

No. 737,738.

PATENTED SEPT. 1, 1903.

C. F. HITCHCOCK.
VAPOR GENERATOR.

APPLICATION FILED APR. 22, 1902.

NO MODEL.

2 SHEETS—SHEET 1.

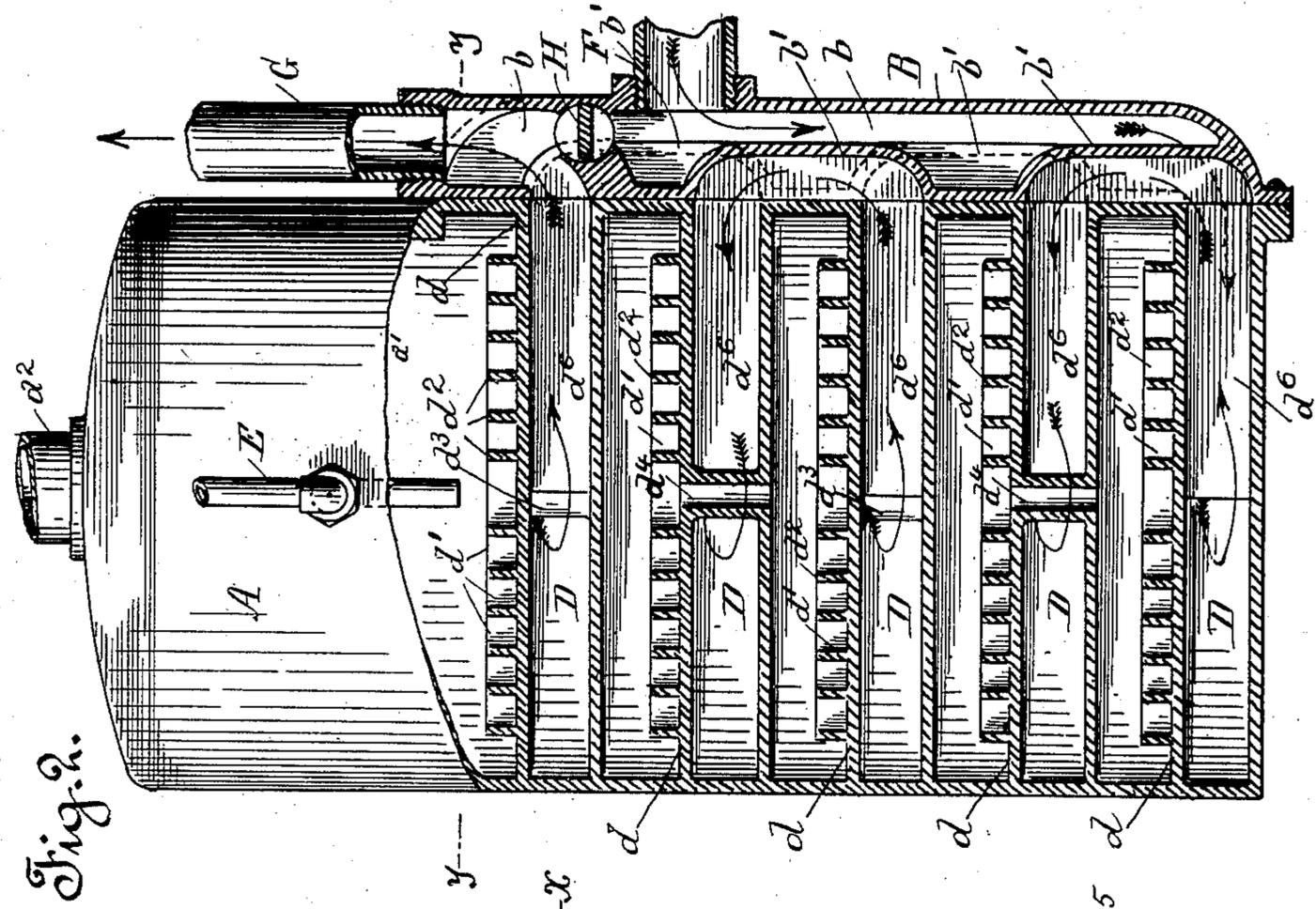


Fig. 2.

