No. 735,021. PATENTED JULY 28, 1903.

F. E. & F. O. STANLEY.

STEAM GENERATOR.

APPLICATION FILED DEC. 6, 1898.

NO MODEL. 2 SHEETS—SHEET 1.

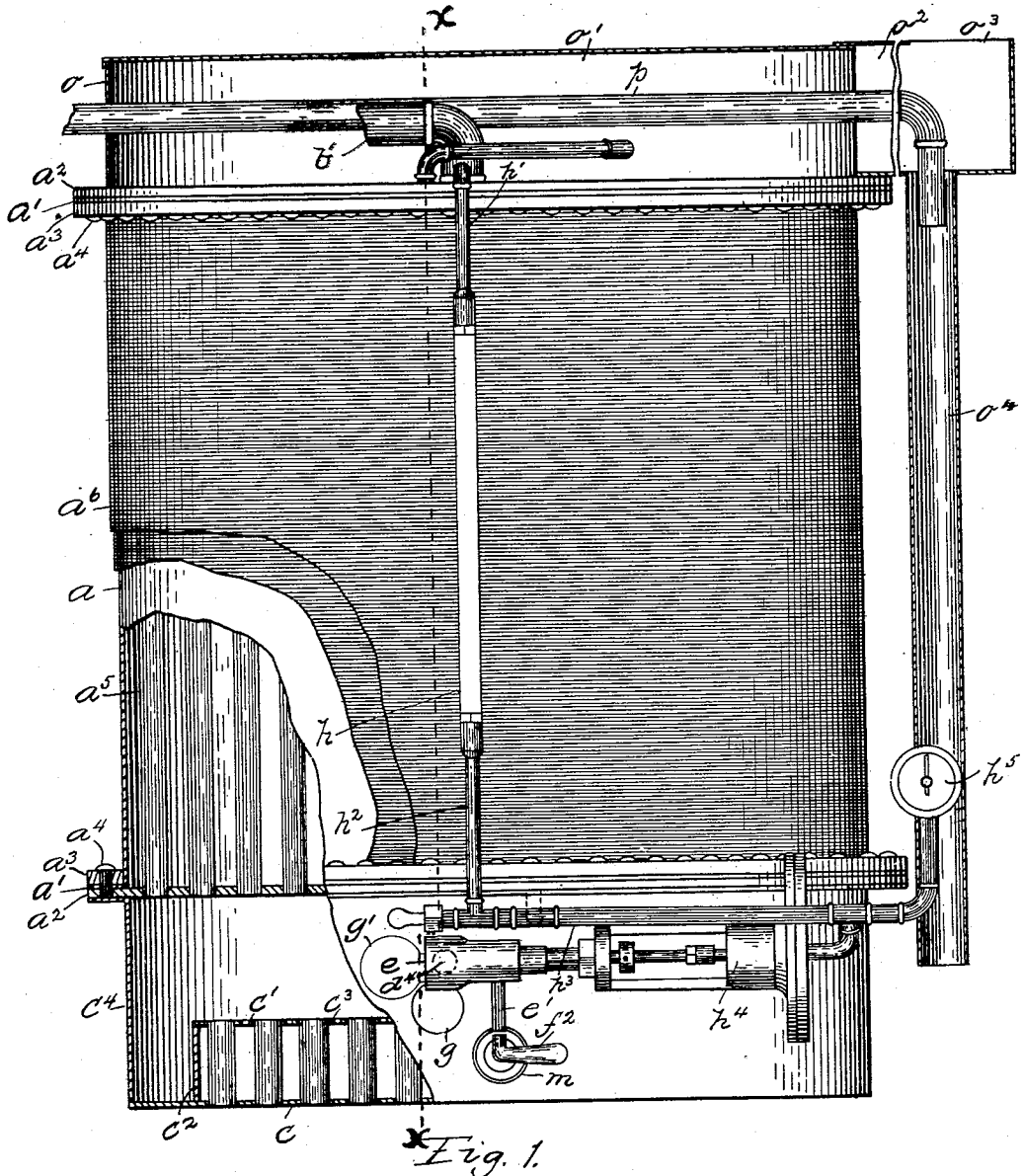

Fig. 1.

Witnesses:

H. B. Davis.

J. L. Hutchinson.

Inventors:

Frank E. Stanley

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NO MODEL. 2 SHEETS—SHEET 2.

