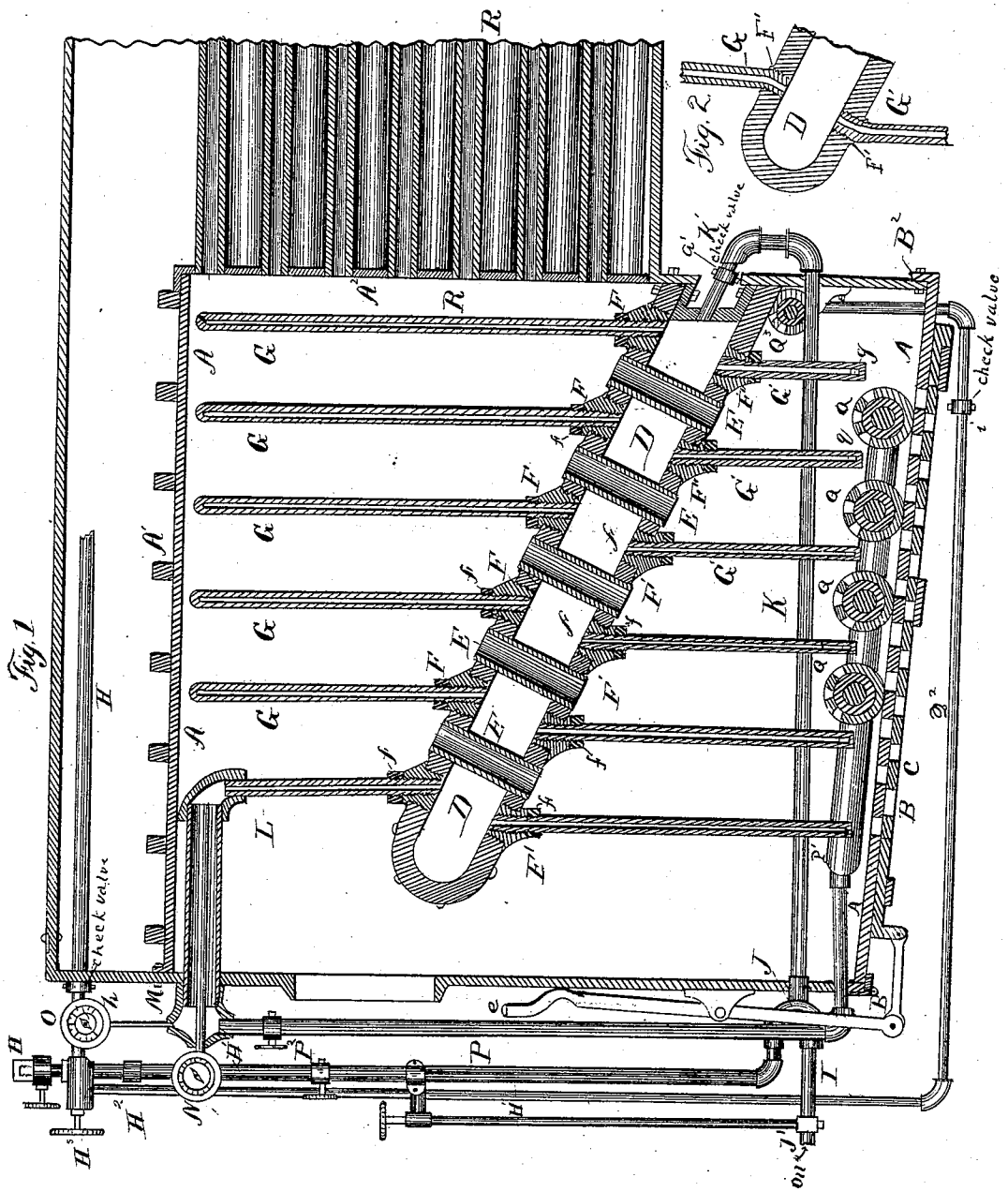
(No Model.)

