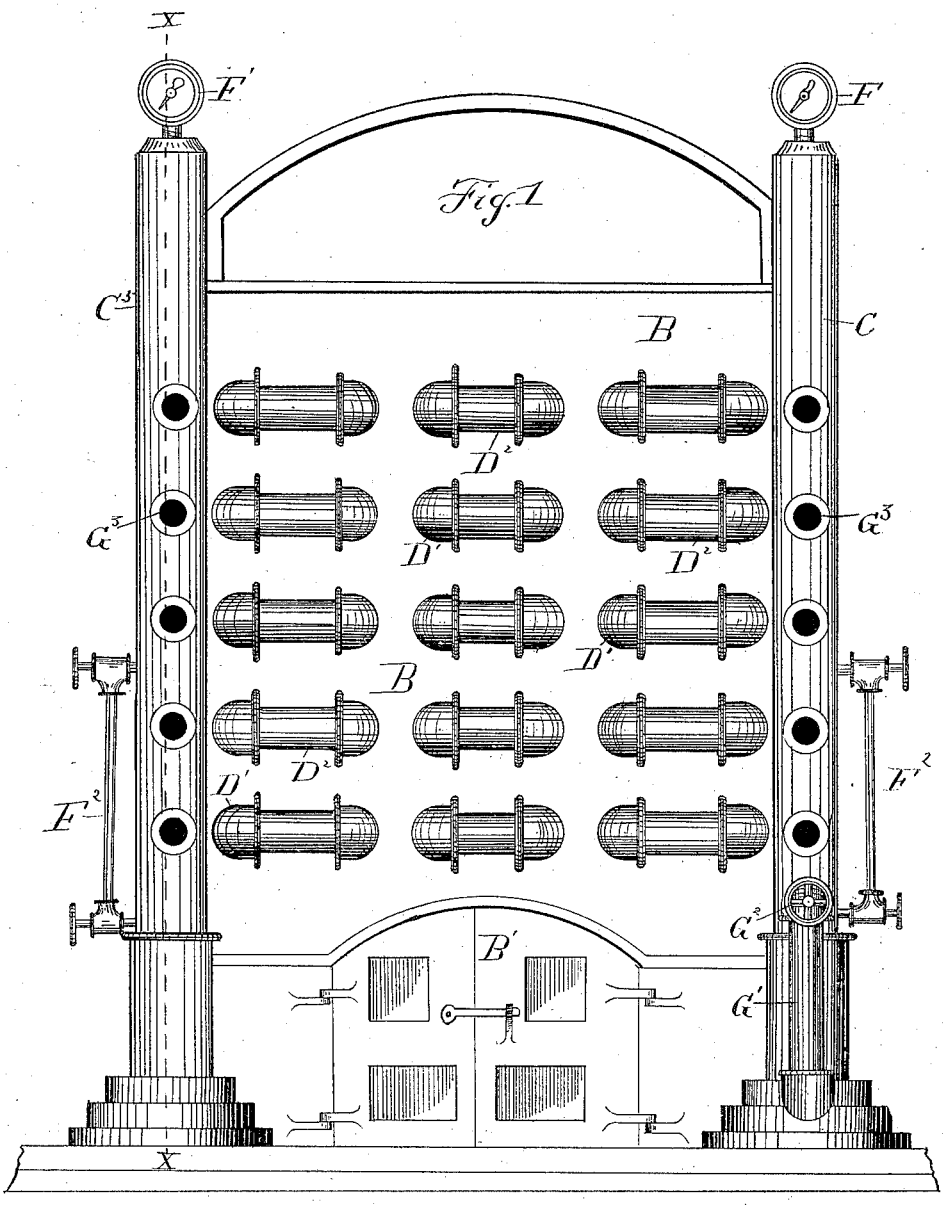
(No Model.) 4 Sheets—Sheet 1.

A. I. AMBLER.

HYDROCARBON VAPOR GENERATOR.

No. 306,311. Patented Oct. 7, 1884.