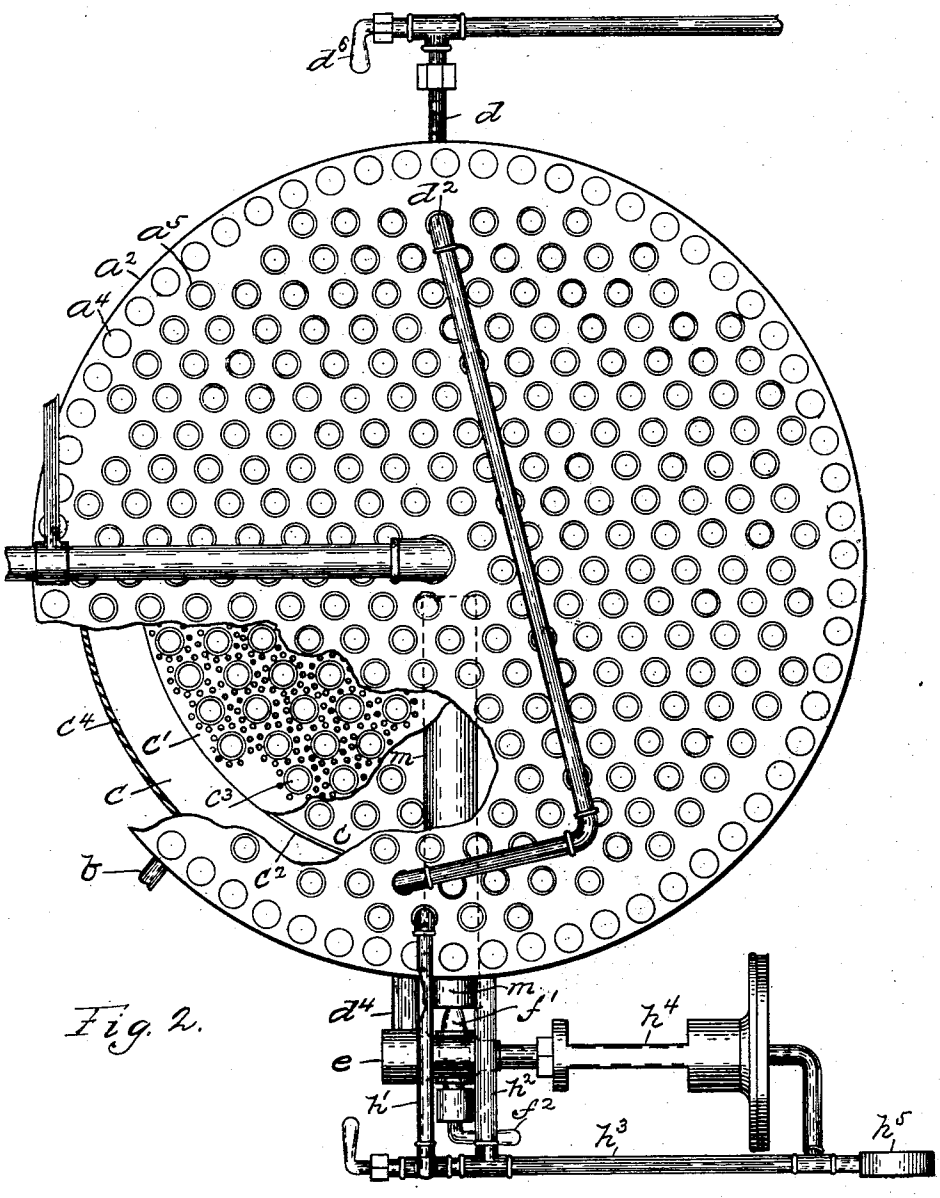

Fig. 2.

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No. 735,021. Patented July 28, 1903.

UNITED STATES PATENT OFFICE.

FRANK E. STANLEY AND FREELAN O. STANLEY, OF NEWTON, MASSACHUSETTS, ASSIGNORS TO THE STANLEY AUTOMOBILE COMPANY, A CORPORATION OF NEW YORK.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 735,021, dated July 28, 1903.

Application filed December 6, 1898. Serial No. 698,448. (No model.)

To all whom it may concern:

Be it known that we, FRANK E. STANLEY and FREELAN O. STANLEY, of Newton, county of Middlesex, State of Massachusetts, have invented an Improvement in Steam-Generators, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

In that class of burners for steam-generators in which a hydrocarbon liquid has been employed it has been common to volatilize the liquid by subjecting the conducting-pipe leading to the burner to the heat of the products of combustion or of the steam. This is effective to the extent of securing the desired combustible vapor during the operation of the burner and the heating of the boiler; but after the flame of the burner has been extinguished and steam is no longer generated the hydrocarbon liquid is no longer volatilized, and special means must be employed to secure this result before the burner can be again ignited. To avoid the necessity of the use of such special heaters, except in starting the burner in the first instance, we conduct the oil-supply pipe through a substance which is heated from the burner and which will retain its heat for a long time, even after the steam in the boiler has practically cooled and condensed, so that a supply of vapor can be had at the burner long after the latter has been extinguished. To this end we make use of the water in the boiler, leading the oil-pipe through the same. The liquid is retained by closing the valve f^2 or d^6, and the water will retain its heat for a lone time after the flame of the burner is extinguished and will be hot enough after steam ceases to be generated to volatilize the oil flowing toward the nozzle at any temperature above the volatilizing-point of gasolene.

