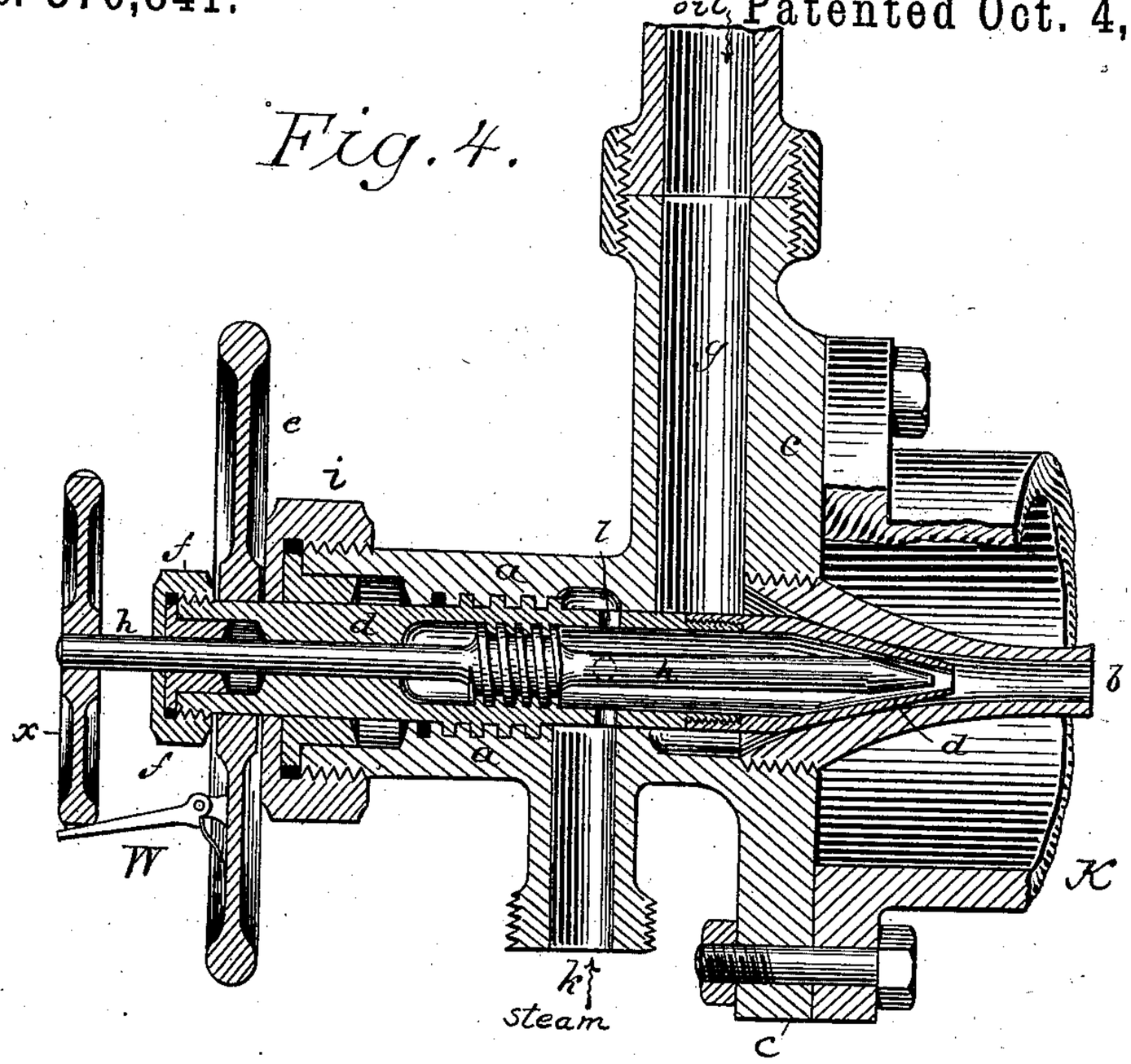