Witnesses.
W. H. Brown,
George H. Ellis.

Inventor.
Augustus I. Ambler
By Wallace A. Bartlett
His attorney.

(No Model.) 4 Sheets—Sheet 2.

A. I. AMBLER.

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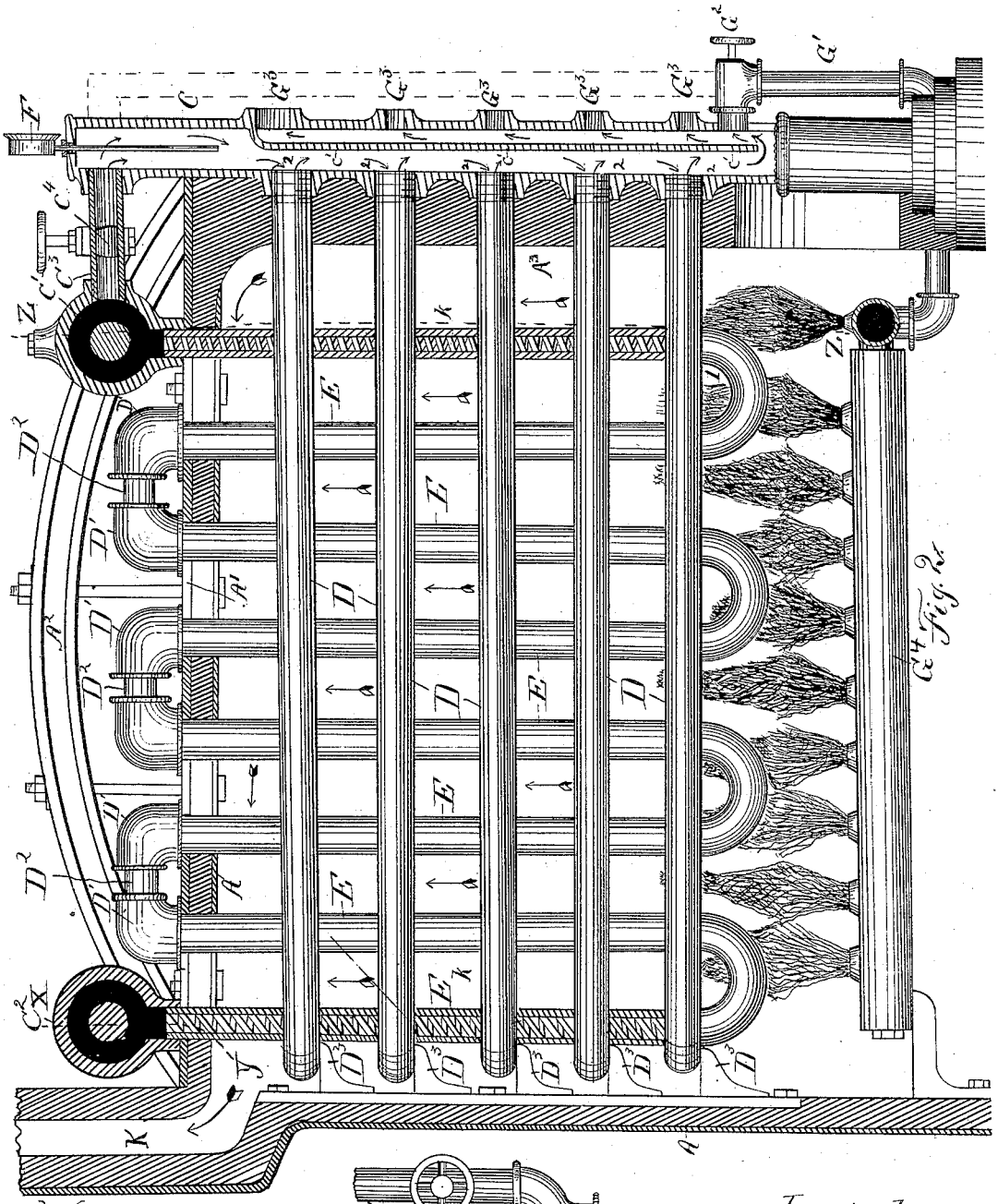

Fig. 2.

