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T. CLARKSON

STEAM GENERATOR OR WATER HEATER

Filed Jan. 23, 1924

2 Sheets-Sheet 1.

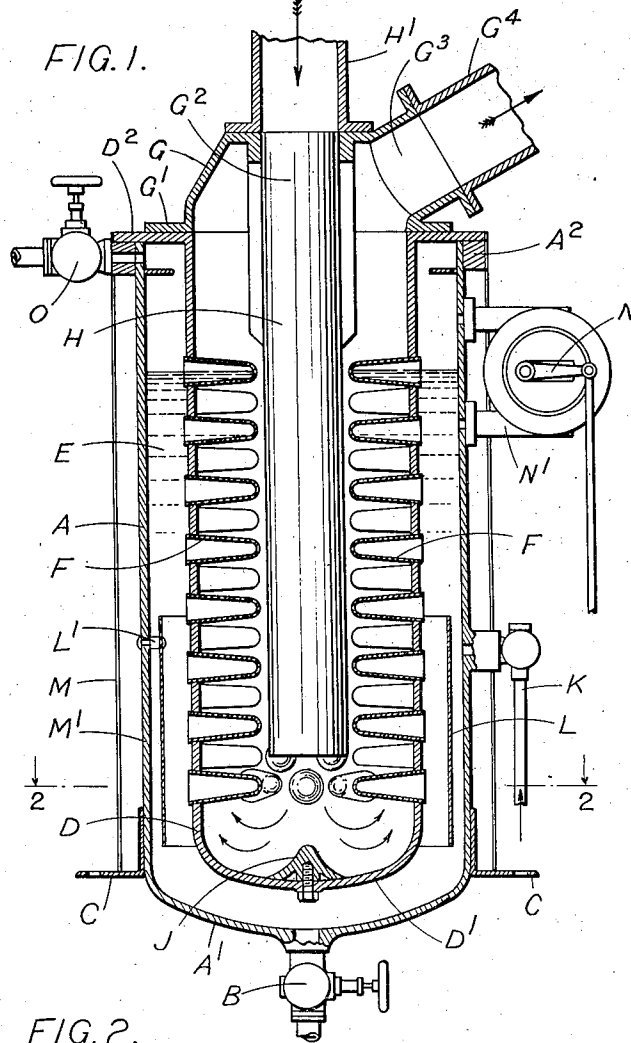
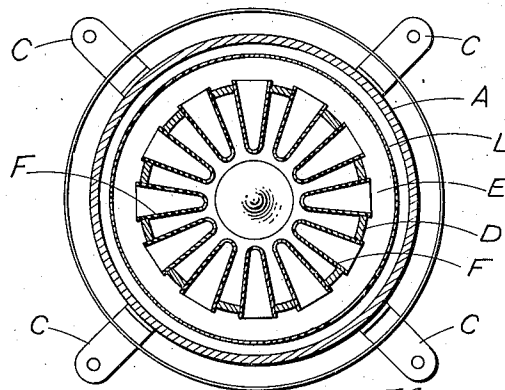


FIG. 2.