One arrangement which has proved very effective is illustrated in the accompanying drawings, in which—

Figure 1 shows in side elevation and partial section a boiler and a hydrocarbon-burner and means for supplying fuel thereto embodying this invention. Fig. 2 shows in plan view and partial section the apparatus shown in Fig. 1, some of the parts being omitted for clearness. Fig. 3 shows in vertical section the apparatus shown in Fig. 2, taken on the dotted line $x\,x$, the boiler being broken away to save space on the drawings.

The tubular boiler will be set upright and will be provided with a supply-pipe b for the water and with an outlet-pipe b' for the steam. A hood o is placed on top of the boiler and is constructed to form a chamber o' above the boiler, a passage o^2 leading laterally from said chamber o', from which an upward passage o^3 leads and also from which a downward passage o^4 leads, the products of combustion thus having two exit-passages. Normally the products of combustion will rise through the upward passage o^3, and to cause them to pass down through the passage o^4 the exhaust-steam pipe p from the engine (not shown) will enter said chamber o' and pass across to the opposite side and then project downward a short distance into the downward passage o^4. When the exhaust is passing down through said passage, the products of combustion will be drawn down with it, drawing also a supply of air in through the passage o^3, which is mixed with the exhaust-steam and modifies the character thereof.

The burner consists of a bottom plate c, provided with a number of perforations, and a top plate c', located a short distance above it and provided with a like number of perforations, and said plates are set in parallel horizontal planes and are secured together by a vertical side wall c^2 of circular shape, thereby forming a vapor-receiving chamber. A number of short tubes c^3 are provided, the ends of which are expanded into the perforations of said top and bottom plates, which provide vertical passages directly through said vapor-receiving chamber, but which do not communicate therewith. These two plates $c\,c'$ are supported by a circular shell or case c^4, which is secured to and depends from the bottom of the boiler, the top plate c' being located a short distance below the bottom of the boiler to provide a combustion-chamber above the vapor-receiving chamber, the top wall of which is formed by the bottom of the boiler and the bottom wall of which

is formed by said vapor-receiving chamber. The top plate c' is formed or provided with a large number of small orifices up through which the vapor from the vapor-receiving chamber passes as it is burned, and said orifices are herein shown as arranged in groups or circles around or concentric to the perforations into which the upper ends of the tubes c^3 are expanded, so that around each short tube or pipe c^3 a large number of small orifices will be located. The short tubes c^3, which pass through the vapor-receiving chamber, open directly into the combustion-chamber and admit a large supply of air, and the vertical tubes of the boiler lead directly from the top of the combustion-chamber and insure a continuous upward draft and carry off the surplus air. The vapor will be forced into the vapor-receiving chamber under pressure and will be caused to pass up through said small orifices and burned in the combustion-chamber, and as the vapor is forced through the orifices an upward draft will be created which draws a supply of air up through the short tubes c^3, which commingles uniformly with the vapor in the combustion-chamber to insure complete combustion on the well-known principle of an Argand burner. The heat which is generated in the combustion-chamber will be conducted up through the tubes of the boiler, being assisted very materially by thus arranging the vapor-burner beneath the boiler and having the air-supply tubes of said burner extended in the same direction as the tubes of the boiler.

The liquid hydrocarbon is contained in a tank (not shown) and is conveyed along a pipe d under suitable pressure, and said pipe d enters the combustion-chamber of the heating apparatus directly beneath the boiler and is connected to the lower end of a vertical pipe d', which may be one of the tubes of the boiler, or it may be a pipe passing up through one of the tubes of the boiler, and said pipe d' is connected at its upper end to a horizontal pipe d^2, which passes along the top of the boiler, through the chamber o' to the opposite side thereof, and its opposite end is connected to the upper end of a vertical pipe d^3, which, like the pipe d', may be one of the tubes of the boiler, or it may be a pipe passing down through one of said tubes, and the lower end of said pipe d^3 terminates within but near one side wall of the combustion-chamber and is connected by a short pipe d^4 with a valve-casing e, which has depending from it a short pipe e', the lower end of which is connected with a valve-casing f, having a delivery-nozzle f' at one end, which is provided with a shut-off valve f^2. A passage is thus provided from the pipe d to the delivery-nozzle f, and the valve f^2 controls the delivery. An auxiliary valve d^6 is also provided in the pipe d, which controls the supply of liquid hydrocarbon. The boiler is in the first instance heated by any suitable means, and as the water contained in the boiler increases in temperature the liquid hydrocarbon which passes along the pipe d and up the vertical pipe d', and so on, along the said passage will soon become volatilized by the heat of the water of the boiler, and the volatilized liquid or vapor will enter the valve-case e preparatory to being forced into the vapor-receiving chamber to be burned; yet the temperature of the contents of the boiler is not sufficient to carbonize the liquid hydrocarbon.