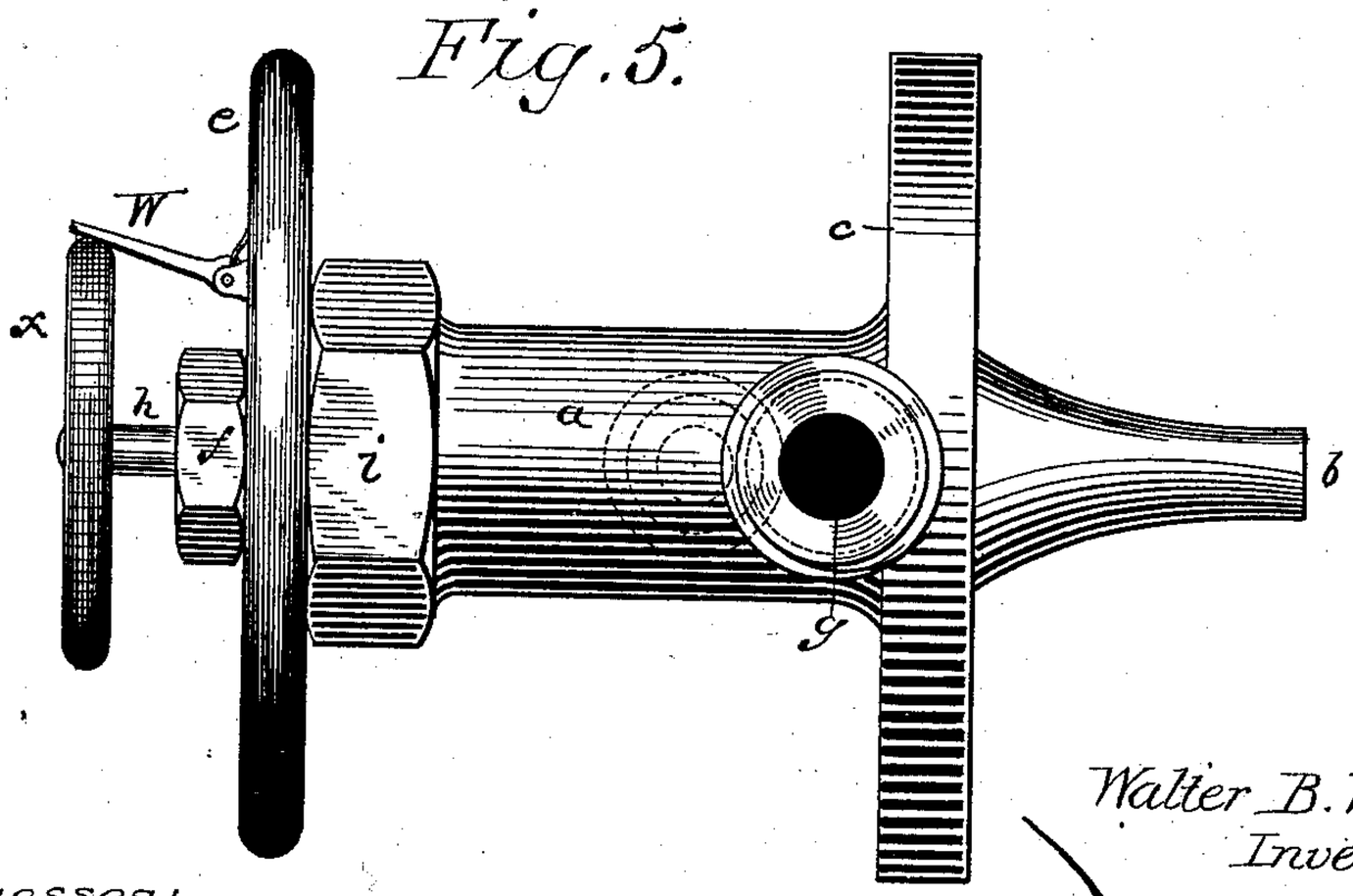