A. I. AMBLER.

HYDROCARBON VAPOR FUEL GENERATOR AND BURNER.

No. 310,013. Patented Dec. 30, 1884.



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UNITED STATES PATENT OFFICE

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HYDROCARBON-VAPOR-FUEL GENERATOR AND BURNER.

SPECIFICATION forming part of Letters Patent No. 310,013, dated December 30, 1884.

Application filed February 16, 1884. (No model.)

To all whom it may concern:

Be it known that I, AUGUSTIN I. AMBLER, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Hydrocarbon-Vapor-Fuel Generators and Burners, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to a mechanism for combining steam with hydrocarbon oil for the production of a combustible vapor, and of burning the same for use in locomotive-boilers, and for other purposes, especially in the fire-boxes of boilers of the locomotive pattern, or what is known as the "plain" fire-box.

The object of my invention is to produce a practicable hydrocarbon-flame free from ash, smoke, and cinders for locomotive-boilers, to do away with the use of wood and coal in running and using the same, especially on passenger-locomotives, and to construct a vapor-generating and vapor-burning apparatus which may be applied to locomotive-boilers as at present constructed with very slight alterations or additions. To this end I make use of the devices hereinafter described and shown in the drawings, in which—

Figure 1 is a central longitudinal section of the fire-box of a locomotive-boiler with my apparatus in place, and showing also the boiler-front, the crown-sheet, and flue-sheet, and a section of the flues and other details, as will be hereinafter explained. Fig. 2 is a partial section which illustrates modifications hereinafter referred to.

A A, &c., indicate the fire-box of a locomotive-boiler. A′ is the crown-sheet, and A^2 the flue-sheet, from which the flues lead to the exhaust-chamber through the water-space in the boiler, in the usual manner.

The bottom of the fire-box B is hinged or bolted in place, and may be dropped down on the hinges B′ to permit the placing (putting in and taking out) of the diaphragm and burners in position, and when closed may be secured in position by bolts B^2. Inside the fire-box I place the diaphragm box or retort D, firmly secured in position, so that it will extend obliquely from the rear of the fire-box forward and upward toward the fire-door and crown-sheet, as illustrated. This diaphragm or retort is made steam-tight, and of such strength as to stand the heat and bear the pressure required. It may be made of cast-iron, wrought-iron, or steel, or of rolled plates bolted or riveted together.

The diaphragm box or retort D has tubular passages or pipes E E leading through it, for the passage of heat and flame from the burners. When made of steel or iron plate, the shell of this diaphragm or retort is bent or made on a former. The bushings or bosses F F on the upper side of the plate and bosses F′ F′ on the lower side are screwed into holes tapped into the plate above and below. If the diaphragm is cast, these projections may be merely bosses cast on the plate above and below, and may be in such number and so located as required. (See Fig. 2.) If rolled plates are used for the diaphragms, these bosses may be struck up in the plates while undergoing the operation of rolling. The pipes G G, G′ G′, and L are screwed into the bosses F F, so as to communicate with the interior of the diaphragm box or retort D. The pipes G G are of such length as to reach nearly to the crown-sheet and are closed at their upper ends. The pipes G′ G′ are of such length as to reach nearly to the bottom of the fire-box, and are closed at the lower ends by screw plugs or caps; or the pipes may enter the bosses or bushings F at an angle with the axial line of the bushings; or the bushings may be bored axially and the pipes in making may be bent, so that when screwed into the plate they will take a perpendicular position. (See Fig. 2.) Jam-nuts applied to the pipes above and below the bushings serve to hold them firmly in place and to pack the joints. Bushings or bosses F′ F′ on the lower side of the plate of the diaphragm serve to retain the lower pipes, G′, which communicate with the interior of the box D, and extend down toward the bottom of the box. These pipes are closed at the lower ends by plugs *g*, which may be removed for the purpose of cleaning or blowing out. The object of the pipes G and G′ is to present an enlarged heating-surface to the contents of the diaphragm box or retort D. A pipe, L, leads from the upper portion of the diaphragm

