No. 626,163. Patented May 30, 1899.

C. Q. HAYES.

STEAM GENERATOR.

(Application filed June 22, 1898.)

(No Model.)

Fig. 1.

Fig. 2.

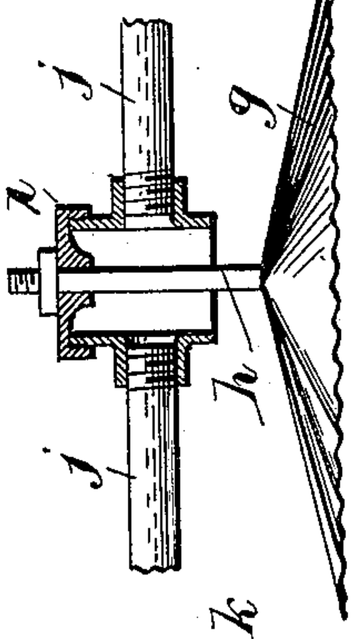


Fig. 3.

Fig. 4.

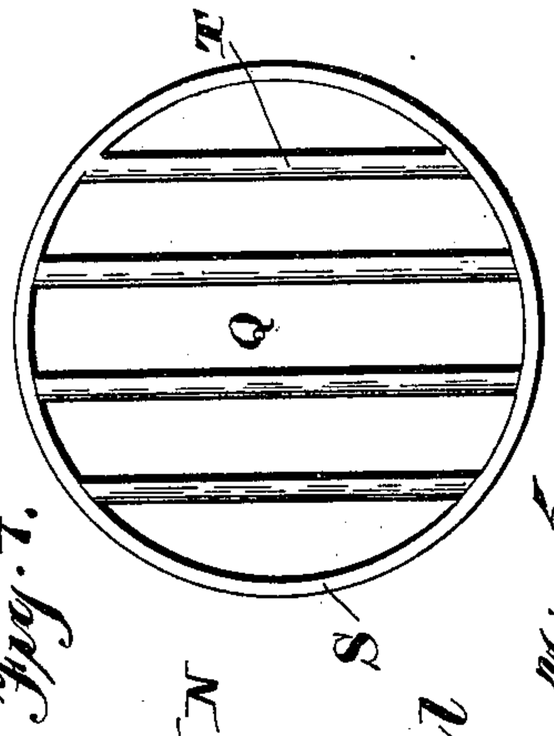


Fig. 5.

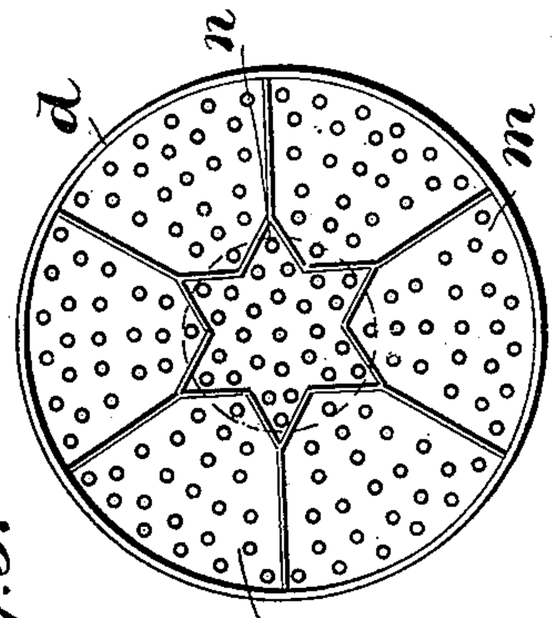


Fig. 6.