Fig. 5.



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4 Sheets—Sheet 4.

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HYDROCARBON FURNACE.

No. 370,841. Patented Oct. 4, 1887.

Fig. 6.

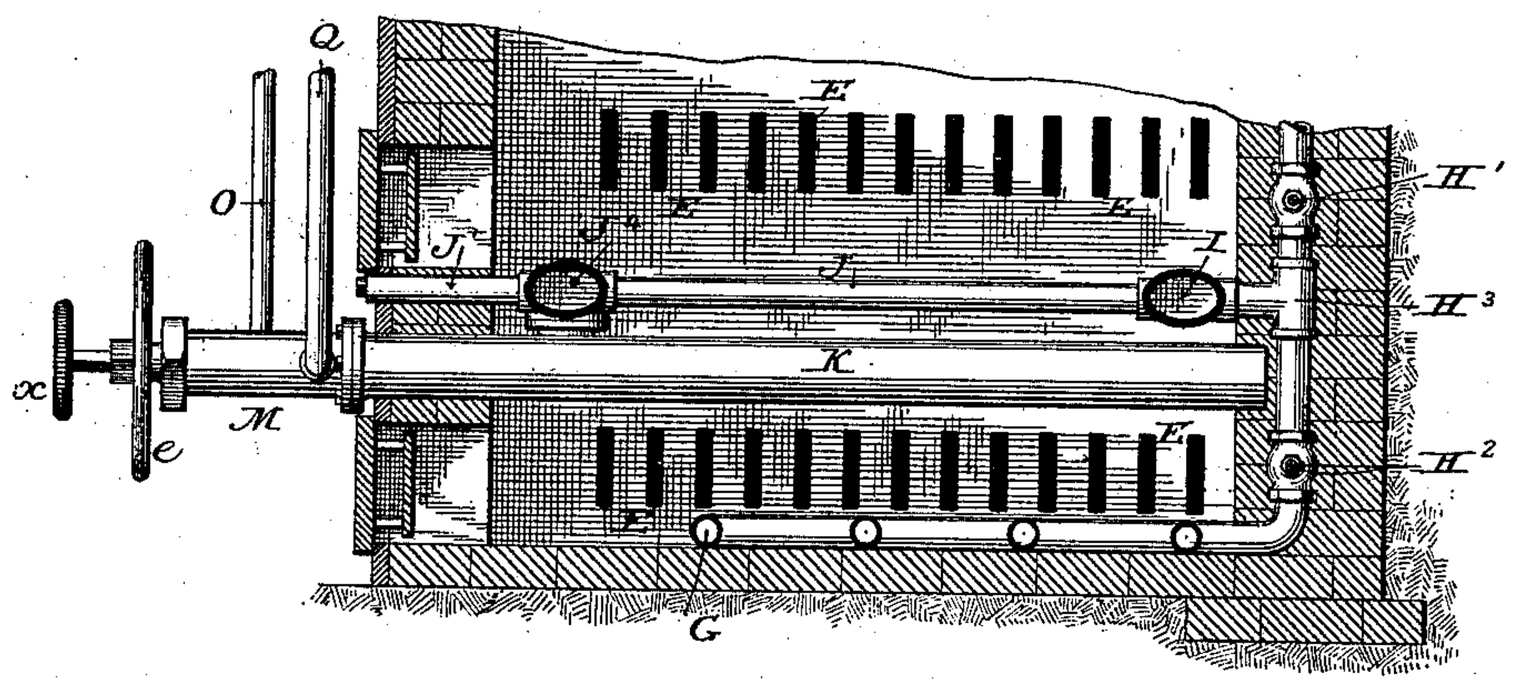
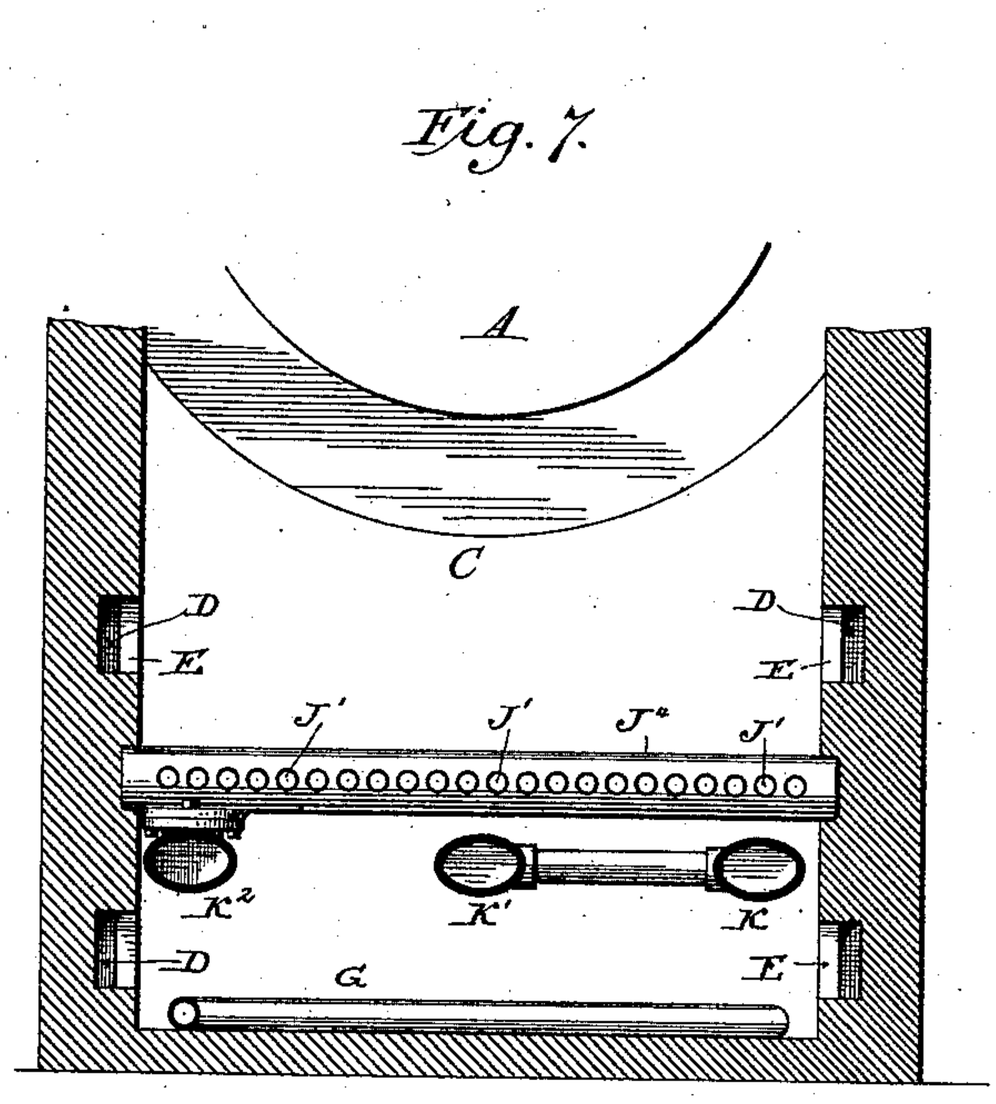


