

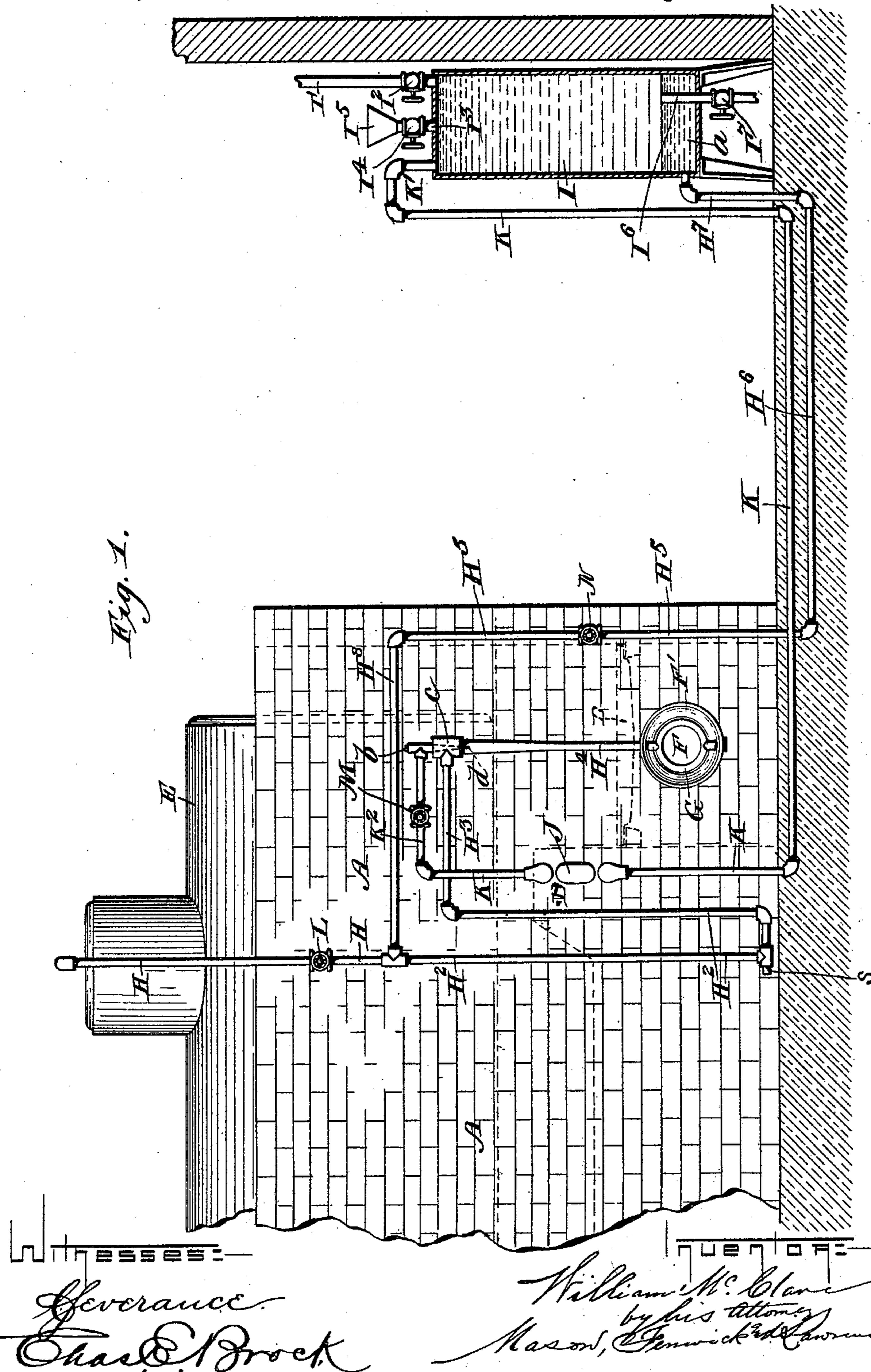
(No Model.)

