A. I. & W. R. AMBLER.

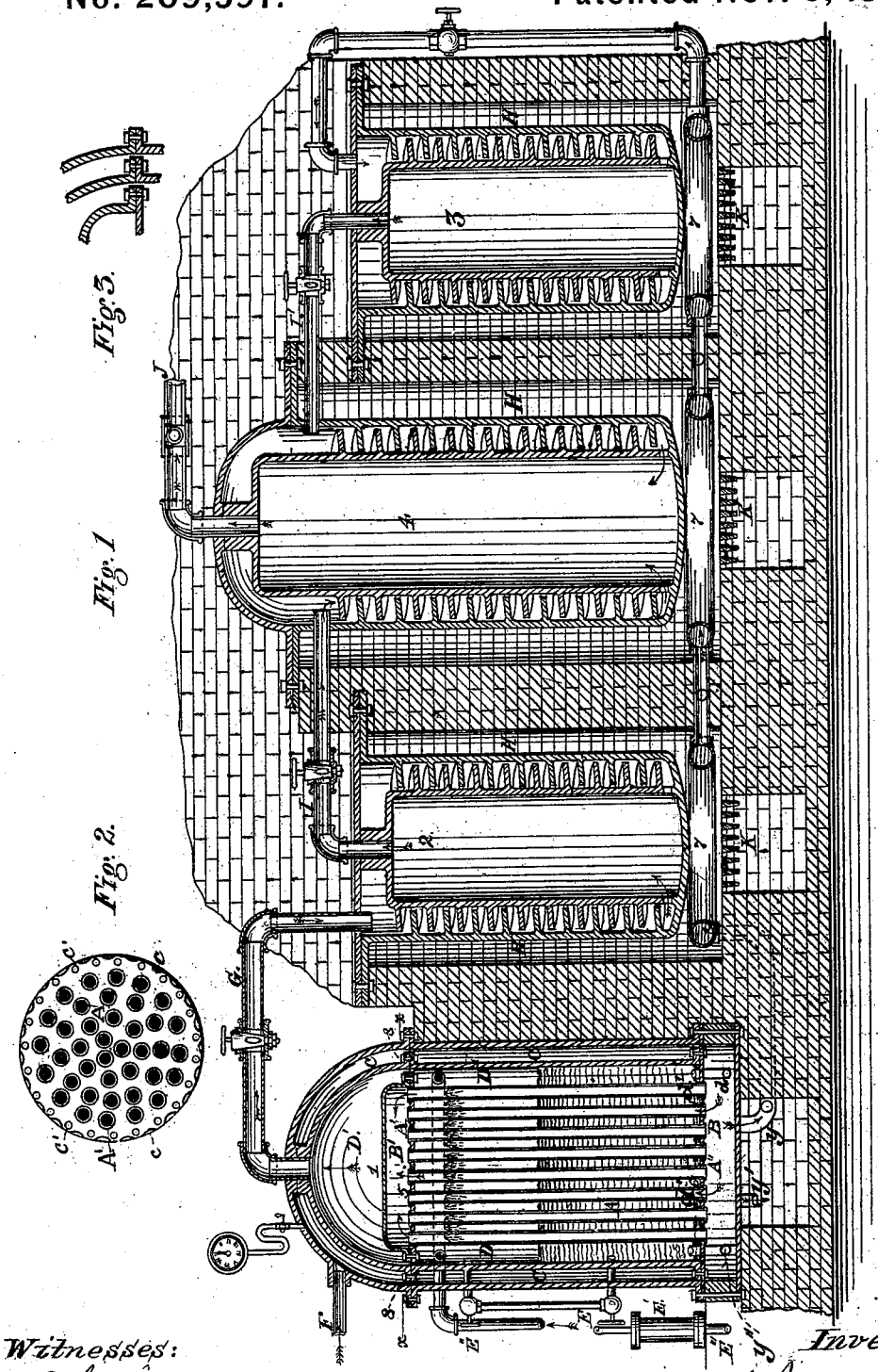
Gas-Generator.

No. 209,597. Patented Nov. 5, 1878.

Fig. 3.

Fig. 1

Fig. 2.



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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN GAS-GENERATORS.

Specification forming part of Letters Patent No. **209,597**, dated November 5, 1878; application filed June 12, 1878.

