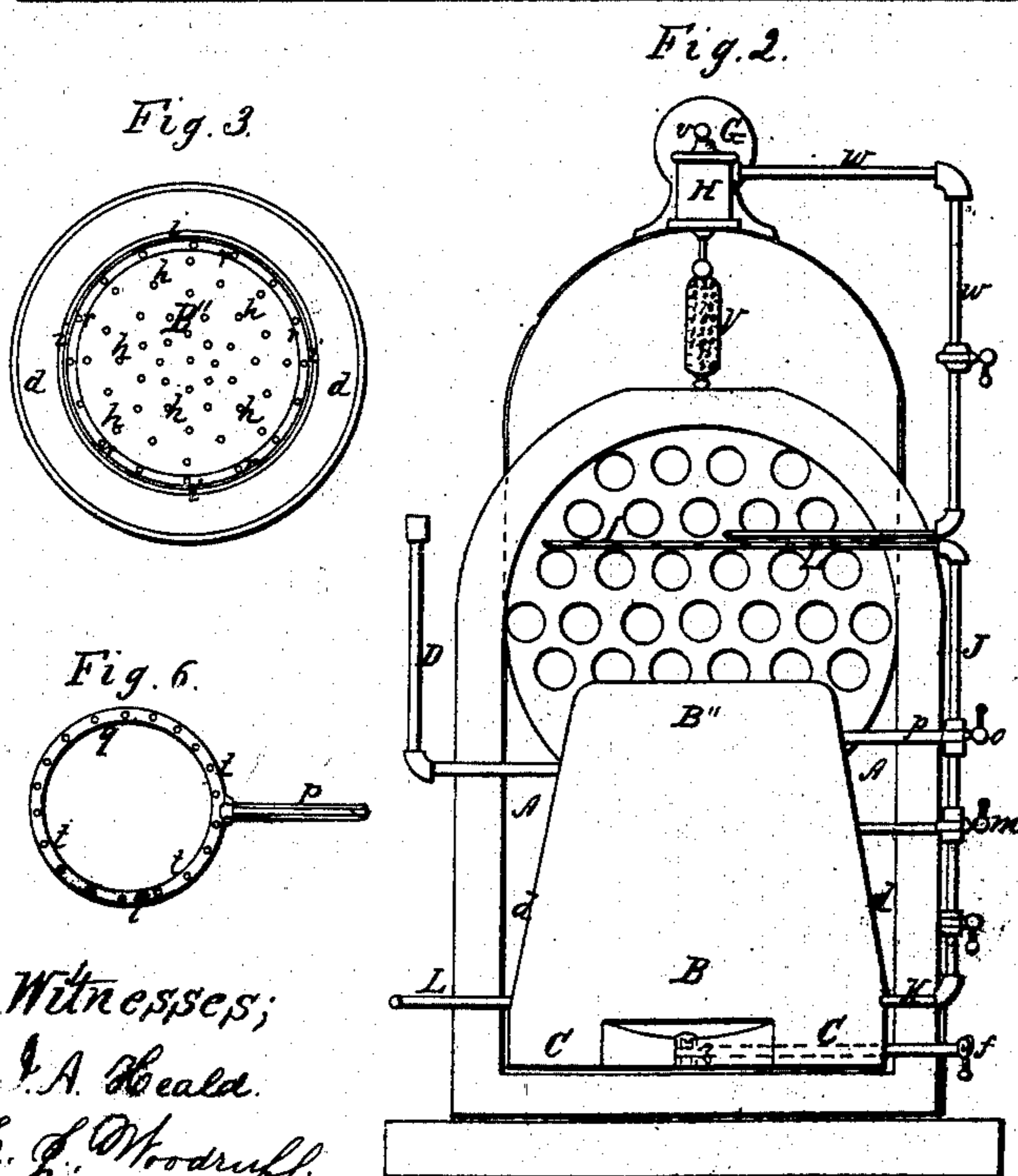