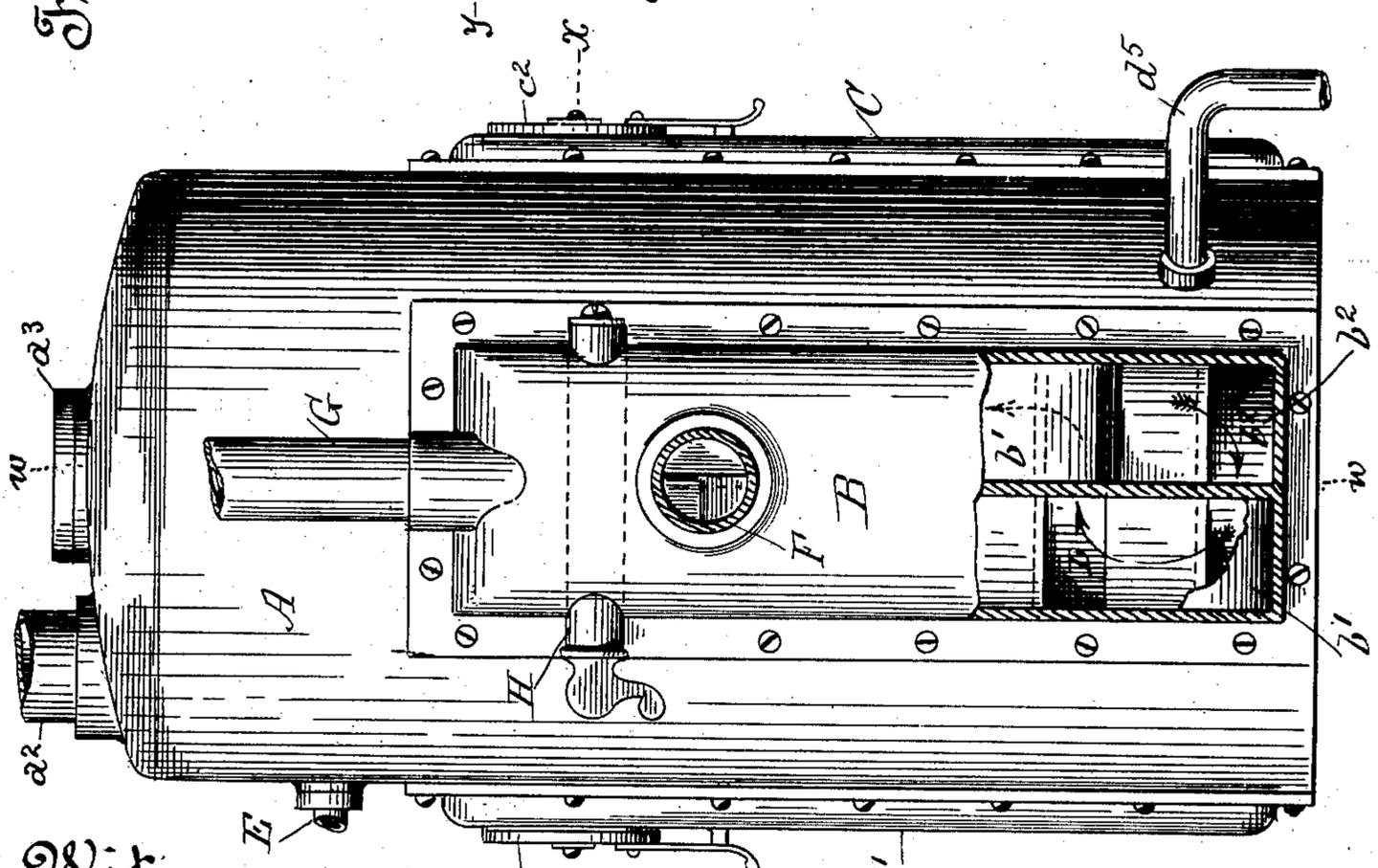


Fig. 1.

Witnesses.
W. H. Harten
 Walter F. Lane.