To all whom it may concern:

Be it known that we, AUGUSTIN I. AMBLER and WILLIAM R. AMBLER, of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Gas-Generators; and we do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

Our invention relates to improvements in the construction of apparatus for generating an inflammable gas or vapor from hydrocarbon-oils and like materials; and the invention consists in certain combinations of parts, consisting of a series of tubes arranged within a cylindrical vessel, and so secured to a head-plate as to rise and fall within the vessel or casing, and thereby allow for the expansion and contraction of the metal without breaking the joints of the tubes; also consisting of two cylinders, arranged one within the other, and provided with a dome having double walls, and connected by hollow bolts or apertures for the passage of the vapors, as hereinafter more fully set forth.

The invention further consists in the combination of the vaporizing-vessel, constructed, as above described, with a series of retorts and superheaters, for the purpose of forming gas in the manner described; and, further, in the combination of the vaporizer, having the series of tubes before referred to, with a layer of mercury superposed on the plate to which the lower ends of tubes are attached, to protect the joints, all as hereinafter more fully set forth.

Figure 1 of the accompanying drawings is a sectional elevation of the apparatus, showing the relations of the parts one to the other. Fig. 2 is a plan view of the lower plate of the upper steam-space, showing the holes and bolts which pass through the parts, uniting the upper and lower plates of the upper steam-space.

The outer rim or periphery of these parts is so connected and made so as to have an even and a movable bearing against the inner surface of the inner vessel, so as to compensate for undue strain resulting from any unequal contraction or expansion of the metal composing the several parts of the machine, and thus avoid leakage in the joints of the tubes A A where they enter the tube-plates above and below; or, instead of the holes, this plate may be corrugated upon the outer rim, and still retain the requisite bearing upon the surface, and allow the vapors to pass from the oil-chamber D to the gas or dome chamber D′ for use, through the corrugations in lieu of the tubes.

In constructing an apparatus of this character, a cylindrical or other suitably-formed vessel is provided, such, for instance, as is shown in Fig. 1. Upon the top of the vessel a dome-shaped cover is secured, by being bolted to a flange formed upon the upper end of said vessel.

Within the vessel above described there is placed another vessel, in all respects like the one described, except that it is of less diameter and length, in order that a chamber, C, may be left between the two, into which steam may be admitted through the pipe F from a common generator or from a superheater arranged in any convenient position outside of the apparatus here described.

The two vessels above described are furnished with perforated heads 5 and 6, as shown in Fig. 1 of the drawings. These perforations are provided with tubes A, which pass through and are secured tightly in said heads; and to prevent leaking of these tubes, quicksilver or other suitable material may be placed in the lower end of the inner cylinder or vessel, D, as shown at *d′*.

At each end of the tubes A there is formed a chamber, B and B′, for the reception and circulation of steam which enters at F. The lower one of these chambers is formed by bolting to the flange formed upon the outer vessel a ring of metal, to the lower edge of which there is secured a sheet of metal, which covers

the lower portion of the chamber. The upper chamber is made by forming a sheet of metal in such a manner as to leave a space sufficient to allow the steam which enters it through the tubes A to circulate freely therein. The interior of the interior vessel forms the chamber D D, for the reception of the hydrocarbons, which may consist of any oils or liquids bearing that name, such as petroleum and other oils and substances capable of being vaporized by the heat imparted from steam in its normal or superheated condition.

In making provision for the introduction of the oils to this chamber a pump, E′, is provided, which may be secured to the wall of the outer vessel or any other suitable support, it being arranged in such close proximity thereto as to allow of its being readily connected to a pipe, E, which is made to enter the vessels by passing through the walls of both, and is then curved around the interior of the inner one, as shown in the drawings, its under surface being perforated with small holes, so that as the oil enters it may be reduced as nearly as possible to the form of spray. This pump may be worked by hand in the usual manner, or it may be driven by machinery, and so regulated in speed as to cause a regular supply of oil, according to the rate of evaporation which is taking place within the chamber.

In order that the height of the oil in the chamber may at all times be known, a glass indicator of any convenient form may be attached to the vessels, as shown in the drawing. A steam-gage may be attached to the steam-space in the dome, as shown.