2 Sheets—Sheet 1.

W. McCLAVE.  
FURNACE.

No. 496,384.

Patented Apr. 25, 1893.



Severance.  
 Chas. E. Brock

(No Model.)

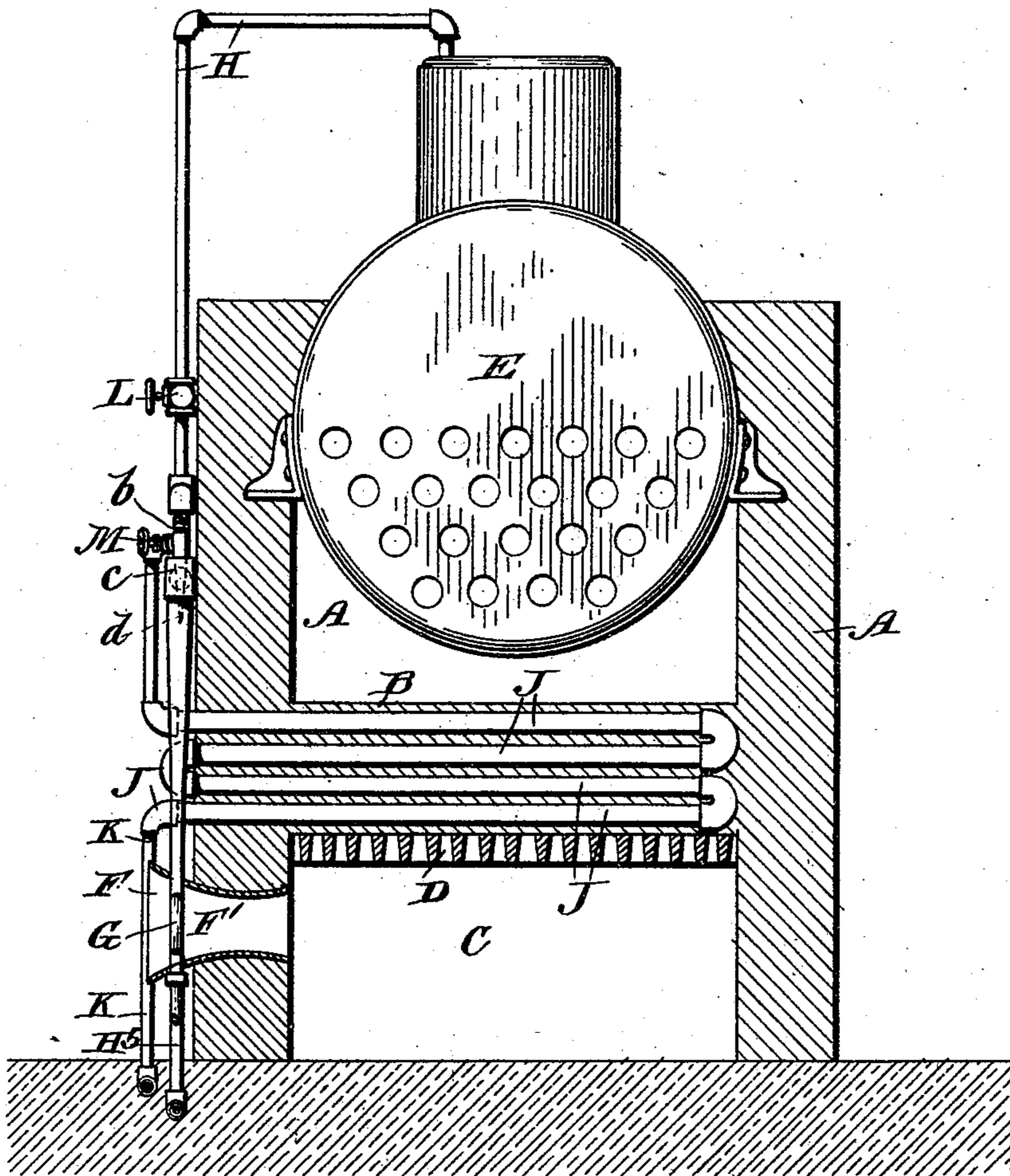
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*Fig. 2.*