Fig. 7.



Witnesses:
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UNITED STATES PATENT OFFICE.

WALTER BLAKE WRIGHT, OF CHICAGO, ILLINOIS, ASSIGNOR TO WILLIAMS & WRIGHT, OF TROY, NEW YORK.

HYDROCARBON-FURNACE.

SPECIFICATION forming part of Letters Patent No. 370,841, dated October 4, 1887.

Application filed July 10, 1886. Serial No. 207,706. (No model.)

To all whom it may concern:

Be it known that I, WALTER BLAKE WRIGHT, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Hydrocarbon-Furnaces, of which the following is a specification.

My invention relates to furnaces adapted for using hydrocarbon fuel, and has reference to a novel arrangement of the furnace-setting, in the construction and arrangement of the burners and the generators, in the construction of the gas-chamber and the grate, and in various other features and details of construction, hereinafter set forth.

In the drawings, Figure 1 is a longitudinal vertical section through the furnace of a steam-boiler, showing my improved apparatus applied thereto; Fig. 2, a vertical transverse sectional view; Fig. 3, a horizontal section; Figs. 4 and 5, views illustrating the construction of the injector, and Figs. 6 and 7 views illustrating a slight modification in the arrangement of the retorts.

A indicates an ordinary return-flue tubular boiler, and B the brick-work or setting thereof, which varies from the usual plan in particulars which I will explain. That portion of the setting or masonry in rear of the bridge-wall C, instead of being flat, as usual, is made concentric with the boiler A, as shown in Figs. 1 and 2, so as to bring the burning gases as close to the boiler as possible, thereby utilizing all of the heat. I have found by practical tests that much heat has been lost under prior constructions, and that smaller passages are needed for the gas used in this and similar furnaces than where coal and like fuel is used.

The second point of novelty in the setting consists in providing air ducts or passages D, which extend from the rear of the furnace to opposite sides of and open into the fire-box, as shown by the dotted lines in Figs. 1 and 2.

It will also be noticed that these passages D are provided with openings E underneath the boiler A and adjacent to the burners.