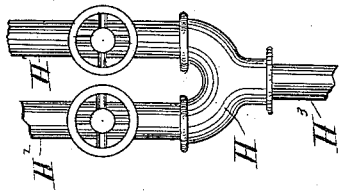

Fig. 3.

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(No Model.) 4 Sheets—Sheet 3.

A. I. AMBLER.

HYDROCARBON VAPOR GENERATOR.

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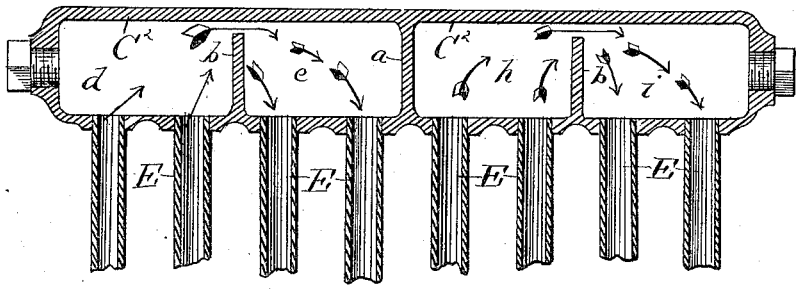


Fig. 5.

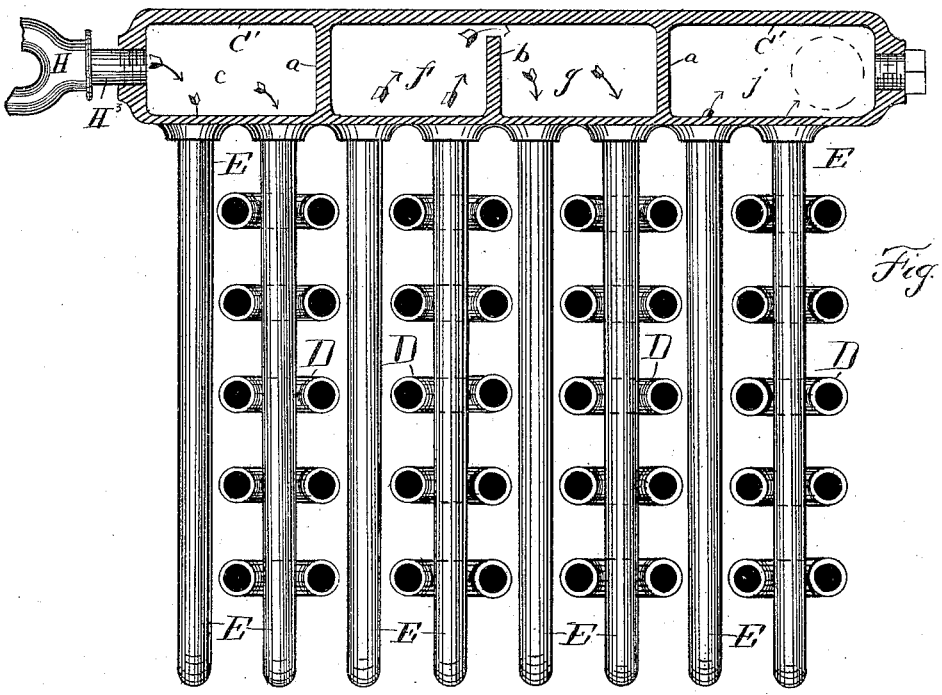


Fig. 4.

Fig. 6.

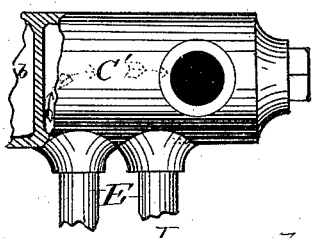
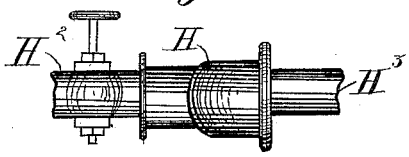


Fig. 7.