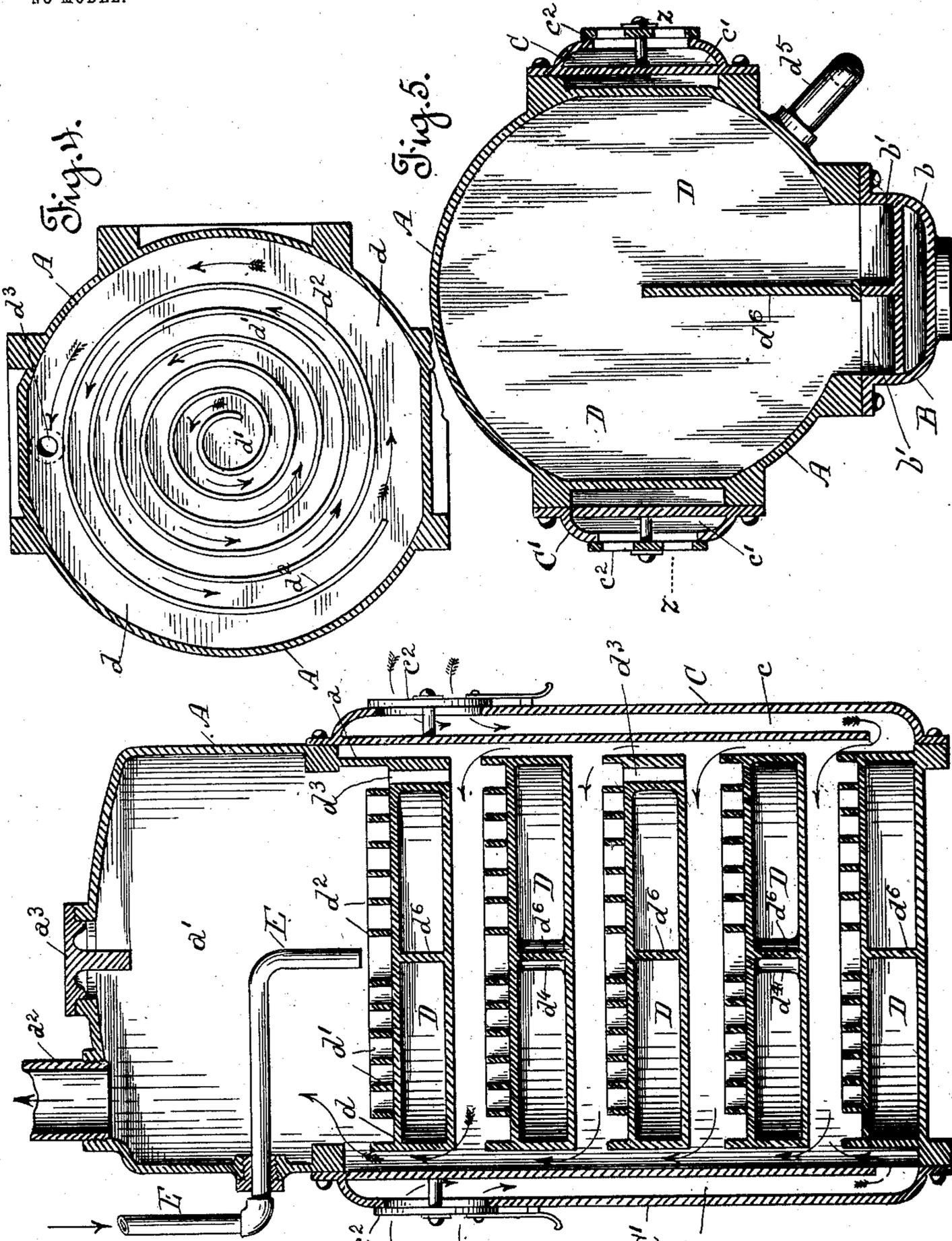
Inventor.
 Charles F. Hitchcock
 by *Wm. F. Booth*
 his Attorney

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NO MODEL.

2 SHEETS—SHEET 2.



Witnesses.
W. H. ...
Walter F. Case.

Fig. 3. c²

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 his Attorney.

UNITED STATES PATENT OFFICE.

CHARLES F. HITCHCOCK, OF OAKLAND, CALIFORNIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO EAGLE ENGINE CO., OF SAN FRANCISCO, CALIFORNIA, A CORPORATION.

VAPOR-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 737,738, dated September 1, 1903.