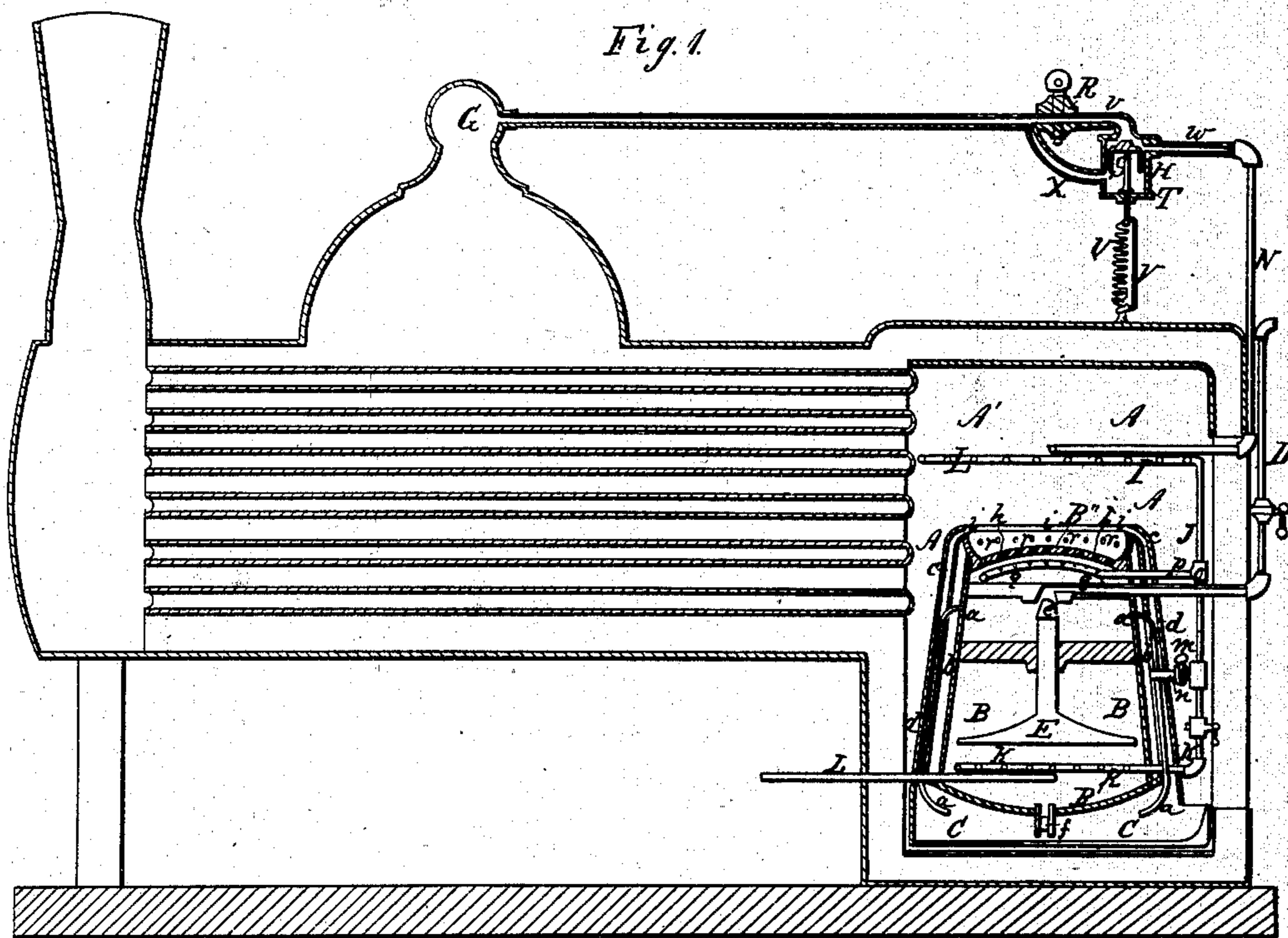