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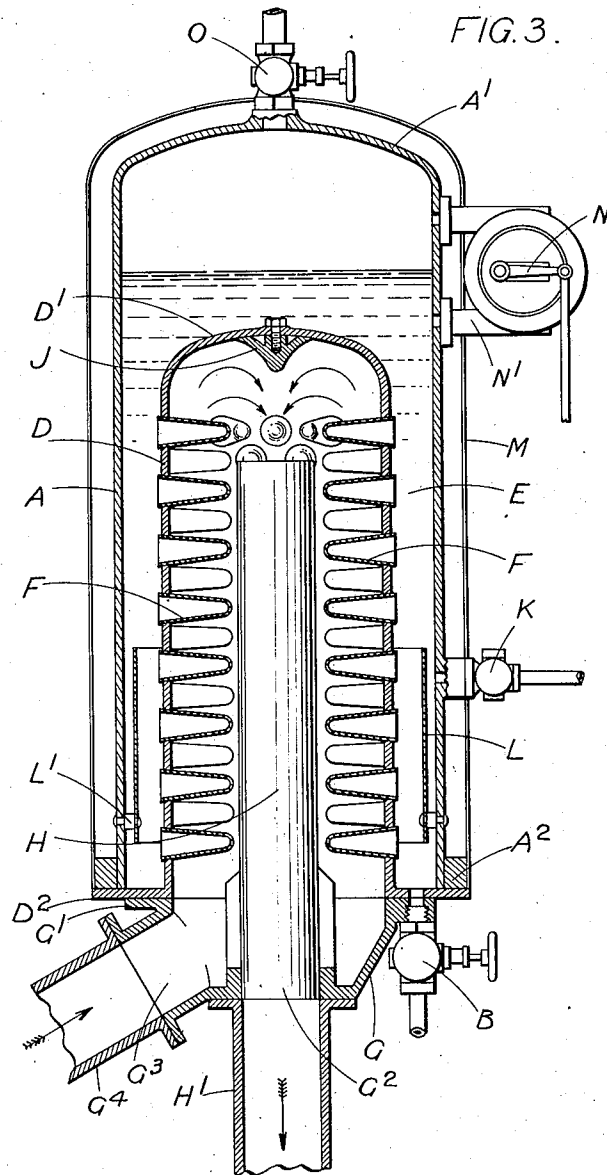
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STEAM GENERATOR OR WATER HEATER

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2 Sheets-Sheet 2



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Patented Aug. 2, 1927.

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UNITED STATES PATENT OFFICE.

THOMAS CLARKSON, OF LONDON, ENGLAND.

STEAM GENERATOR OR WATER HEATER.

Application filed January 23, 1924, Serial No. 688,036, and in Great Britain February 15 1923.

This invention relates to steam generators or water heaters and has for its object to provide a generator or water heater of simple but efficient construction which is intended more particularly to be heated by gases such as the waste or exhaust gases from a prime mover or other source.

A further object is to provide a steam generator or water heater, to be employed more especially in this way, which will be cheap and simple in construction so that it can be readily dismantled and cleaned while being capable of transferring to the water the greatest possible amount of heat from the gases.

A still further object is to make the generator or water heater so reliable that it will call for the minimum of attention while ensuring that it will effect the maximum of economy while providing steam for useful work or maintaining a hot water supply by utilization of the heat from otherwise waste gases.

Further objects of the invention will be seen from the embodiments of the invention illustrated by way of example in the accompanying drawings, in which

Figure 1 is a sectional elevation of a steam generator construction arranged for the hot gases to enter and leave at the upper end of the generator.

Figure 2 is a section on the line 2—2 of Figure 1.

Figure 3 is a sectional elevation of an alternative construction of steam generator in which the hot gases enter and leave at the bottom.

In the construction illustrated in Figures 1 and 2, the outer member or shell of the generator is constituted by a cylinder A of suitable length one end A' of which is closed permanently so that this end of the cylinder is integral with the wall of the cylinder the end A' being, for example, produced by pressing or a like process. Around the open end of the cylinder A is a flange A² of suitable width while in the centre of the closed end A' is a small opening provided with a cock B which enables mud and sediment to be removed, the end A' of the cylinder being so contoured that this material will accumulate in the neighbourhood of the opening and thus facilitate cleaning. The cylinder A is mounted vertically on a suitable base by means of brackets C. The inner member of the generator is constit-

ed by a cylinder D with one end D' closed and formed integral with the cylindrical wall thereof, the end D' being formed by pressing or otherwise in a manner similar to the formation of the end A' of the outer cylinder A. As shown, the inner cylinder D has a diameter appreciably less than the internal diameter of the outer cylinder A, these diameters being determined in accordance with the desired dimensions of the steam and water space E which is formed between these cylinders. Around the open end of the inner cylinder D is formed a flange D² of substantial width so that this flange will close the open end of the annular water and steam space E and can be secured to the flange A² around the open end of the outer cylinder A by means of bolts or the like. The inner cylinder D is thus supported by its flange D² concentrically within the outer cylinder A with the closed end D' of the inner cylinder separated from the closed end A' of the outer cylinder by a distance substantially equal to the distance between the cylindrical walls of the two cylinders. In the wall of the inner cylinder D there is fixed a series of thimbles F each thimble being formed, for example, by pressing so that it is integral throughout and has a slight taper so that its rounded and closed end is of less diameter than the open end of which is fixed in some suitable manner in the wall of the cylinder D. In practice it is found sufficient to insert each thimble in an opening in the cylinder and press or hammer the thimble into place any expanding process or screwthreading being unnecessary since, in the case of a steam generator, the pressure within the thimbles is always in a direction tending to keep them in place and maintain tight joints between the thimbles and the cylinder wall. The thimbles are constructed and arranged in a manner substantially similar to that described and illustrated in the specification and drawings of the present inventor's British Letters Patent No. 108,177, the thimbles projecting radially inwards from the wall of the cylinder D and their open ends communicating with the steam and water space E between the cylinders A and D. The thimbles are disposed in that portion of the wall of the inner cylinder D which lies at and below the normal water level in the generator.