Witnesses.
C. W. H. Browne,
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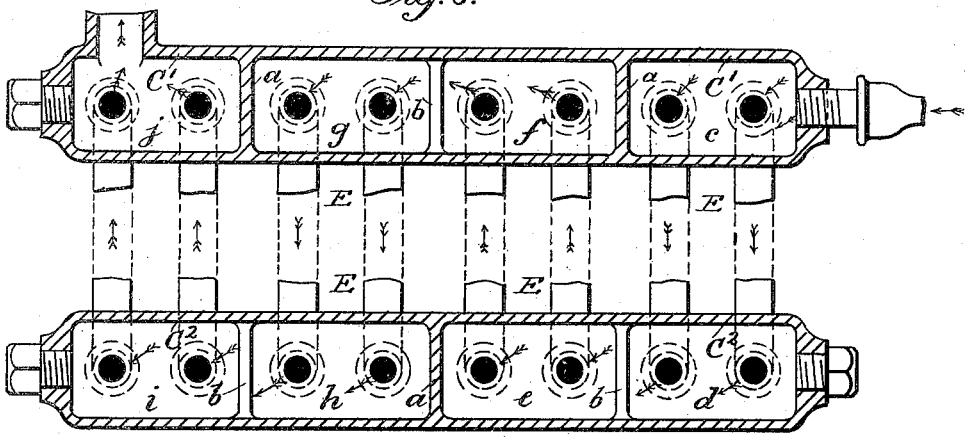
(No Model.) 4 Sheets—Sheet 4.

A. I. AMBLER.

HYDROCARBON VAPOR GENERATOR.

No. 306,311. Patented Oct. 7, 1884.

Fig. 8.



WITNESSES:

W. W. Jenner.

M. L. Williams.

INVENTOR

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Attorney

UNITED STATES PATENT OFFICE.

AUGUSTIN I. AMBLER, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO ROSELINE N. AMBLER, OF SAME PLACE.

HYDROCARBON-VAPOR GENERATOR.

SPECIFICATION forming part of Letters Patent No. 306,311, dated October 7, 1884.

Application filed April 4, 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 Generators, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to hydrocarbon-vapor retorts or generators for furnaces, steam-boilers, and other places where combustion of fuel at a high temperature is required.

My invention consists in the special construction and arrangement of pipes or tubes and flues by which a very large heating-surface is exposed to action of flame and heat, as hereinafter pointed out in the claims; also, in the special arrangement of the connections of said pipes, so as to protect said connections from direct exposures to flames; also, in the arrangement of the heating-pipes with relation to each other.

The object of my invention is to produce an apparatus in which superheated steam and the hydrocarbon vapors will be thoroughly and effectively combined, resultant gas will be held for a long time under pressure and exposed to the action of heat, while a steady movement or circulation of the vapor may be had, if desired, and from which apparatus the excess of vapor gas produced may be conducted to any desired point of combustion, as a metallurgic or other furnaces, the fire-box of a steam-boiler, or the combustion-chamber of a gas-retort, a small quantity only of said vapor being required for consumption in the vapor-generator.

In the drawings, Figure 1 is a front elevation of my improved vapor-generator, showing the cylindrical columns at the corners, the front plate, and the couplings of the horizontal pipes outside the fire-chamber. Fig. 2 is a vertical longitudinal section on line *x x*, Fig. 1, showing the pipes in elevation and the interior arrangement of pipes, the supporting-plates, and various details, the vertical pipes being broken away in part. Fig. 3 is a plan or elevation of the three-way pipe and valves in which the steam and oil are commingled to produce the vapor. Fig. 4 is a vertical transverse section on line *z z*, Fig. 2, looking toward the rear of the combustion-chamber. Fig. 5 is a partial section similar to Fig. 4, taken on line *x y*, Fig. 2. Fig. 6 is a plan of a portion of one of the supply and storage tubes, part being broken away to show the transverse partition. Fig. 7 is an elevation or plan showing the three-way pipe in different position from that shown in Fig. 3. Fig. 8 is a horizontal section of pipes C′ C², the connecting pipes and parts being mainly broken away.