In practice it will be found necessary to make provision for the escape of any water that results from the condensation of steam in this part of the apparatus; and to accomplish this a pipe, Y′, is secured to the lower head of the steam-chamber B, said pipe being supplied with a cock or valve, (not shown,) which may at any time be opened to allow such water to flow out and be conducted by a pipe to any desired point.

It will also be found necessary in practice to provide for the drawing off from the oil-chamber of the residuum of the oil remaining after all that portion thereof which is capable of being vaporized has been separated; and, in order that this result may be accomplished, a pipe, Y″, is passed through the lower tube-sheet, as shown, and is to be provided with a cock or valve, so that it may be used to conduct the residuum out of the chamber, and to any place where it is desirable to deposit it. The steam passes from the dome steam-space C to the steam-space between the two vessels through the bolts, made hollow for the purpose, which secure the inner portion of the dome to the vessel.

The series of apertures shown in Fig. 2, at *c c*, or hollow bolts *c′*, are for the passage of the gas or vapor generated in chamber D up into the dome or chamber D′, from whence it passes off through pipe G to the retorts for roasting. It is deemed advisable at times, for the purpose of increasing the rate of evaporation, to admit steam into contact with the oil in the chamber D; and, in order that this may be accomplished, there is placed in the lower chamber, B, a pipe, *d*, which is provided with a cock or valve, so that when the steam in said chamber is of sufficient pressure to overcome the weight of the column of oil in the chamber it may be opened, and the steam passed directly into the body of the oil.

The operation of this portion of the apparatus is as follows: The parts having been constructed and arranged as described, the pump E′ is operated so as to force the oil, which may be taken from any suitable receptacle, into chamber D D; and when it has been raised therein to the proper height steam is admitted to the space between the two vessels through the pipe F, which, as above described, is connected to a steam-generator or to a superheating apparatus, the steam filling the space between the two domes, and then passing down through the hollow bolts in the upper and lower head or tube-sheet into the lower chamber, B, passes thence up through the tubes A A into the upper steam-chamber, B′, thus heating the oil in chamber D D to such an extent as to vaporize it, said vaporized portion rising and passing through the apertures *c c′* or hollow bolts into the dome, where it is kept heated by the steam, and from which it passes into the pipe G, through which it passes into the hydrocarbon-retort 2. This retort consists of an outer and inner vessel, the outer one of which is so much larger than the inner one as to leave a chamber between the two. The outer vessel of this retort will be made of cast metal, having heads secured thereto, and having upon its inner surface an inwardly-projecting spiral or worm flange, which reaches nearly to the outer surface of the inner vessel, which is also of cast metal, and has upon its outer surface an outwardly-projecting worm or flange, like the one above described, which is so arranged that in placing the interior vessel in position it can be screwed into the outer one, and thus form a spiral as well as zigzag path for the gas, which is received into a chamber between the upper portions of the two vessels through the pipe G, and after passing down through the spiral passage between the two vessels it enters the interior vessel through an aperture in the bottom thereof, and up through the same, from which it passes through a pipe, I, to what is denominated the "mixing-retort" 4. This retort consists of two vessels, constructed in general like the ones last above described, they being provided with the spiral path and the aperture for the gas to enter the interior vessel, in which the gas is retained until it has been mingled with the requisite amount of hydrogen, as will now be explained.

The hydrogen used in this apparatus is

generated and treated as follows: Steam is taken from the vaporizer or gas-retort first described through the pipe *y* in the bottom of its lower chamber, and is led to the superheating-pipes 7, which consist of coils of pipes placed in or around the furnaces K, as shown in Fig. 1 of the drawing. These furnaces are supplied with fuel, which is ignited, and thus the steam in the pipes is superheated, and at the same time the gas in the retorts 2 and 4 and steam-retort 3 is to a considerable extent heated by the products of combustion which pass up into the chambers H H. After the steam has passed through the series of superheaters 7 7 7 it passes through a pipe which is supplied with a valve for controlling the flow thereof into the retort 3, which is constructed substantially like the gas-retort 2, and from thence it passes in its superheated condition to the mixing-retort 4, where it mingles, and is mixed with the gas therein contained, after which the mixture in the form of a gas is allowed to pass to a gasometer through the pipe J, which is supplied with a valve for regulating its flow.