Application filed April 22, 1902. Serial No. 104,107. (No model.)

To all whom it may concern:

Be it known that I, CHARLES F. HITCHCOCK, a citizen of the United States, residing at Oakland, county of Alameda, State of California, have invented certain new and useful Improvements in Vapor-Generators; and I do hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to that class of vapor-generators especially adapted for the use of the heavier petroleums, commonly known as "crude oil," and in which the oil is caused to flow over a vaporizing-surface heated by the exhaust-gases from the engine.

In vapor-generators of this class there are two essential considerations—namely, the proper path or course for the oil over the heater or vaporizer surface and the proper direction or course of the exhaust-gases to heat said surface. The heavy character of the oil renders it necessary in order to volatilize as much of it as possible under the heat available that its course upon the vaporizer-surface be both extended and continuous, the former to subject it for a considerable time to the heat and the latter to avoid clogging by the non-volatilizable residue, which residue where the flow or course is continuous will be carried to the end thereof, where it can be properly disposed of.

The direction or course of the heating medium (especially where the exhaust-gases from the engine are used) must be such as to conduct it to every part of the vaporizing-surface and through a course sufficiently long to utilize its gradually-diminishing temperature by bringing it into contact at first, when its temperature is highest, with those portions of the vaporizing-surface over which the oil is passing from which most of the volatilizable products have been driven, and later, when its temperature is reduced, in contact with those portions of said surface over which the fresher oil is flowing.

To these essentials must be added the consideration of the structure of the heater or vaporizer itself, both with regard to its surface over which the oil flows and its opposite surface, which is exposed to the heating me-

dium; the relative arrangement and connection of the heater or vaporizer with the casing, the air-channels, and the means for regulating the admission of both air and the heating-gases.

The object of my invention is to secure the best results in these particulars, whereby an effective vapor-generator of this type is obtained.

My invention consists in the novel constructions, arrangement, and combinations of parts, which I shall hereinafter fully describe and claim, reference being had to the accompanying drawings, in which—

Figure 1 is an elevation of my generator, a portion of the front cap B being broken away to show the beginning of the heat course. Fig. 2 is part elevation and part section, the latter being on the line *ww* of Fig. 1. Fig. 3 is a section on the line *zz* of Fig. 5 at right angles to the section of Fig. 2. Fig. 4 is a horizontal section on line *yy* of Fig. 2. Fig. 5 is a horizontal section on line *xx* of Fig. 1.

A is a casing of suitable cross-section, here shown as circular. It has openings in its vertical walls at three places, one of which, which may be called the "front," is covered by a cap B, the others, termed the "sides," being covered by the caps C and C' on the right and left, respectively.

The heater or vaporizer within the casing comprises a vertical series or tier of separated hollow boxes D, which are in practice cast with the casing. The flat upper or top wall *d* of each box forms the vaporizing-surface, upon which the oil flows. The path *d'* for the oil on said surface is a spiral one, formed by the spirally-directed flange *d²*, as seen particularly in Fig. 4. The discharges by which the oil is directed to and through the successive oil-paths alternate in position from circumference to center. In the arrangement shown (see Fig. 3) the oil-feed pipe E delivers at the center of the uppermost vaporizing-surface *d*, and the discharge *d³* from said surface is at the outer part. The discharge *d⁴* from the next surface is at the center, and so on alternating throughout the series, the discharge of the non-volatilizable residue

from the lowermost surface being through the side of the casing, as shown by the pipe d^5 , Figs. 1 and 5.