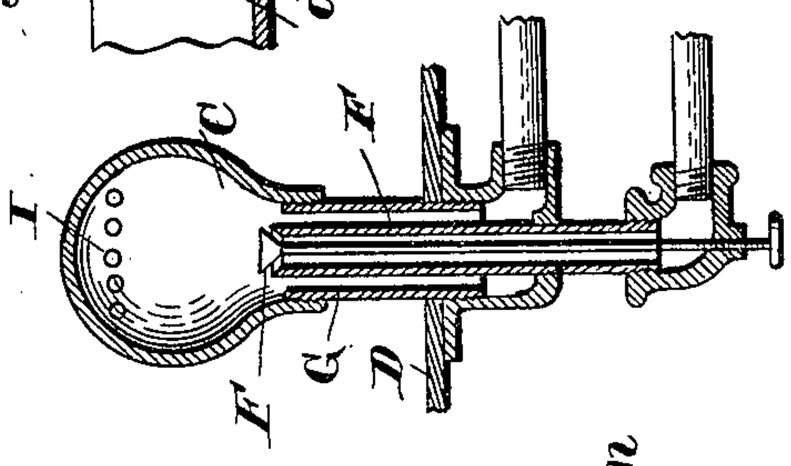
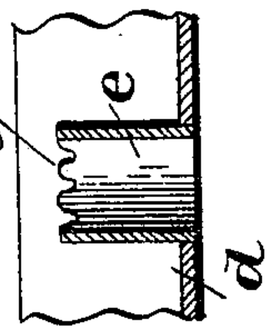


Fig. 7.



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UNITED STATES PATENT OFFICE.

CALVIN Q. HAYES, OF GRAND FORKS, NORTH DAKOTA.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 626,163, dated May 30, 1899.

Application filed June 22, 1898. Serial No. 684,153. (No model.)

To all whom it may concern:

Be it known that I, CALVIN Q. HAYES, a citizen of the United States, residing at Grand Forks, in the county of Grand Forks and State of North Dakota, have invented new and useful Improvements in Steam-Generators, of which the following is a specification.

My invention relates to improvements in steam-generators, and pertains to a construction adapted especially to be used for the generation of steam, but which may be used for the purpose of heating air or gases, all of which will be fully described hereinafter, and particularly referred to in the claims.

The primary object of my invention is to provide a large area of heating-surface which is subjected to the direct combustion of a burner, whereby not only the heating-surface is heated to a high degree, but by means of which there may be a quick generation of steam at a minimum consumption of fuel.

Another object of my present invention is to provide a steam-generator or air-heater in which a burner is situated in a furnace in direct communication with a heating-surface to which the water and vapors generated therefrom are subjected for quickly generating steam with the consumption of a comparatively small quantity of fuel.

The object of my invention also pertains to the construction and arrangement of parts hereinafter fully shown and described.

In the accompanying drawings, Figure 1 is a central vertical sectional view of an apparatus embodying my invention. Fig. 2 is an enlarged sectional view of the water-feeder, and Fig. 3 is a plan view of the extensible water-feeding pipe. Fig. 4 is a top plan view of the grate which supports the heating-surfaces. Fig. 5 is a top plan view of a water-disseminator which is situated over the heating-surfaces. Fig. 6 is an enlarged sectional view of the burner. Fig. 7 is an enlarged detail sectional view of one of the short tubes *e*.

Referring now to the drawings, A indicates a casing or boiler, in the lower end of which is situated a chamber B, forming a burner-furnace. This burner-furnace or chamber B is of a smaller diameter than the interior diameter of the casing or boiler A, the relative sizes of the furnace and boiler being about that here shown, though it may be varied without affecting my invention.

