





# UNITED STATES PATENT OFFICE.

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## STEAM-GENERATOR.

No. 825,649.

Specification of Letters Patent.

Patented July 10, 1906.

Application filed March 31, 1902. Renewed November 7, 1904. Serial No. 231,680.

*To all whom it may concern:*

Be it known that I, RENÉ HENRY, a citizen of the Republic of France, residing at Montreal, in the district of Montreal, Province of Quebec, Canada, have invented certain new and useful Improvements in Steam-Generators, of which the following is a specification.

My invention relates to improvements in steam-generators, particularly referring to the circulating-tubes therefor; and the object of the invention is to provide a quick generator cheap to manufacture, whereby the arrangement of the tubes will facilitate the circulation of the water and steam in such a manner as to insure economy in fuel and render the repairing or replacing of a tube a simple matter; and it consists, essentially, of a plurality of tubes having closed outer ends, one or more heads provided with an internal passage, a plurality of plugs extending across the said passage in alignment with the tubes and designed to support centrally lesser tubes open at both ends and projecting into the aforesaid tubes, suitable plugs closing the entrances in the head or heads to each open plug, and a steam-reservoir surmounting the tubes, the various parts being constructed and arranged in detail, as hereinafter more particularly described.

Figure 1 is a perspective view of my generator, partially in section, showing several heads joined together with the outer edge wall removed. Fig. 2 is an enlarged sectional detail of the stops, plugs, tubes, and portion of a head. Fig. 3 is an enlarged sectional front elevation of a head broken away. Fig. 4 is an enlarged detail of a plug with a portion of the inner tube.

Like letters of reference indicate corresponding parts in each figure.

*a* represents the heads, which are preferably serpentine in shape, having the passage *b* cored out to the full extent of their length.

*c* represents orifices leading into the passage *b* and arranged alternately in vertical rows.

*d* represents corresponding orifices from the passage *b* and converging slightly toward their outer ends.

*e* represents tubes closed at one end and at the other inserted into the orifices *d*, so as to extend inwardly therefrom. The tubes *e* flare

outwardly somewhat at their open end to correspond with the taper in the orifices *d* in order to facilitate the removal of the tubes from the head.

*f* represents hollow or open tubes having the diagonal partition-wall *g* and the orifice *h* therethrough. The plugs *f* are designed to be inserted in the orifices *c* and extend across the passage *b* and enter the orifices *d*.

*j* represents inner tubes open at both ends and supported in the central orifices *h* of the plugs *f* and extending into the tubes *e* in proximity to the closed end.

*k* represents solid plugs, preferably threaded and screwed into the orifices *c*.

*l* is a steam-reservoir above the tubes *e* in the heads *a*, communicating from head to head and suitably closed at each end.

*m* is a tie-rod extending through the steam-reservoir and designed to hold the several heads *a* securely together.

It must be here understood that in the outside heads the closed end of the reservoir may be solid with the casting or provided with removable cover-plates.

*n* represents feed-pipes leading from a common feed into the various heads at their lowermost ends immediately beneath the bottom tube.

Having described the various parts in detail, I shall now more particularly explain the device in operation. The water is turned on into the common feed-pipe and branches off into the several feed-pipes *n*, filling the lowermost end of each head *a*, and, continuing its flow, passes through the inner tube *j*, the mouth of the latter being flush with the partition-wall *g*. The flow continuing, the water passes out of the inner tube and is turned backwardly by the closed end of the outer tube *e*. The stream now, finding a passage between the outer and inner tubes, flows on in its return until its course is obstructed by the partition-wall *g*, the latter turning it upwardly, where the wall *g* again provides an obstruction from its under side, the water finds an opening in the orifice *h*, leading to the inner tube next above the one it has been through. The further passage up the series of tubes is similar until within a certain number of the top, when the plug *f* is placed in reverse position, closing the opening beneath into the inner tube, and thus directing the steam which has been generated from the



water into the outer tube first and returning the same through the inner tube to pass through the orifice *h*, which has been converted from an inlet to an outlet by the reversal of the plug *f*.