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D. D. VAN NORMAN, L. B. BROWN & E. R. MORRISON,
BURNING HYDROCARBON OILS.



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UNITED STATES PATENT OFFICE.

DELEVAN D. VAN NORMAN, LESTER B. BROWN, AND ENOCH R. MORRISON,
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IMPROVEMENT IN BURNING HYDROCARBON OILS.

Specification forming part of Letters Patent No. 49,179, dated August 1, 1865.

To all whom it may concern:

Be it known that we, DELEVAN D. VAN NORMAN, LESTER B. BROWN, and ENOCH R. MORRISON, of Petroleum Centre, in the county of Venango, in the State of Pennsylvania, have invented certain new and useful apparatus for the purpose of burning superheated steam, in combination with a small portion of gas evolved from petroleum and other hydrocarbon liquids, for fuel, the supply of both steam and liquid being made self-adjusting, and the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 represents a longitudinal section through a tubular boiler with the superheating steam and gas-generating apparatus cut in section, and the pipes and stop-cocks, with the self-acting cut-off valves to regulate the supply of both the steam and the petroleum or other hydrocarbon liquids. Fig. 2 shows a front-end view of a steam-boiler with the fire-box open, and the steam-heating, gas-generating, and burning apparatus, with the supply-pipes all placed in position for use in the fire-box of the boiler. Fig. 3 shows the top of the gas-generating retort with the steam and gas jets. Fig. 4 represents a section across the lower end of the retort with the coil of steam-pipe for heating the liquid to generate the gas. Fig. 5 shows a detached view of the coil, which is placed in the fire-box for superheating the steam. Fig. 6 shows a detached view of a steam-pipe with jets, which may be placed directly under the gas jets in the retort.

The object of our discovery and invention is to lessen the bulk and the expense of fuel for generating steam in steam-boilers, and to make use of such substances for fuel as have heretofore been regarded as of little or no value.

Our invention consists in the use of superheated steam as producing the most intense flame, when burned in connection with carbonated hydrogen from petroleum or other hydrocarbon liquids, by means of apparatus in substance as hereinafter described.

To enable others skilled in the art of engineering to fully understand our principle and to make and use our apparatus for burning superheated steam with a small portion of gas,

we will describe it in detail, referring to the drawings, and to the letters of reference marked thereon.

The same letters indicate the like parts in all of the several figures.

In the furnace or fire-box A A of any ordinarily-constructed steam boiler is placed a retort, B B, the sides and top of which may be made of cast-iron, of any desired dimensions and form. The bottom of the retort B' should be made dishing or concave and of copper, the sides of the retort being surrounded by a steam-chamber, b b, cast with it, both being closed by the copper bottom B'.

On the outside of the steam-chamber, and surrounding it, is a smoke-flue, c c. The jacket or covering d d is connected at the bottom and supported upon a base, C C, which forms a pan to receive the residuum drawn from the retort, and used for the purpose of burning it and a small portion of petroleum or other hydrocarbon liquids in starting the fire, in order to generate gas and put the whole in operation. At or near the top of the retort B B are taken out two or more small pipes, a a, which pass down the smoke-flue c c, between the steam-chamber and the outside jacket, for the purpose of conveying a small portion of the gas underneath the bottom of the retort B' to assist the combustion of the ingredients in the pan C and to facilitate the making of gas in the retort.

The inside of the retort B B is kept supplied with petroleum or other hydrocarbon liquid by means of a pipe, D, which is connected with a tank or reservoir, which may be placed in any desired position for convenience and safety, there being a supply-cock and a check-valve in the pipe D, between the retort and the oil-tank, to prevent back-action by the pressure of the gas and the possibility of fire following the pipe to the tank.

In order to regulate with certainty the steady and maximum quantity of oil to be used in the retort, we place a self-acting float, E, on the top of which is a cone-valve, e, and seat, which is fitted so as to shut off the flow from the supply-pipe D when the float rises to a given point, thus preventing an undue and wasteful expenditure of oil, and guarding with certainty against overflow or choking up the retort, thus making a perfect self-regulator for

the supply of the crude material for generating the gas.

In the center of the copper bottom of the retort B' is an outlet or stop-cock, *f*, to draw off the residuum into the pan C C, where it may be consumed and the retort kept clean and free from any accumulation of extraneous matter. The smoke caused from the burning petroleum or residuum in the pan C passes up the flue *cc*, which surrounds the retort and steam-chamber, where it escapes at the angular opening *iii* and comes in direct contact with the flame of the gas and steam and is entirely consumed.

The top of the retort B'' is made convex, and is sunk below the outlets of the steam-chamber and smoke-jacket, the top surface being perforated with a series of very small outlets, *h h h*, for the gas to escape where the combustion takes place, being readily ignited by the heat and flame surrounding it as it is brought in contact by the inclined outlet of the smoke-flue.

The carbureted hydrogen gas emitted from a retort or jets inclosed in the furnace or fire-box of a steam-boiler will not get a sufficient supply of oxygen to burn with any degree of intensity, and to supply the deficiency we have discovered and made available superheated steam, which, in its application and use, forms the most important part of our invention.