Situated at the lower end of the furnace or chamber B is a burner C. This burner and attachments are connected to a plate D, that is bolted to the bottom of the furnace, whereby the plate may be detached, and with it the burner, for the purpose of repairing or cleaning. The burner consists of a central oil-feeding tube E, having a valve F, by means of which a fine stream of oil may be fed under pressure from a pump, and G is an air-inlet which surrounds the oil-inlet within the burner B, as clearly shown in Fig. 6, through which air is also forced by means of a pump or other suitable agency. The oil and air being forced through these tubes and a proper quantity of air supplied practically a smokeless blue flame can be maintained under the forced draft. The burner-casing C is provided with a plurality of openings I, through which the air or products of combustion pass within the furnace or chamber B. An opening J with a tube is provided at the lower end of the chamber or furnace, and this opening is adapted to be closed or opened through the medium of a slide-valve K, and through this tube when the slide-valve is opened a torch may be inserted for the purpose of igniting the burner. After its ignition the slide will be closed, and, if desired, this slide may be provided with a peep-hole of mica or glass, whereby the operator may look through the opening and ascertain the condition of the burner. The upper end of this chamber or furnace B is flared outward, as shown at L, and at a point below this flared portion the furnace is provided with a crown-sheet or head M for catching any water that falls from the heating-surfaces N thereabove. Projecting upward from this crown-sheet is a plurality of tubes P, which project above the upper flared end, as shown, and have their ends turned slightly laterally, as shown at *a*, for the purpose of preventing the dripping therein of water. There are preferably as many of these tubes as can be placed in the crown-sheet to be at the same time water-tight. A grate Q is within the boiler at a point above these tubes P and supported upon brackets *b*. This grate consists of a

ring S and cross-bars T, the latter being slightly concaved to hold a small quantity of water to prevent them from becoming overheated and bending downward under the weight of these heating-surfaces N, which are placed upon and supported by this grate, as clearly shown. These heating-surfaces N consist of woven wire of a proper size, one being placed upon the other, whereby an enormous amount of heating area is provided, the water falling upon these woven-wire sheets in a manner to be now described. Situated above these heating-surfaces and either supported directly by them or by brackets *c* is a pan *d*, provided with a plurality of upwardly-projecting tubes *e* of a height less than the depth of the pan, as shown. The edges of these tubes are corrugated, as shown at *f* in Fig. 7, whereby the water runs over the ends of these tubes and is divided into small streams by the corrugations and falls upon the heating-surfaces or wire sheets N. The steam generated by the heating-surfaces passes upward through these tubes *e*, as will be readily understood. Supported above this pan is a circular spreader *g*, preferably corrugated radially and feeding the water outward from its center in small streams. This spreader is supported through the medium of a rod *h*, secured to a connection *i*, and projecting laterally from this connection *i* are water-feed pipes *j*, which have their ends communicating with the space *k* between an outer casing or shell *l* and the boiler proper, A. The water flowing from the inner ends of these pipes falls upon the top of the spreader and from the spreader falls into the pan *d* and from the pan upon the heating-surfaces, as before stated. This pan *d* is divided into a plurality of compartments *m*, as shown clearly in Fig. 5, the dotted line *n* in this figure representing the diameter of the spreader *g* and from which it will be seen that a part of the water from the spreader falls into the several compartments. The object of dividing this pan into compartments is to insure an equal distribution of the water from the spreader into the several parts of the pan should the boiler be used upon a boat, and thus be in motion. This will insure a more equal distribution of the water from the pan through its numerous tubes upon the heating-surfaces than would otherwise be possible when the boiler is used upon a movable base such as a boat. When the boiler is used as a stationary boiler, these compartments may be omitted and also the spreader *g* may be omitted and water fed directly to the pan through one or more pipes, as may be desired. An automatic blow-off K′ is provided for the space between the furnace B and the boiler, the said blow-off being one of common form and need not therefore be described or shown in detail here, it forming of itself no part of my present invention. The object of this blow-off is to prevent such an accumulation of water between the furnace and the boiler as to run over into the pan M, forming the top of the furnace B. Also the surrounding shell *l* may be omitted without departing from the spirit and scope of my invention, it being preferred, however, and by means of which the water has an initial heating before passing to the heating-surfaces N.

In operation water is forced between the boiler and shell until it overflows through the feed-pipes R upon the spreader *g* and from thence into the pan, and from the pan it is distributed upon the heating-surfaces N. The upper end of the boiler A is provided with several openings 3, through which steam passes into the space between the boiler, thus equalizing the pressure upon the water, whereby it will flow through the feed-pipes R, as will be readily understood by those skilled in the art. The oil and air supplied to the burner, and also an air-pipe 4 may be provided for the furnace B, are forced into the furnace under pressure by any well-known mechanism such, for instance, as a pump, preferably about equal to the pressure of the steam, and when forced into the chamber quickly expands and creates in this chamber a pressure which will be greater than the pressure of steam above, and thus prevent the steam from passing through the pipes P into the furnace B. When the shell *l* is omitted, water will be forced directly by a pump through the feed-pipe R into the boiler. The products of combustion from the burner are not of necessity nor intentionally mixed with the steam, though of course whatever products of combustion pass through the pipes *a* will combine with the steam.