box or retort D to chamber M in the upper part of the fire-box. This chamber M projects inward from the front of the fire-box. A pressure-gage, O, is placed in connection with this chamber, and serves to indicate the pressure in chamber M, and therefore in box or retort D. A pyrometer, N, serves in similar manner to indicate the degree of heat in said receptacles. A pipe, P, leads from chamber M to near the bottom of the fire-box, where it turns and enters said box, and is there expanded, as at P′, and supplied with burners Q Q. These burners are in numbers as great as may be necessary, and have top and quartering passages, so as to distribute flame along the lower plate of the retort D and throughout the fire-chamber above and below. More than one tube P′ and more than one series of burners may be employed, as found desirable. The passage-way for the gas or vapor from the chamber M, and therefore from the diaphragm to the burners, is controlled by the valve P^2. The bottom of the fire-box directly beneath the burners Q has air-passages B B, which may be opened or closed by sliding the perforated plate C, as by lever *e* or in any other manner. A pipe, H, leads from the steam-space in the boiler, and has two branch pipes, H′ and H^2, leading down from the valve H^3, which controls the entrance to both pipes. A check-valve at *h* shuts off or prevents steam from flowing into the boiler through said pipe H. The pipe H′ leads to a three-way passage, J. A pipe, J′, enters another arm of this three-way passage and serves to bring an oil-supply to said three-way, being governed by valve in said pipe J′. Hydrocarbon oil is supplied to this pipe from any suitable reservoir under such pressure as to impel it forward into pipe K and retort D. The pipe H^2 leads down beneath the fire-box through pipe Q^2, connected by union *i* to a sprayer, Q^3, which is a pipe arranged crosswise of the fire-box, and has perforations similar to the burners, but so directed that a blast of steam forced through it will be directed across and along the bottom of diaphragm or retort D toward the front of the fire-box and around the diaphragm into the upper fire-chamber. The pipe H′ has a second source of steam-supply from a donkey or other boiler outside the engine by the application of a hose or coupling at the point covered by cap H^1. This is to enable the engineer to put the retort or apparatus in operation and raise steam in the boiler before leaving the round-house.

The operation of my device is as follows: Steam is admitted to pipe H′ and oil to pipe J under suitable pressure. At the three-way J the steam and oil will be intimately commingled, and will pass forward together through pipe K, past the check-valve K′, into the diaphragm box or retort D. When the required pressure of steam and vapor has been attained in the diaphragm—say twenty to thirty pounds—as indicated by gage O, and when the pyrometer N indicates a sufficient degree of heat in said receptacle, the valve P^2 may be slightly opened, and the vapor or gas will then flow down the pipe P to pipe P′ and to the burners. The gas escaping from the burners will be ignited, as by a bit of burning waste, and will flame up around the pipes G′ G′. As combustion is increased and the flame enlarged, the valve P^2 is further opened, when the flame from the several orifices of the burners will unite and rise against the bottom of the diaphragm, where part of the heat and flame will pass through the passages E E, serving to heat the contents of said retort, while a part of the heat and flame will be deflected forward by the force of pressure and the inclined bottom of the diaphragm, and, passing around the front thereof, will impinge upon the crown-sheet A′. From the crown-sheet A′ the flame and heat will be again deflected, and, commingling with that which has passed through the passages E E, will flow around the pipes G G and L, and so on to the flue-sheet A^2 and through the flues R to the exhaust-chamber in front of the flues. Only a weak exhaust will be advisable, if any at all; in fact, by the application of this apparatus and the use of vapor fuel, the exhaust may be used to heat the water before entering the boiler by any of the modes in use for that purpose. Should the pyrometer or pressure-gage at any time indicate that the pressure or heat in the retort is becoming too great, the valve H^3 is opened to admit steam to pipe H^2, and so around to the sprayer Q^3. This has the effect of blowing a current of steam across the bottom of the diaphragm and driving the heat and flame around the front thereof, against the crown-sheet, and into the flues, thus tending to distribute the heat and increase the steam-production while reducing the temperature on the lower side of the plate of the retort D, and to equalize the combustion by transferring the superabundant heat in the lower chamber to the chamber above, and this should be continued so long as may be required. In running downgrade the flame should be turned down, so far only, however, as to retain the proper normal pressure of steam and temperature of heat in the retort and fire-box.