A tube m is contained in the vapor-receiving chamber, which is made quite large in diameter and of sufficient length to project through the side wall of said chamber and to terminate at or near the middle of said chamber, and said tube is open at each end, although it may have a number of openings within the vapor-receiving chamber, if desired. The delivery jet or nozzle f' enters the outer end of the tube m, but only a short distance, and said delivery jet or nozzle is considerably smaller in diameter than said tube m, so that an ample air-supply passage is provided around said jet or nozzle, and as the vapor is forced into the tube m under pressure a supply of air will be drawn in with it, which mingles with it, and consequently mixed vapor and air will be delivered to the vapor-receiving chamber. The vertical air-tubes c^3, before referred to, will provide additional supplies of air, and the quantity of air thus supplied will be sufficient to enable a blue, or what is commonly called a "colorless," flame to be at all times secured, thus obviating the production and deposit of carbon on the bottom of the boiler or within the tubes of the boiler.

In starting the apparatus the valve f^2 will remain closed, and a flame—such, for instance, as from a torch—will be temporarily introduced into the combustion-chamber through an aperture g, which is normally closed by the cap g' and held in juxtaposition to the pipe d^4 until such time as said pipe shall become heated sufficiently to volatilize the liquid hydrocarbon, forcing the liquid hydrocarbon back as the vapor is generated. Then the valve f^2 will be opened and the vapor caused to enter the vapor-receiving chamber through the tube m, being delivered at or near the middle of the chamber, and the vapor then passes up through the orifices in the top plate and will at once become ignited and begin to heat the water in the boiler, and thereafter as the water heats, the pipes which pass through the boiler and which provide a passage for the liquid hydrocarbon soon become heated sufficiently to volatilize said liquid hydrocarbon, causing it to pass continuously in a volatilized condition into the vapor-receiving chamber.

The vapor will be burned in the combustion-chamber, and the air-supply will be sufficient to mix with the vapor at a proper ratio to insure complete combustion, and as a large number of air-inlet passages are provided which are well distributed throughout the

combustion-chamber and located adjacent the vapor-orifices the air and vapor will be very uniformly and thoroughly commingled.

Any suitable form or construction of water-gage may be provided, and herein an ordinary glass gage h is connected into the pipes h' h^2, which are connected with the top and bottom of the boiler, and said pipe h^2 has leading from it a short pipe h^3, which is connected with a regulator-valve h^4 of any well-known or suitable construction, and said pipe h^2 also has connected with it a steam-gage h^5 of suitable construction. The regulator-valve h^4 is provided for the purpose of automatically controlling the supply of vapor to the vapor-receiving chamber by reducing the supply to the minimum when the steam-pressure in the boiler arrives at a predetermined point.

By the arrangement described after water in the boiler is once heated if the flame is extinguished the heat of the water will suffice to volatilize the oil in that part of the pipe within the water-space and retained therein by the cock or valve f^2, arranged between the burner and boiler, so that the burner can be relighted long after the other parts of the apparatus have cooled off and until the water in the boiler is below the volatilizing-point of the oil.

We do not here claim the construction or combination of boiler and burner shown, this being the subject of our Letters Patent No. 661,561, dated November 13, 1900, and No. 637,176, dated November 14, 1899, nor do we claim the upwardly and downwardly directed outlet-passages with the exhaust-steam entering into the downwardly-directed passage, since the same are covered in another application divided from this application.

We are aware that it has been proposed to arrange the oil-supply pipe for a vapor-burning generator upon the outside of the boiler in juxtaposition with the water-space of the boiler to maintain the vaporization of the oil for a time after the fire under the boiler has been extinguished, for the water retains its heat for a considerable time after the fire has been extinguished. By the arrangement here disclosed, however, the oil-pipe passing directly in or through the water-space of the boiler is more effectively acted upon by the contained water than would be the case were the pipe upon the outside of the boiler. The oil-pipe is also directly acted upon by the products of combustion in the hood o' when the burner is lighted.

Without limiting ourselves to the precise construction and arrangement of parts shown, we claim—

1. The combination with a steam-generator, of a burner for heating the same having a chamber to receive a mixture of vapor and air, a continuous oil-supply pipe leading to the burner and passing through the water-space of the generator, and a valve in said pipe between the generator and burner, substantially as described.

2. The combination with a steam-generator, of a burner for heating the same having a chamber to receive a mixture of vapor and air, a chamber through which the products of combustion pass, and a continuous oil-supply pipe for said burner passing through said chamber and through the water-space of the generator.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

FRANK E. STANLEY.
FREELAN O. STANLEY.

Witnesses:
B. F. BACON,
CHARLES F. BACON.