Each hollow box D has within it a partition d^6 , Figs. 2 and 5, here shown as radial, Fig. 5, the purpose of which is to provide a circuitous course through the box for the heating-gases in order to effect their proper distribution within the entire box. The front cap B is provided with a channel b , Fig. 2, with which near its upper portion the pipe F for delivering the heated exhaust-gases which come from the engine communicates, as seen in Figs. 1 and 2. With the top of this channel communicates the escape-pipe G, and in said channel between the pipes F and G is a relief-damper H, Figs. 1 and 2. The heater-boxes D on their fronts next to the cap B open through the casing, as in Fig. 2, and said cap on its inner surface is formed or provided with means which act in conjunction with the open fronts of the boxes and their partitions to form a continuous circuitous course for the heated gases through the series of boxes. The construction here shown, Figs. 1, 2, and 5, of the inner surface of cap B consists of a series of overlapping laterally-alternating pockets b' , which while separating the cavities of the boxes on each side of their partitions connect said cavities of the same side of succeeding boxes alternately. In the lower end of channel b is an opening b^2 , Fig. 1, which communicates with the cavity of the lowermost box D on one side of its partition d^6 . The uppermost box communicates on one side of its partition with the upper end of channel b , Fig. 2. The course of the heated exhaust-gases is indicated by the arrows in Figs. 1 and 2—to wit, from pipe F into channel b of cap B, down in said channel (damper H being closed) and through opening b^2 into the lowermost box on one side of its radial position d^6 , thence around the inner end of said partition and back on its other side to the open front of the box, thence up through the pocket b' of cap B on that side to the same side of the open front of the next box, thence into said next box on that side of its partition and around said portion to the open front of the box and into the second pocket b' of cap B and up to the next box, and so on throughout the series of boxes, and finally out from the uppermost box into the top of channel b and through pipe G.

The side caps C and C' are formed with channels c and c' , Figs. 2 and 5, for admitting air to the casing A. The upper ends of these channels communicate, by means of openings controlled by dampers or valves c^2 , with the outer air, and their lower ends open into the bottom of the casing, as shown in Fig. 3. In order to insure the air thus admitted from one side passing over the vaporizer-surfaces of the boxes to the other side, and thus to carry the vapor over to the body of air passing up said other side, there is between one

side of the uppermost box D and the casing a stop-plate a , Fig. 3, which cuts off the direct communication of the air on that side with the top chamber a' of the casing. By regulating the damper c^2 of said first side just enough air may be admitted to pass over the oil to carry the vapor off, but not to cool said oil. The top chamber a' is sufficiently capacious to serve as a reservoir for the vapor volatilized from the oil, and it is from this chamber that the communication at a^2 is made with the engine to supply the vapor thereto. There is also a safety or blow-out valve or cap a^3 in the top of chamber a' to provide against the effect of accidental back-firing from the engine.

The operation of the generator is as follows: The oil is supplied from pipe E to the center of the uppermost vaporizing-surface d . Upon this it flows through the spiral path d' formed by flange d^2 to the outer portion of said surface. There it falls through the discharge d^3 upon the outer portion of the second vaporizing-surface d and thence in the spiral path d' thereof to the center of said surface, where it falls through the central discharge d^4 upon the center of the third vaporizing-surface, and so on down to the last surface, the non-volatilizable residue being discharged through pipe d^5 . This path of the oil is thus extended and continuous. During its course the oil is subjected to heat for a length of time sufficient to drive off its volatile vapors, and by its continuous flow the residue is carried on down to the discharge without tending to clog the path. Another advantage of the spiral path on a flat surface is that the flow of the oil through it is practically uniform irrespective of the level of said surface, which in certain uses of the generator—as for example, upon a ship or other floating vessel—is inclined in various directions, due to the rolling of the vessel. Such a spiral path of a flat surface has also the further and decided advantage of causing a uniform flow of the oil, due solely to the head or level of the oil therein, in contradistinction to a true helical path like that formed on a convex or concave surface, where the flow is due to the inclination of the surface, thereby producing a too-rapid flow. The spiral path also affords the greatest extent of course and the least obstruction to the flow of the oil, thereby distinguishing it from a zigzag course, in which by reason of the obstructing angles the non-volatilizable residue is more apt to clog the path.

The exhaust-vapors from the engine, entering at the base of the generator, are carried through an extended course and into contact with every portion of the heater. They are hottest at the lower part of the generator, where their greater heat is required to volatilize such remaining portions of the oil as can be driven off, and they are coolest at the upper portion, where the more-readily vola-

utilizable portions of the oil require less heat to be driven off.

The heat of the generator can be regulated by the damper H, by which the whole or any portion of the exhaust-gases may be diverted directly to the escape-pipe G.