It is intended that the pipes or tubes used for the construction of my vapor-generator shall be wrought-iron pipes of usual construction. The sections of which the generator is composed are single lengths of tube bent into U form. The joints, fittings, and connections are removed from that part of the chamber which is exposed to the action of heat and flame, so that great convenience in coupling the sections together may be attained, and the most lasting and economical wear of the pipes be secured.

H represents the three-way pipe in which oil and superheated steam are commingled, one being admitted through the pipe H′, the other through pipe H². The pipe H³ leads to the large supply and delivery tube C′. The tube C′ extends over the combustion-chamber from side to side, being protected from direct exposure to the flame and heat by the floor or support A′. The tube C′ is preferably of cast metal, and is provided with bosses 2, into which one end of the drop-pipes E are secured. The tube is divided transversely by partitions *a b*.

The device I here describe has the vertical pipes arranged in sets of two, each set communicating with a separate chamber in the tube C′. Thus the first pair of drop-pipes, E, lead downward from chamber *c* in the tube C′. These drop-pipes, after making a bend at 1, lead upward to the first of the elbows, D′, only one of which is shown in Fig. 2, the other being directly behind the same. By a short pipe, D², provided with right-and-left screw, the elbow D is connected with elbow D′. From this elbow another U-shaped pipe leads down and up to the next elbow-coupling. Four U-shaped pipes are thus shown in Fig. 4 to be

joined together by elbows and short links above the floor A, the last U-pipes connecting with the rear connecting-tube, C^2, or with the chamber *d* therein, (see Fig. 5.) Tube C^2 is parallel with C′ and over the rear of the combustion-chamber. Any gaseous substance contained in chamber *d* will pass over the top of the partition *b* into chamber *e*, and from this chamber will pass down and up the return series of U-shaped pipes to chamber *f* in the front tube, C′, where it will pass over partition *b* to the chamber *g*, and will then go through another series of U-shaped pipes to the chamber *h* in tube C^2, and thence through chamber *i* and the U-shaped pipes to the chamber *j* in the tube C′, at the opposite end of the tube C′ to that in which it entered said tube.

Instead of making the chambers in the tubes C′ and C^2 to communicate with two sets of pipes, each chamber in said tubes may communicate with one pipe only—that is, a single set of U-pipes and connections may lead from the first chamber in tube C′ back to the chamber in C^2, and a similar set lead again forward. In such case the gaseous matter in passing from chamber C to chamber *j* will traverse the whole length of the vertical pipes and their connections. The chamber *j* in tube C′ has a pipe, C^3, leading to vertical cylindrical standard C, a valve, C^4, intervening. The standard C is provided with a pyrometer, F, and with a partition or diaphragm, *c*′, extending nearly to the bottom, and dividing said columns into two chambers. One of these chambers is provided with outlets through bosses 2 2, into which one end of horizontal U-shaped pipes D D are secured, preferably, by screwing. These pipes D D lead back to the rear of the combustion-chamber, (see Fig. 2,) where they are supported by brackets D^3 at the return-bends. The return-bends of these horizontal pipes D pass through the front plate, B. This plate B is detachable from the cylindrical columns, so that all the parts may be readily assembled. The pipes are coupled by elbows D′ and the connecting-links D^2 in front of the plate B. The connection from standard C to standard C^5 is thus similar to that of tube C′ with the tube C^2, except that the standards are not shown to be divided by transverse partitions, but it is obvious they may be so divided.