By the arrangement described I am enabled to dispense with the burning of coal in the fire-box of a locomotive-boiler. The boiler can be heated to any degree required without the production of smoke, ashes, or cinders. The apparatus can be applied to any locomotive or similar boiler now in use, or to any stationary boiler constructed substantially the same as a locomotive-boiler, or what is known as the "plain fire-box."

The fire is made self-feeding by the simple manipulation of the valves, and requires little care or attention, and the services of a fireman may be dispensed with.

The whole operation being under the absolute control of the engineer, by the proper manipulation of the valves, the fire may be

extinguished in an instant and immediately relighted and started again, as by lighted waste or by electricity.

Having thus described my invention, what I desire to claim and secure by Letters Patent is—

1. The combination, with the fire-box of a locomotive-boiler, of a diaphragm constituting a retort inclosed within said fire-box and extending from side to side thereof, supply-pipes leading from steam and oil vessels or receptacles to said retort, and a pipe leading from the retort to the burners, substantially as described.

2. In the fire-box of a locomotive-boiler, a closed inclined and hollow diaphragm or retort, and tubes extending therefrom in the direction of the crown-sheet above the diaphragm.

3. In combination with the fire-box of a locomotive-boiler, a series of tubes extending down from the diaphragm in the direction of the bottom of the box, having ends closed by removable plugs or caps, substantially as shown.

4. The inclined diaphragm D, having passages E, leading directly through it, the vertical pipes G, opening into the chamber of said diaphragm, and the vapor-burners placed beneath the same, all being combined in the fire-box of a locomotive-boiler, so that the flames from the burners shall impinge upon the bottom of the diaphragm and the pipes connected therewith and be commingled and deflected, substantially as shown and described.

5. In combination with the fire-box of a locomotive-boiler, a series of vapor-burners arranged near or on the bottom of said fire-box, and an inclined diaphragm, constituting a retort, placed in position above said burners to deflect the flames, substantially as described.

6. The combination of a steam-pipe and an oil-pipe leading to a pipe common to both, a hollow diaphragm-retort, which is fed by this last-mentioned pipe, a check-valve, K, in said pipe, and a pipe, L, leading from the interior of said diaphragm to burners beneath said diaphragm, substantially as shown and set forth.

7. The combination, with the retort, of a steam jet or sprayer arranged beneath the retort to cool the lower plate of the diaphragm, to distribute and equalize the heat in the lower and upper chambers of the fire-box, substantially as described.

8. In combination with the inclined diaphragm or retort having passages E E and pipe L, arranged as described, the burners Q Q and the sprayer Q^3, arranged, as described, to blow the flame and heat from the bottom around the front of the retort, to distribute and equalize the same, substantially as shown and described.

9. In combination with the inclined diaphragm having passages leading directly through the same and vertical pipes extending from the diaphragm in both directions, a system of steam and oil pipes leading to the interior of the diaphragm, and a system of pipes leading from the interior of the diaphragm to a series of burners arranged beneath the diaphragm, whereby a gaseous vapor may be produced in the diaphragm, and thus led to the burners, the combustion of the same serving to heat the diaphragm and attachments and also the water in the boiler, and raise the steam to and retain the same at the working pressure and temperature required for use, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

AUGUSTIN I. AMBLER.

Witnesses:
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P. S. WELCH.