The apparatus will be provided with safety-valves, blow-off pipes, and steam connections, the same as boilers are usually provided with, and which need not be here shown or described, they being well understood by those skilled in the art.

In order to enable the feed-pipe *j* to be placed within the upper end of the boiler, short sections *j′* screw into the ends of these pipes, whereby the pipes may be expanded or contracted for the purpose of placing them into the boiler and then expanding them outward through the openings provided therein for their ends, as illustrated in Fig. 1.

A boiler constructed as herein shown and described has an enormous heating-surface which is subjected to the direct heat from a burner and enables a large quantity of water to be converted into steam and also enables me to generate steam very rapidly at a minimum cost or consumption of fuel.

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

1. A boiler having a burner-furnace in its lower end provided with a top and communicating with the upper portion of the boiler, a

burner situated in the furnace, a plurality of heating-surfaces within the boiler above the furnace, and means for feeding water to the heating-surfaces, substantially as described.

2. A boiler having a furnace at its lower end, the top of the furnace being in pan fashion with projecting tubes, a burner within the furnace, a plurality of heating-surfaces above the top of the furnace, and means for supplying water to the heating-surfaces, substantially as described.

3. A boiler having a burner-furnace in its lower end, the top of the furnace being of pan fashion and provided with a plurality of projecting pipes forming communication between the furnace and the upper portion of the boiler, the pipes projecting above the pan-shaped top of the furnace, heating-surfaces situated above the furnace, and means for supplying water to the heating-surfaces, substantially as described.

4. A boiler having a burner-furnace in its lower end provided with a pan-shaped top, a plurality of tubes passing through the pan-shaped top and extending above the top thereof, the upper ends of the tubes extending laterally, a plurality of heating-surfaces situated above these tubes, and means for feeding water to these heating-surfaces, substantially as described.

5. A boiler having in its upper portion a plurality of woven-wire heating-surfaces, means for distributing water to these heating-surfaces, and a heater for the heating-surfaces, substantially as described.

6. A boiler having in its upper portion a plurality of horizontal woven-wire heating-surfaces, a burner situated below the heating-surfaces and directly heating them, and means situated above the heating-surfaces for distributing water over the surfaces thereof, substantially as described.

7. A boiler having in its upper end heating-surfaces composed of woven wire, a burner situated below the woven wire for heating the same, and a water-distributer situated above the heating-surfaces, substantially as described.

8. A boiler having a heating-surface in its top, a water-distributer comprising a pan with a plurality of pipes projecting therefrom and of a height less than the depth of the pan, a heater, and a water-feeder communicating with the pan, substantially as described.

9. A boiler having a heating-surface in its top, a water-distributer comprising a pan divided into a plurality of compartments, each compartment having a plurality of projecting tubes of a height less than the depth of the pan, a heater for the said surface, and a means for feeding water to the several compartments of the pan, substantially as described.

10. A boiler having in its upper end a heating-surface, a water-distributer comprising a pan having a plurality of projecting tubes of a height less than the depth of the pan, the pan divided into compartments, and a spreader situated above the pan adapted to feed water to the several compartments of the pan, substantially as described.

11. A boiler comprising a plurality of heating-surfaces situated in its upper end, a water-disseminator situated above the pan, a shell surrounding the boiler forming a water-space, and water-feed pipes communicating with the said space and feeding water to the said disseminator, substantially as described.

12. A boiler having a heating-surface, a water-disseminator consisting of a pan provided with a plurality of projecting tubes of a height less than the depth of the pan, the upper edges of the tubes being corrugated, and means for feeding water to the pan, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CALVIN Q. HAYES.

Witnesses:
H. L. WHITHED,
S. S. TITUS.