WITNESSES:  
Sperance  
Chas. Brock

WILLIAM M. McCLAVE  
by his Attorneys  
Nason, Fenwick & Lawrence

# UNITED STATES PATENT OFFICE.

WILLIAM MCCLAVE, OF SCRANTON, PENNSYLVANIA.

## FURNACE.

SPECIFICATION forming part of Letters Patent No. 496,384, dated April 25, 1893.

Application filed December 22, 1892. Serial No. 456,023. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM MCCLAVE, a citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Furnaces with Air, Steam, and Hydrocarbon Fuel-Feeding Attachments; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention consists in a novel means as will be hereinafter described and claimed for effecting by the pressure of live steam and the condensed water thereof, the supply of liquid hydrocarbon to vaporizing pipes or chambers, vaporizing said hydrocarbon, mixing the vaporized, liquid hydrocarbon with live steam, forcing the mixture by the pressure of steam to the air duct or tuyere of a blower, mixing it with air and supplying the mixed product to a furnace or other heating apparatus and thus utilizing it as an auxiliary fuel.

It also consists in a novel combination of means for preventing the hydrocarbon vapor from passing into the boiler, and certain other features hereinafter described and claimed.

Figure 1 in the accompanying drawings represents my invention and a boiler furnace in side elevation and Fig. 2 is a cross section showing the boiler furnace in section, and my invention in front elevation.

A A in the drawings designate side walls; B a bridge wall; C an ash pit; D a grate or other appropriate supporting bed; E a steam boiler; F a steam blower of boiler furnace of ordinary construction. The blower in the illustration given consists of an air duct or tuyere F' and a steam jetting device G connected with a steam pipe H leading from the boiler E, but the discharging portion H<sup>4</sup> of the steam pipe H may be entered into the air duct of a fan blower as illustrated in Fig. 3 of Letters Patent No. 485,820, granted to me November 8, 1892, or in any other practical way whereby the mixture of air, steam and vapor of liquid hydrocarbon can be forced into the ash pit or underneath and up into a fire bed of solid carbonaceous fuel; or into any other suitable part of a boiler or other

furnace, and utilized as an auxiliary fuel for facilitating and promoting combustion.

The hydrocarbon tank I is constructed at its top with a pipe I' having a cock I<sup>2</sup> whereby it may be filled with liquid hydrocarbon from an elevated barrel by gravity, or from any other source of supply by the aid of a force pump. It also may be constructed with a pipe I<sup>3</sup> having a cock I<sup>4</sup> and funnel I<sup>5</sup>, so that it may be filled from a can. Through the bottom of a tank I a draw-off pipe I<sup>6</sup> provided with a cock I<sup>7</sup> is passed and made to extend up above said bottom to the height that it is desired to have the water, which, at the start is placed in the tank before the hydrocarbon is placed therein; or above such water which is in the tank by reason of condensation of water from the steam in the branches H<sup>7</sup>, H<sup>6</sup>, H<sup>5</sup>, of live steam pipe H, which connects the tank with the boiler E. This tank is connected by means of a conducting hydrocarbon pipe K, K', K<sup>2</sup>, having a cock N, with the said live steam pipe H, and with circulating heating pipes or chambers J arranged in the bridge wall B or other suitable part of a furnace which is adapted for heating the liquid hydrocarbon to a temperature about equal to or greater than high pressure steam; or which will vaporize the hydrocarbon to any desired extent. From the steam pipe H the above mentioned branches H<sup>4</sup>, H<sup>5</sup>, H<sup>6</sup>, H<sup>7</sup>, are extended, the terminating end of the branch H<sup>7</sup> entering the water compartment *a* of the tank. This branch turns downwardly from the tank a considerable distance, and then unites with the horizontal branch H<sup>6</sup> which extends a considerable distance, and then turns upward and unites with the vertical branch H<sup>5</sup>, which extends as high or higher than the top of the tank I, and then turns and unites with the branch H<sup>8</sup> which runs horizontally a considerable distance and unites with the part H of the live steam pipe which leads into the boiler. Below the point where the branch pipe H<sup>8</sup> makes its connection with the steam supplying pipe H, the steam pipe has a downward and upwardly running U-shaped extension H<sup>2</sup> of considerable length, the upwardly turned leg of the said U-shaped extension, at its upper terminus, uniting with a horizontal