From the gasometer just alluded to the gas may be taken to any desired location where it is to be used.

This method of treating the hydrocarbon oils of commerce enables the operator to furnish a fuel which is in a very convenient form for use, is more economical in cost than solid forms of fuel, and is freed from many objections which are found to exist in such fuel—as, for instance, when used for melting iron the injurious effects of the sulphur and phosphorus and other debasements contained in coal upon the iron are avoided, and a better quality of iron is the result; and when used in steam-generators, the injurious effects of sulphur, cinders, &c., upon the metal composing the fire-box are avoided. It also makes available a class of substances for fuel which have hitherto been of little or no value.

Another and an important feature is that an illuminating-gas of excellent quality is produced from the materials above alluded to, which will be found to be cheaper than the ordinary kind of gas for that purpose.

An important element of the invention is found in the fact that the plates composing the chamber B′ are so constructed and applied that they have a bearing upon the inner surface of the inner cylinder, but have no vertical fastenings other than that supplied by the fastening of the tubes in the lower steam-plate of the chamber B′. This is done to compensate for the unequal expansion and contraction of the metal in all parts of the machine affecting the same. The heading, of the tubes A A is thus made to fit tight, so as to form a bearing on the inner surface of the inner cylinder or vessel, and the flanges of the inner cylinder or vessel are made to fit tight, so as to form a bearing on the inner surface of the outer vessel, substantially for the same purpose—that is to say, to compensate for any unequal contraction or expansion of the parts and to secure a compact machine. This peculiar construction of the parts referred to is more fully illustrated by Fig. 3 of the drawings, which is an enlarged sectional view of the joints on the line *x x*, Fig. 1.

With a device constructed as described, we are enabled to obtain a perfect circulation of the steam through the parts of the generator to which steam is supplied, and to construct the machine in a solid and compact form, requiring no stay-bolts for staying the parts, not liable to disarrangement of the parts, and easily taken apart for examination and repairs. This construction perfectly protects the tubes A A from undue strain, and from getting out of line in shipping or otherwise. The plates or headings of the tubes are made of iron or copper, and put in as thick as the size and the headings will allow.

Another advantage resulting from the peculiar construction and arrangement of parts is that the gaseous vapors are subjected to a process of expansion and contraction as they pass from one retort to the other, which it is found materially aids in commingling or uniting them to form a permanent gas. Thus the expanded vapors passing from the dome D′ are contracted as they pass through the pipe G and the spiral duct H before entering retort 2, and again expand within said retort, are again contracted as they pass from said retort through the pipe I and spiral duct of retort 4. The same action is going on with the watery vapor or steam as it passes through the superheaters 7 and their conducting-pipes, the retort 3, and the pipe I′, leading from thence into the mixing-retort 4.

If desired, the superheaters 7 may be supplied with iron-filings, and the retort 3 with charcoal or like material well known to the art.

We are aware that apparatus for generating gas from hydrocarbon oils has heretofore been invented, and that the use of tubes through which steam is passed for heating oil is not new at this date. We do not therefore broadly claim such as our invention; but

What we claim as new, and desire to secure by Letters Patent, is—

1. The combination of chamber B′, head-plate A′, and tubes A, constructed as described, and made separate from the inner casing, D, so as to rise and fall within said casing, and allow of the expansion and contraction of the metal without breaking the joints, substantially as set forth.

2. The vaporizing-vessel constructed, as described, of two cylinders, one arranged within the other, and provided with a dome having double walls, in combination with the chamber B′, plate A′, and tubes A, made separate from the inner casing, D, as described, and the spaces being connected by hollow bolts or apertures for the passage of the vapors, substantially as specified.

3. The combination of the vaporizer or oil-

receptacle, the retorts 2, 3, and 4, constructed as described, the superheaters 7 7 7, furnaces K K, and connecting-pipes G I I′.

4. In the vaporizer, constructed as described, the tubes A and plate A″, to which the lower ends of the tubes are secured, in combination with a layer of mercury, *d′*, for the purpose of protecting the joints of the tubes, substantially as set forth.

In testimony that we claim the foregoing as our own we affix our signatures in presence of two witnesses.

AUGUSTIN I. AMBLER.
W. R. AMBLER.

Witnesses:
D. G. STUART,
P. HANNAY.