It will be seen from the foregoing description that the position of the partition-wall is the main feature in the reversal of the circulation, for the mere turning around of the plug a half-turn from its first position presents on the lower side a passage outside the inner tube instead of into it—that is, the partition-wall and the inner tube serve to guide the steam or water into the outer tube.

The plug *k* is firmly screwed into the orifice *c* and abuts the outer side of the plug *f* to hold the latter securely in the position desired, and as the opposite end of the plug abuts the edges of the casing of the tube *e* the latter by reason of its flaring ends against the tapered orifices *d* is held firmly in place.

The removal of the various parts for replacing or repair is a very salient feature in my device. For instance, on the removal of a plug *k* the plug *f* may be drawn out, carrying with it the inner tube *j*. The orifice is then free, and the tube *e* can be removed with ease, for the flaring open end of the tube abuts the converging portion of the orifice. The withdrawal of the plug *f* removes the pressure on the end of the tube, leaving it comparatively loose in the orifice to be taken out.

It must be understood that I do not confine myself in construction to this tapered joint, as many other ways may be adopted equally efficacious.

The position of the tubes makes it impossible for the combustible properties from the fire to ascend in any but a tortuous passage, thus securing the full advantage of a large heating area.

The reversal of the plugs leading to the upper tubes is for the purpose of superheating the steam, and though it cannot be accurately stated, yet it is supposed that the water is flashed into steam very soon after entrance.

The application of this system of circulating-tubes need not necessarily be confined to a generator, as illustrated, as it will be readily understood that it may be used in an ordinary water-tube boiler, or for radiators, or in fact, in any case where such circulation is a necessity.

I have shown in Fig. 1 the steam-pipe *o* from the end of the steam-reservoir *l*, whereas in Fig. 3 I have shown the said pipe from a different point and have replaced it with a pipe *p* in order to explain more clearly the conversion of the generator as described from a flash-boiler to an ordinary water-circulating-tube boiler.

Instead of further illustration a few words will explain that the introduction of my cir-

ulation to a regular steam-boiler with water-tubes is a simple matter. The heads will be exactly as described and the circulation the same, and the only difference will be a quantity of water above and below the tubes, as usual in steam-boilers. The circulation will differ from steam-boilers known, as it does not pass clear through the tubes, but returns to the head after passage through the tubes, as fully explained in the foregoing.

In further reference to the adoption of my circulation-tubes I may mention that the facilities provided for easy repair and the certainty of a perfect circulation in each series make this system very valuable for hot-water furnaces used in heating houses by gas, for ammonia-condensers, for ice and refrigerating plants, particularly as to the elimination of the joints, for surface condensers for condensing-engines, for feed-water heaters, for serpentine for alcohol distilleries and breweries, rendering it easy to clean the tubes inside, which is now impossible.

Another point to emphasize in my generator is the advantage of passing the water first through the inner tube in entrance, and thus heating it before it comes in contact with the outer tube.

A suitable valve is necessary for the feed where this generator is used for other than stationary engines in order to insure the regularity of feed to the several heads; but as such is of necessity a separate application I shall not go into further particulars herein more than merely mentioning that for marine purposes my generator will not fail through want of a proper feed.

What I claim as my invention is—

1. In a steam-generator, a head having a passage extending lengthwise thereof and having ingress and egress openings, a plurality of open plugs provided each with an orificed wall and dividing said passage into a number of compartments, a series of tubes closed at one end, extending from said head and in communication with said passage on one side of said walls, and a number of lesser tubes open at both ends and lying within the closed end tubes, said lesser tubes being in communication with said passage on the other side of said walls through the orifices thereof, substantially as described.

2. A steam-generator comprising a plurality of hollowed heads serpentine-shaped and provided with orifices therethrough in the bellying portions of the serpentine, a plurality of tubes projecting from the orifices, and closed at one end, plugs designed to partition the hollow in the head, a diagonal obstructing-wall carried by each plug, a plurality of lesser tubes extending into the aforesaid tubes and supported by the partition-plugs, and inlets to the several heads and outlets from the same, as and for the purpose specified.