branch pipe  $H^3$  which connects just above a branch connection of the steam pipe with that part  $H^4$  of the steam supply pipe which leads to the air duct of the blower  $F$ , and which portion of the steam pipe is closed at top with a screw cap  $b$ , on removal of which a wire can be run down through a hydrocarbon vapor discharging jet nozzle, and into it, to clean it out whenever clogging occurs. In a T-coupling  $c$  of the live steam pipe the aforesaid hydrocarbon vapor discharging jet nozzle  $d$  is applied, said nozzle being of less diameter than the interior of the coupling, and its terminus being below the point where the steam from the horizontal branch of the U-shaped portion of the steam pipe enters the branch portion  $H^4$  of said steam pipe and discharges the vaporized hydrocarbon amidst the steam in the said part  $H^4$  of the steam pipe. The discharge of the vaporized hydrocarbon into the portion  $H^4$  of the steam pipe is thus not only effected by the steam acting upon the water piston in the tank and in the branches  $H^5$ ,  $H^6$ ,  $H^7$  and through said piston upon it, but also by the suctional force of the steam on its way to the blower  $F$  through the branch  $H^4$ . The U-bend  $H^2$  of the steam pipe  $H$  forms a trap into which the steam from the boiler is compelled to pass before it reaches the part  $H^4$  of the steam pipe  $H$ , and owing to this a column of steam is constantly in the upturned leg of the U-bend of the steam pipe, as well as in the steam pipe leading into said leg, and a back pressure is constantly acting to prevent the hydrocarbon vapor, which is lighter than steam and water, from passing into the boiler instead of into the fire, as would be the case if the connection from the boiler with the part  $H^4$  of the steam pipe were made direct, or without this interposed trap, the back pressure referred to being due to the fact that the jet orifices of the jetting device of the blower are of less capacity in their aggregate discharging area than the diameter of the steam supply pipe, and thus while imperfect operation is avoided injury to the boiler metal or rivets by contact of the hydrocarbon vapor therewith is prevented, as will be hereinafter more fully seen.

By my invention I am enabled to use live steam acting upon a body of water beneath a column of hydrocarbon which is lighter than water for effecting the feed of the hydrocarbon to the vaporizing pipes or chambers and from said pipes or chambers into the live steam pipe where it is mixed with the live steam, and thence in a mixed condition to the duct of the blower and from thence to a fire bed of solid carbonaceous fuel. It will be seen that the water of condensation of the steam will rest in the vertical branch portions  $H^7$  and  $H^8$  of the steam pipe  $H$ , and constantly form a water piston for forcing the liquid hydrocarbon out of the tank into pipe  $K$   $K'$   $K^2$  by pressure of live steam behind it; and that the height of the column of condensed steam serves to increase the pressure by its gravi-