It will be seen that the passages D extend for a long distance in proximity to the passage or space occupied by the flames, and, being separated therefrom by a thin partition or shell of fire-brick, the air is highly-heated, and by the openings E and the openings in the fire-pot is delivered in a highly-heated condition into the different parts of the furnace. Burners G are placed beneath the boiler at suitable points, and also in the fire-box. These burners consist of iron piping, perforated, and provided with nipples, if desired, those beneath the boiler and in rear of the bridge-wall being curved to conform to the shape of the boiler and embedded slightly in the brick-work or masonry to retain them properly in position. The pipe H, connecting the series of burners, extends vertically within the bridge-wall, as shown in Fig. 1, and is provided with valves or cocks H′ and H², which are operated by means of wheels secured to stems or rods connected with the valves and projecting out through the side of the furnace, as shown in Fig. 2.

Between the valves H′ and H² is a small branch pipe, H³, which communicates at one end with the pipe H and at the other end with a gas-chamber, I, as shown in Figs. 1 and 3. The gas-chamber is preferably, though not necessarily, elliptical in cross-section, extends across the rear end of the fire-box, projects out through both sides of the same, and is provided with removable caps or end plates. Communicating with and extending from the forward side of gas-chamber I is a series of pipes, J, which are carried out through the front of the furnace, and provided at their outer ends with removable plugs J′, to facilitate the removal of deposits, &c.

Grates composed of tubes adapted to receive water have long been used, and of course I make no broad claim thereto.

Just inside the front wall these pipes are provided with a T-coupling, J², from the lower branch of which extends a short pipe, J³, which connects them with the front one of the generating-retorts, K², the latter being in turn connected with the remaining retorts, K′ and K.

Below the valve H² the pipe H extends along the bottom of the fire-box, and is perforated to form burners G, the pipe being also in some cases extended upward in the front part of the fire-box, so as to burn the gas in the upper part thereof, as clearly indicated in Fig. 1.

The retorts K K′ K², like the gas-chamber I, are advisably elliptical in cross-section and project through or beyond the side walls of the

furnace, and one of them, preferably K^2, is provided with a pipe, L, which is tapped in its lower side and communicates with a sewer, for a purpose presently explained. These retorts are connected alternately at opposite ends by short pipes, and at one end of the retort K (the end farthest from the pipe connecting it with the retort K′) is an injector-valve, M, of the peculiar construction shown in Figs. 4 and 5, and hereinafter described in detail.

N indicates a superheater at the rear end of the boiler, which, by means of a pipe, O, communicates with and delivers superheated steam to the injector M, the pipe being provided with a regulating-valve, O′.

Opening into the boiler below the water-line is a pipe, P, which communicates at its lower end with the gas-chamber I, as shown in Fig. 2, the pipe being provided with a valve, P′. The hydrocarbon is fed to the injector through a pipe, Q, connected with a suitable supply, the quantity supplied to the injector being controlled by a valve, Q′.

Referring, now, to Figs. 4 and 5, the details of construction of the injector will be fully explained, though no claim is made in this application to such construction, which is described and illustrated herein merely to better enable others to practice the invention claimed.

A shell or cylinder, *a*, has formed upon its end a broad circular flange, *c*, by which the injector is bolted to the end of the retort K, the flange *c* in turn receiving a conical nipple, *b*, axially in line with the cylinder *a*, though of course the flange may be omitted and the fore end of the cylinder threaded to screw into the retort. The cylinder *a* is threaded internally to receive a hollow valve-stem, *d*, which is threaded externally through a portion of its length. This stem *d* projects out through the end of the cylinder, and the latter is provided with a stuffing box or gland, *i*, which, when removed, permits the removal of the hollow stem. At its inner end the stem *d* is made conical and projects into the nozzle *b*, as shown in Fig. 4, being turned or ground to accurately fit and close the same.

In advance of the screw-thread on the stem *d* are four openings, *l*, (more or less,) in the body of the stem, which open into or communicate with a steam supply passage, *k*, and conduct the steam supplied by pipe O to the interior of the hollow stem *d*. Outside of the cylinder *a* the tubular stem *d* is provided with a hand-wheel, *e*, by which the stem may be rotated to screw it into or out of the nipple *b*, and thereby regulate the exact amount of hydrocarbon delivered through the injector to be commingled with the steam.