3. In a device of the class described, the combination with a casing having a suitable furnace-chamber and flue therefrom, of a plurality of hollowed heads secured together and provided with lateral orifices converging slightly toward their inner end, a plurality of tubes closed at one end and beveled at opposite ends and projecting from the said orifices, a plurality of reversible partition-plugs having each a single inclined deflecting-wall dividing the passages into compartments, a plurality of lesser tubes supported from an orifice in the deflecting-wall, a steam-reservoir and suitable plugs for the entrances to the partition-plugs, as and for the purpose specified.

4. In a device of the class described, the combination with a casing having a suitable furnace-chamber and flue therefrom, of a head having one or more serpentine passages therethrough and provided with lateral orifices leading to and from the said passages, a plurality of tubes closed at one end and projecting from the said orifices, a plurality of partition-plugs in the serpentine passages having each an inclined deflecting-wall, said walls dividing the passages into compartments, a plurality of lesser tubes supported by the said plugs and extending into the aforesaid tubes, and suitable plugs for the entrances to the tubes and partition-plugs, as and for the purpose specified.

5. In a device of the class described, a casing having a suitable furnace-chamber and flue therefrom, a plurality of heads having serpentine passages therein and provided with orifices therethrough, a plurality of tubes closed at one end and projecting from the said orifices, a plurality of partition-plugs having a diagonal obstructing-wall with an orifice therethrough, a plurality of lesser tubes supported from the orifice of the said partition-plug, and extending into the aforesaid tubes, a plurality of stops for the entrances to the partition-plugs of the tubes, and a steam-reservoir, as and for the purpose specified.

6. In a device of the class described, the combination with a hollowed head having orifices leading thereinto provided with screw-plugs, of an open plug having an oblique solid portion designed to partition the hollowed heads, a tube closed at one end and projecting from the head, a lesser tube open at both ends and inserted through the plug and extending into the aforesaid tube, and suitable inlets and outlets, as and for the purpose specified.

7. In a device of the class described, an open plug having an oblique solid portion extending from end to end designed to form an

obstructing-wall and provided with a central orifice therethrough, a casing, a tube closed at one end and projecting from the said casing, a lesser tube extending into the aforesaid tube from the orifice in the plug and suitable inlets and outlets, as and for the purpose specified.

8. In a device of the class described, a plug having an oblique solid portion provided with a single orifice therethrough, a casing, a tube closed at one end and inserted in said casing at the opposite end, a lesser tube extending into the aforesaid tube from the orifice in the said solid portion of the plug, suitable inlets and outlets and screw-plugs designed to close the opening to the aforesaid open plugs, as and for the purpose specified.

9. In a device of the class described, in combination, a head provided with an internal passage, having orifices therethrough, a plurality of open plugs provided with a partition-wall, and an orifice in the said wall, a series of tubes, a plurality of lesser tubes extending into the aforesaid tubes from the open plugs, said plugs dividing said internal passage into a number of compartments communicating one with the other through said tubes, a suitable inlet to the internal passage, and a return-pipe from the said passage above the tubes to below the same, as and for the purpose specified.

10. In a device of the class described, in combination, a hollow serpentine head having orifices therethrough, a series of tubes closed at their free ends, a plurality of open plugs having a diagonal obstructing-wall, a plurality of lesser tubes extending through the said partition-wall into the aforesaid tubes, suitable chambers above and below the tubes, and outlets and inlets respectively therefrom, as and for the purpose specified.

11. In a device of the class described, a plurality of heads hollowed and having communicating passages at the top thereof, a plurality of open plugs having diagonal partition-walls designed to divide the hollow head into compartments, a plurality of series of tubes closed at their free ends, a plurality of lesser tubes extending through the partition-wall of the open plugs into the aforesaid tubes, suitable inlets and outlets from said hollow heads, and a plurality of solid plugs in the orifices in the face of the head, as and for the purpose specified.

Signed at Montreal this 29th day of March, 1902.

RENÉ HENRY.

Witnesses:

LLOYD BLACKMORE,  
GRAHAM CURTIS.