From the base of standard C (or it may be C^5) a pipe, G′, controlled by valve G^2, leads to the burner-pipes G^4 in the combustion-chamber. These burner-pipes are arranged at such intervals as may be necessary or convenient in the combustion-chamber, and are provided with burners of approved pattern. The standards C and C^5, or either of them, may have as many apertures G^3 as may be necessary for the attachment of pipes leading to furnaces, steam-boilers, and the like. The upper plate, A′, is supported by hangers or bolts from the arches or girders A^2, and should preferably be lined with asbestus or fire-brick. The front plate, B, should also have a backing, A^3, of refractory material, as should all the interior walls of the generator-furnace. The lower part of the front plate is provided with doors B′, which should have windows of mica, so that the combustion may be observed through said windows.

The interior of the tubes D and E, or of either set, may have coiled wire K placed therein for the purpose of retarding the flow of gas in the pipes, and also of presenting an increased heating-surface to the gas or vapor flowing through them.

It is quite apparent that the system of horizontal pipes D D may be dispensed with and the operation of the vertical pipes E E will not be affected. In that case, however, a pipe-connection must be made from the tube C′ to the burner-pipes. Such a connection is shown in dotted lines at the right of Fig. 2.

The operation of my device is as follows: Superheated steam from some source of supply (not shown) is admitted to pipe H′, and, passing through the entire system of pipes, heats them to a high degree. This steam may be allowed to exhaust through the burner-pipes G and the burners, and will pass out the flue K after enveloping the outside of the pipes in the combustion-chamber, or the steam may be stopped at the valve G^2. When the pipes shall have been sufficiently heated, the steam is allowed momentarily to exhaust through the flue; then the valves in pipes H′ H^2 are both opened to the desired extent, one to admit an inflow of superheated steam, the other oil under the necessary pressure. The two are mixed in the three-way pipe H and pass on to the tube C′; thence, in the manner hereinbefore explained, through the chambers and tubes to the burners. As the commingled steam and oil in the form of an inflammable vapor escapes from the burners it is there ignited and forms a fierce flame, which surrounds and envelops the tubes arranged in the combustion-chamber above the burners, heating said tubes to a high degree. Now, as the mixed oil and steam passes through these tubes somewhat retarded, as before stated, by the coiled wires, the oil and steam are subjected to the influence of the heat and flame, and the combustible vapor is evolved at a very rapid rate. By retarding the escape of this vapor or gas and regulating the inflow the quantity and quality of the vapor produced may be nicely regulated. Only a small proportion of the vapor will be consumed in the combustion-chamber, to produce a constant supply of vapor-fuel as long as oil and steam are supplied to the pipes. The remainder may be conveyed away for combustion elsewhere.

The U-shaped pipes may enter from any or all the sides, and from the bottom as well as the top of the combustion-chamber; but the couplings will always be outside said chamber.

I claim—

1. The combination, with the supply-pipe C′, having transverse partitions, of the pipe

C^2, having transverse partitions, and the series of U-shaped pipes connecting said pipes, substantially as described.

2. The combination, with the supporting-plate A′, of the U-shaped pipes E, inside the combustion-chamber, and the elbows D′ and connecting-pipes D^2, above said plate and outside the combustion-chamber, substantially as set forth.

3. The combination, with the inclosing-wall and vertical column C, of the horizontal U-shaped pipes D, communicating with said column at one end, and coupled together by connections outside the inclosing-wall, substantially as set forth.

4. The vertical column C, divided by a longitudinal partition for a portion of its length, combined with the U-shaped pipes D, communicating with one of the compartments in said column, substantially as described.

5. The vertical standards outside the combustion-chamber, the U-shaped pipes having their bends inside said chamber and their connections outside the same, and the supporting-brackets under the bends of the U-shaped pipes, all substantially as stated.

6. The series of vertical U-shaped pipes having their couplings outside the combustion-chamber, and the series of horizontal U-shaped pipes passing between the vertical pipes, and having their couplings outside the combustion-chamber, all combined and arranged substantially as stated.

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

AUGUSTIN I. AMBLER.

Witnesses:
W. A. BARTLETT,
E. L. WHITE.