The hydrocarbon is fed through pipe Q to the injector, where, by a passage, *g*, it is delivered all around the front end of the tubular stem just at the base of the nozzle *b*. The opening near the rear end of the hollow stem *d* is reduced somewhat to receive a second valve-stem, *h*, projecting out through the rear end of stem *d*, where it is provided with a hand-wheel, *x*, the end of the hollow stem being provided with a stuffing-box, *f*, to insure a tight joint and prevent the escape of steam.

Within the hollow stem *d* the valve-stem *h* is provided with a hub or boss, which is threaded externally to engage with a thread formed upon the interior of the hollow stem *d*, so that by turning the valve-stem *h* it may be moved longitudinally through the hollow stem. The forward end of the valve-stem *h* is made conical or tapering and projects into the tapering nose of the hollow stem *d*, so that by moving said rod *h* backward or forward it will be caused to increase or decrease the size of the steam-jet which issues from the stem *d*.

From this construction it will be seen that the amount of steam and the amount of hydrocarbon delivered into the injector may be varied with accuracy by the rotation of the stems *d* and *h*, respectively.

In some cases, in turning the valve-stem *h* to vary the amount of steam admitted to the interior of the hollow stem *d*, the latter might by friction or from other causes be accidentally turned, and to prevent this and preserve the relative adjustments of the stems *d* and *h*, I provide the wheel with a spring-sustained pawl or dog, *w*, which engages with the periphery of the hand-wheel *x*, and thus prevents independent rotation of the wheels *x* and *e*, except when it is specially desired to have them so moved. By this construction I am enabled to vary the size of the oil-opening without changing the steam-opening, as both the stems *d* and *h* will move together. By controlling the steam at the point of delivery I am enabled to regulate or change the quantity without any change in pressure.

The gas-chamber I is provided with a pressure-gage, T, and with a pyrometer, U, as shown in Fig. 2. The horizontal pipes J form a grate upon which fire may be built when first starting the apparatus, and this is a very important feature of construction.

The operation of the apparatus is as follows: The valves H′ and H^2 in the pipe H are closed and the valve P′ in pipe P opened, thus allowing water to flow from the boiler A into the gas-chamber I, into the pipes J, and into the retorts K K′ K^2. A fire is then built in the ordinary way upon the pipes J, which act as a grate, and steam generated in the boiler, the pipes J and chambers I, K, K′, and K^2 being protected from the effects of fire by the water which is within them. When steam of sufficient pressure has been generated, the valve P′ is closed and the valve in pipe L opened, thereby allowing all the water in the pipes J, the chamber I, and the retorts to run out, after which the valve is closed. The steam-valve O′ and the oil-valve Q′ are now opened and the steam and oil fed to the injector M through the pipes O and Q. The oil and steam sprayed by the injector M into the end of the hot retort K produce a gas, the hydrogen of the steam being liberated and enriched by the oil, the gas then passing

through the pipes J^3 and J to the gas-chamber I, and on through the pipe H to the burners G. The air passing through the ducts or passages D is highly heated and delivered into the fire-pot and into the space or chamber in rear of the bridge-wall through the openings E, near the burners G, thereby aiding materially the combustion. By allowing the retorts to project out through the side walls of the furnace at their ends, and by applying the removable caps thereto, I am enabled to keep them clean at all times.

In the application of my apparatus to a boiler in a battery of course there will not be room enough, and in some cases no room at all, to permit the retorts to project out through the side walls of the furnace-setting, and to overcome this objection I propose to adopt the construction shown in Figs. 6 and 7.

Instead of arranging the retorts K, K′, and K^2 transversely across the fire-chamber and allowing their ends to project out through the side walls, as in Figs. 2 and 3, I arrange the retorts longitudinally of the fire box or chamber, as shown in Figs. 6 and 7, the rear ends being supported in the bridge-wall, while the front ends, which are provided with removable caps, project out through the front wall of the furnace. This change in the position of the retorts necessitates a change in the connections between the retorts and the grate-surface. In lieu of the bent pipes J^3 and the T-couplings J^2, I use a retort, J^4, which, as shown in Figs. 6 and 7, extends transversely across the fire-chamber above the retorts K K′ K^2 near the front wall of the furnace, this retort J^4 having its ends closed and being supported at each end in the masonry. This chamber or retort is connected at one end to one of the retorts, K^2, and has screwed into its front face a series of pipes, J′, and into its rear face a series of pipes, J, to form a grate-surface, as in Figs. 1, 2, and 3, the pipes J being connected to the chamber I.