The air being supplied to the generator by an outer communication situated some distance above the base of the generator has two advantages—namely, a preliminary heating in passing down in the channels *c* and *c'* and preventing, by reason of the strong inward current of air induced through said channels, the puffing out of any gas from the base of the generator. The removal of the caps B, C, and C', one or more of them, effectually exposes the interior parts of the generator for cleaning or other purposes, and said caps, by reason of their channels, furnish of themselves convenient means for the admission of the air and exhaust-gases and supplement the interior parts in their necessary constructions to form the required courses.

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

1. In a vapor-generator, the combination of a casing having an opening in its front wall, a vertical series of separated hollow boxes within the casing having open fronts, partitions on the interior of the hollow boxes, a cap secured to the casing over its opening, means on the inner surface of the cap forming with the open fronts of the boxes a continuous circuitous course through the series of boxes, said cap having a channel communicating with the lower end of said course, an inlet-pipe discharging into the channel in the cap for the heating medium to pass through said course, an outlet-pipe leading from the upper end of said course, and means for supplying oil upon the uppermost box, said boxes communicating with each other to permit the continuous flow of oil from one surface to the other, substantially as described.

2. In a vapor-generator, the combination of a casing having an opening in its front wall, a vertical series of separated hollow boxes in said casing, spiral flanges on the upper surfaces of said boxes forming spiral paths having communicating passages arranged at the circumference and center alternately, said boxes having open fronts, partitions on the interior of said boxes, a cap secured over the opening in the casing, means on the inner surface of the cap forming with the open fronts of the boxes a continuous circuitous course through the series of boxes, said cap having also a channel communicating with the lower end of said course, an inlet-pipe discharging into the channel in the cap for the heating medium to pass through said course, a discharge-pipe leading from the upper end of said course, means for supplying oil to the upper surface of the uppermost box of the series, said boxes having connecting-

passages for the continuous flow of oil from one surface to the other, substantially as described.

3. In a vapor-generator, the combination of a casing having side openings, a vertical series of successively-communicating vaporizing-surfaces within the casing, means for supplying oil to said series of vaporizing-surfaces, a cap secured over each of said side openings, each cap having a channel communicating with the exterior air and with the lower portion of the interior of the casing, and means within the casing for diverting the air from the channel in one of said caps over the vaporizing-surfaces to the opposite side, substantially as described.

4. In a vapor-generator, the combination of a casing having separated openings in its front and side walls, a vertical series of separated hollow boxes having open fronts, spiral flanges on the upper surfaces of the boxes forming spiral paths, said boxes having communicating passages whereby the oil is discharged from one to the other of said paths at the circumference and center thereof, alternately, a partition on the interior of each box, a cap covering the front opening of the casing, means on the inner surface of the cap forming with the open fronts of the boxes a circuitous course through the series of boxes, said cap having a channel communicating above and below with the upper and lower ends of the course through the boxes, a pipe for exhaust-vapors leading into said channel, a damper in said channel located at a point between said pipe and the point of communication with the upper end of the course through the boxes, means for feeding oil to the top surface of the uppermost box, caps covering the side openings of the casing each having a channel therein communicating above with the exterior air and below with the base of the casing whereby air is supplied thereto, and means in the casing for diverting the air admitted from one of said cap-channels over the oil-paths to the opposite side, substantially as described.

5. In a vapor-generator, the combination of a vertical series of separated hollow boxes the upper flat surfaces of which have spiral flanges formed upon them forming spiral paths for the oil to flow through, said boxes having communicating passages whereby the oil may flow from the path on one box to the path of the succeeding box, partitions in the boxes forming circuitous course therein, and means for feeding a heating medium to the interior of the boxes, said means being arranged to form communicating passages between the source of supply and the course through the boxes at alternate sides of the partitions therein, substantially as described.

6. In a vapor-generator, a plurality of separated hollow vaporizers, partitions in said vaporizers and connections therebetween forming a single continuous circuitous pas-

sage therethrough for a heating medium, and means for delivering the heating medium to said passage, said boxes having communicating passages arranged alternately at points
5 adjacent to the centers and edges of the same, whereby oil may have continuous passage from the top of the uppermost box through the same down to and over the upper surface

of the box located therebeneath, substantially as described. 10

In witness whereof I have hereunto set my hand.

CHARLES F. HITCHCOCK.

Witnesses:

HENRY G. W. DINKELSPIEL,
R. G. HUDSON.