From the cupola G, or any elevated point of the steam-boiler, may be inserted or secured a pipe, *g*, by which a portion of the steam is conducted into the top of the furnace A' A, where it is conveyed through an extended coil of iron or other suitable metallic pipe, I I, the coil being so placed over the retort B B that the jets of flame concentrate upon it to superheat the steam when it is conducted through the pipe J down to near the bottom of the retort, where a portion of the superheated steam is admitted to pass through the copper coil K K, which is submerged in the oil in the retort to aid in generating the gas. From thence the pipe L passes out through the boiler, and may be extended to convey heat to the oil tank or reservoir, where it may pass down through the oil by means of another coil of pipe to prepare it for use by making it more limpid, so that it will flow easily to the retort. From the oil-tank the pipe or escape steam may be admitted into the water-tank to warm the water.

The object of passing the steam through the oil-tank is to separate the water from the oil, which, in its crude state, is always found combined in greater or less quantities.

Now, in order to get an intense flame in the furnace A A, a portion of the superheated steam is let into the chamber *b b* which surrounds the retort B by opening the stop-cock *m* to the branch pipe *n*, when it will find outlets through a series of minute perforations, *r r r r*, around the top of the chamber, they being at such angles as to bring the small jets of superheated steam in immediate contact

with the jets of burning gas from the retort, thus supplying an agent which produces the most intense flame.

If found desirable to weaken or dilute the rich carbureted hydrogen and make it more expansive, a very small portion of steam may be let into the top of the retort B'' by the stop-cock *o* and branch pipe *p*, which connects with the circular pipe *q q*, in which are a series of very small openings, *t t t t*, to allow the steam to commingle with the gas as it escapes for combustion.

The quantity of steam from the boiler to be admitted into the coil of pipe I I to be superheated for the purposes above described is regulated by our improved self-acting steam-pressure governor-valve H, which may be placed in the induction-pipe *g* between the cupola G of the boiler and the coil of pipe I I in the furnace.

The steam-pressure governor-valve H, as seen in Fig. 1, is constructed by having a sliding piston, S, working in a vertical cylinder, T, in which the steam is admitted at the top through a throttle-valve or stop-cock, R, in the pipe *v* leading to the cylinder. The induction-pipe *v* and the eduction-pipe W are both made so as to be closed by the sliding inverted cup-piston valve S, which is connected with a spring-balance, U, and graduated scale V, so that the number of pounds pressure of steam in the pipe W which leads to the coil I I in the furnace may be regulated by the throttle R and accurately known.

To the induction-pipe *g* is connected a branch pipe, X, which communicates with the vertical cylinder T under the cup-piston S, so that when the steam in the boiler is at a greater pressure than is required to balance the force on the piston-valve S, as indicated by the spring-balance V, it will close up the valve S and shut off the steam from the apparatus in the furnace, which will immediately reduce the flame, and consequently the steam in the boiler will be diminished until the spring-balance operates to open the valve S, when the flame increases, and the supply of steam is kept up for all of the purposes required, thus making the steam its own supplier of fuel as well as its own fire-tender.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. Placing in the furnace or fire-box of a steam-boiler a retort for generating gas from petroleum or other hydrocarbon liquids, the retort being surrounded by a steam-chamber from which superheated steam may be used with a small portion of carbureted hydrogen gas for fuel.

2. Placing a copper or other metal coil of pipe in the bottom of the retort, through which superheated steam is admitted to hasten and evolve the gas from hydrocarbon liquids.

3. One or more pipes leading from near the top of the retort down under the bottom of

the same for the purpose of intensifying the heat in the retort, and thereby dispensing with fire in the pan after the steam in the boiler is at working pressure.

4. The smoke-jacket surrounding the retort and steam-chamber, in combination with the fire-pan, whereby the smoke of the burning liquid is brought in contact with gas and steam and is entirely consumed.

5. The float-valve placed in the retort for controlling the supply of petroleum or other liquids for generating gas in the manner herein set forth.

6. The manner of separating the water from the crude oil by passing a coil of steam-pipe through the tank, as described.

7. The perforated coil or circular pipe *q* in the top of the retort, for the purpose of letting a small portion of steam into the top of the

gas-generating retort to commingle with the gas as it escapes for ignition.

8. The arrangement of iron or other suitable metallic pipe for superheating steam in the furnace of a steam-boiler, as herein described, in combination with the gas-generating retort.

9. The construction and arrangement of the steam-pressure governor-valve, in combination with the spring-balance, as and for the purposes set forth.

In testimony whereof we have hereunto subscribed our names.

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