Having thus described my invention, what I claim is—

1. In a hydrocarbon-furnace substantially such as described, the combination of a boiler and burners, a pipe, H, for delivering the vapor to be burned, located partly within the bridge-wall, a gas-chamber, I, located within the fire-pot and connected with the pipe H, and a series of pipes, J, also connected to the gas-chamber I and extending horizontally out through the front of the furnace.

2. In a hydrocarbon-furnace, the combination, with a boiler, of a pipe, H, provided with burners G, a gas-chamber, I, extending transversely across the fire-pot and connected to the pipe H by means of a pipe, H^3, a series of pipes, J, connected to the opposite ends of the gas-chamber I and extending into the front wall of the furnace, a series of generators, K K′ K^2, below the pipes J and connected to a suitable steam and oil supply, and a series of pipes, J^3, connecting the pipes J with the retort K^2.

3. In combination with a boiler and a fire-pot, a gas-chamber, I, a pipe, H, communicating with said chamber, burners supplied by said pipe, and a series of pipes, J, connected with said chamber at one end and embedded at their other ends in the front wall of the furnace, the chamber and pipes being located within the fire-pot and adapted to have a fire built upon them.

4. In combination with a boiler and a fire-pot, a gas-chamber, I, a pipe, H, communicating with said chamber, burners supplied by said pipe, and a series of pipes, J, connected with said chamber at one end and embedded at their other ends in the front wall of the furnace, the chamber and pipes being located within the fire-pot and adapted to have a fire built upon them, and a pipe, P, connected at one end with the water-space of the boiler and at the other end with the chamber I, as and for the purpose set forth.

5. In a hydrocarbon-furnace, the combination of a boiler, a fire-pot, and gas or vapor burners, a grate composed of a series of pipes, a water-pipe connected with the latter, and a gas-pipe, also connected with the grate-pipes and with the burners, the gas and the water pipes each being provided with a valve, substantially as shown and described.

6. In a hydrocarbon-furnace, the combination of a boiler, a fire-pot, a series of retorts, K K′ K^2, located therein and projecting at one or both ends through the walls thereof, and provided with removable caps, a pipe, H, provided with burners, a chamber, I, connected with pipe H, and a series of pipes, J, adapted to form a grate-surface and connected with the retorts and with the generator, substantially as shown and described.

7. In a hydrocarbon-furnace, the combination, with a boiler, of a grate composed of tubular bars J, connected with a gas-generating retort and adapted to serve the twofold purpose of supporting a fire for the generation of steam in the boiler, and afterward serving as distributing-pipes for the gas generated.

8. In a hydrocarbon-furnace, the combination, with a boiler, of a grate composed of pipes J, a series of gas-generators, burners supplied therefrom, and valved water, oil, steam, and discharge pipes P Q O L, arranged and operating substantially as shown and described.

9. In a hydrocarbon-furnace, the combination, with a boiler, A, a fire-pot, and gas or vapor burners, of a grate composed of a series of pipes, J, adapted to have a fire built upon them to generate steam within the boiler, a series of gas-generating retorts connected with the pipes J and communicating with the burners, a valved pipe, as P, adapted to supply water to the pipes J, a valved outlet-pipe, L, also connected with the pipes J, and valved steam and oil supply pipes O and Q, connected with the retorts, all substantially as shown and described.

10. In a hydrocarbon-furnace, in combina-

tion with boiler A and a fire pot or chamber, a series of pipes, J, therein, a chamber, I, connecting said pipes at one end, a series of retorts, K K′ K², below and connecting with the pipes J, valved steam and oil pipes O Q, connected with one of the retorts, a valved water-pipe, P, connected with the chamber I, and a valved gas distributing pipe provided with burners G and connected with the gas-chamber, all substantially as shown.

11. In a hydrocarbon-furnace, the combination, with a boiler and fire-pot, of a grate consisting of a series of pipes, a water-pipe connected with the latter, a gas-pipe, also communicating with the grate-pipes and with burners for consuming the gas, and valves applied to the gas-pipe at each side of the point of communication with the grate-pipes, whereby water may be prevented from entering the same and gas may be admitted to or excluded from the gas-pipe at either or both sides of said point at will.

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