tal force. The globe cock  $L$  serves as a means for cutting off the steam from the boiler, the cock  $M$  for regulating the supply of hydrocarbon to the mixing branch pipe  $H^4$  of the steam pipe  $H$ , and the cock  $N$  for regulating or shutting off entirely the supply of steam to the bottom of the tank; and also for trapping the water of condensation in the water chamber  $a$  and vertical branch  $H^5$  of the steam pipe and holding it ready for serving as a water piston for forcing out the hydrocarbon from the tank during the drawing off of the water from the tank to make room for refilling with liquid hydrocarbon. It is obvious that by lengthening the vertical branch  $H^5$  of the steam pipe and elevating the horizontal branch  $H^8$  a greater pressure will be secured, as the height of the column of water in said branch  $H^5$  will add to the force on the under side of the column of liquid hydrocarbon in the tank. It will also be understood that by means of the U-shaped bend  $H^2$  forming a trap any liability of the hydrocarbon vapor passing into the boiler will be avoided, because the vapor of hydrocarbon is lighter than vapor of water, or steam; and this being the case and the blower being higher than the lowest part of the trap, the vapor will escape at the point of least resistance. By thus preventing the hydrocarbon vapor passing into the boiler any serious consequences from the presence therein will be avoided, which is important as the vapors of crude oil contain elements that cause rust and destruction to the material and rivets of which the boiler is constructed; it also contains elements of a highly explosive character which might, in the presence of great heat, cause serious consequences.

At the bottom of the U-bend an automatic drip-cock or valve  $s$  is provided to prevent the accumulation of water by condensation in the steam pipe when the apparatus is not in action, such difficulty being often experienced from leaky globe valves.

In the event that it is found advantageous to simply introduce steam direct from the boiler to the blower, this can be done by shutting cocks  $M$  and  $N$ , and this feature of the apparatus is important at such times as when the supply of oil from the tank is exhausted and it is not convenient to get an immediate supply; but this manner of mixing steam and air is not regarded novel of itself or independently of the liquid hydrocarbon supplying and hydrocarbon vapor controlling means hereinafter described.

What I claim as my invention is—

1. In a combined hydrocarbon vaporizing, and vapor, hydrocarbon and steam mixing apparatus, the combination of the liquid hydrocarbon tank and means for causing live steam from the live steam pipe to condense in said pipe and form a water piston for effecting by the pressure of the live steam behind and upon the water piston, the feed of the liquid hydrocarbon to a vaporizer, and a

steam mixing branch pipe, and air duct of a furnace blower, substantially as described.

2. The combination with a liquid hydrocarbon tank, of a steam pipe having branch pipes in which a portion of the live steam condenses and forms a water piston forward of the live steam, and a hydrocarbon branch pipe in which the hydrocarbon is mixed with steam, a liquid hydrocarbon supply pipe connected with the tank, a live steam circulating coil or chamber, an air duct of a blower and a furnace adapted for having the said mixed vapors and air passed beneath and up through the fuel on a grate or supporting bed, substantially as described.

3. The combination of a live steam supply pipe connected with the boiler and leading to a mixing device which is connected to a jetting device in the air duct of a blower, and having a downward and an upward extending part forming a U-bend as H<sup>2</sup>, which bend forms a steam trap; and a hydrocarbon vapor supply pipe leading from a supply tank to the mixing device, substantially as described.

4. A liquid hydrocarbon tank provided with a filling passage at the top, an entrance pas-

sage near its bottom for condensed steam, and a draw-off pipe with cock, said draw-off pipe having its receiving end located some distance above the bottom of the tank, in combination with a hydrocarbon conducting pipe, and a live steam pipe, both pipes provided with branches, the steam branches arranged far enough from the steam pipe H to effect a condensation of a portion of the steam into water, and thus cause a water piston to form below the body of liquid hydrocarbon in the tank and forward of the live steam, and the feeding of the liquid hydrocarbon out of the tank to be accomplished by pressure of the steam upon the water; and the said draw-off pipe serving to trap a quantity of water in the tank equal to its height or the height of its discharging end above the bottom of the tank, substantially as described.

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

WILLIAM McCLAVE.

Witnesses:

E. T. FENWICK,  
C. CALVERT HINES.