A cap G conveniently somewhat conical

closes the open end of the inner cylinder D the cap G having a flange G' which rests on and is secured to the flange D² at the end of the cylinder D. In the centre of the cap G is an inlet opening G² whence a tube H of suitable structure extends downwards into the cylinder D the tube lying in the space between the closed ends of the thimbles and adjacent thereto. In the conical wall of the cap is an outlet opening G³ communicating with an outlet pipe G⁴. A pipe H' leads hot gases, as for example exhaust products from an internal combustion engine to the central opening G² in the cap G whence they pass down the tube H. Facing the inner end of the tube H and secured on the inner side of the closed end D' of the cylinder D is a conical deflector J of firebrick or other suitable material adapted to deflect the hot gases flowing from the tube H so that they traverse the spaces between the thimbles F before passing upwards around the tube H into the cap G whence they escape through the opening G³ and pipe G⁴. In this way the hot gases circulate thoroughly throughout the interior of the cylinder D and give up a substantial portion of their heat to the water in the thimbles F and water space E.

Water is delivered into the space E through the outer cylinder A by means of a feed water pipe K communicating with the space E at a suitable point, and it is convenient to dispose a light metal and cylindrical shield L in the water space E between the inner and outer cylinders so that as the feed water enters it will be caused to flow downwards and upwards and around the inner cylinder D or into the thimbles F opposite the inlet from the pipe K. The shield L is so mounted on studs L' as to permit it to expand or contract freely relatively to the cylinders A and D. The cylinder A is preferably provided with suitable lagging M. The delivery of feed water to the generator may be controlled automatically as for instance by a float operated device N such as described and illustrated in the specification and drawings of the present inventor's Letters Patent of the United States of America No. 1,350,988 or alternatively by a thermostatic or pressure actuated device. A steam outlet controlled by a valve O is provided in the cylinder A at the upper end of the space E.

In the steam generator illustrated in Figure 3, the construction is similar to that shown in Figures 1 and 2, the whole apparatus, however, being inverted.

In this case the cylinders A and D are mounted with their open ends downwards and the member D is made slightly shorter so as to leave a larger space between the closed ends A' and D' of the two cylinders,

the drain cock B being disposed at the bottom of the annular space between the cylinders and passing through the flanges G' and D² to permit the removal of mud and sediment from the space E. Further, the feed water pipe K and metal shield L are arranged so that the feed water is delivered at the correct position in the height of the generator. The steam outlet valve O in this construction is conveniently disposed in the centre of the closed end A' of the cylinder A and the device N for controlling the feed water supply is positioned according to the water level. In this construction it is conveniently arranged for the hot gases to enter through the lateral opening G³ in the cap G the gases then flowing upwards over the thimbles F and flowing out through the pipe H. The other parts of the steam generator or water heater are arranged in a similar manner to that described with reference to Figures 1 and 2.

While the invention has been shown and described in detail for two embodiments thereof, it is not limited to either of these forms, but includes both of these, and other alterations which come within the scope of the appended claims.

What I claim as my invention and desire to secure by Letters Patent is:—

1. A water heater of the class described, including in combination, inner and outer elongated tubular wall-members, vertically disposed and enclosing between them a water and steam space, a series of watertubes supported in the inner wall-member and projecting inwardly therefrom, said tubes opening into the water space between said wall-members and having closed inner ends, an aperture through which hot gases may be introduced into the interior of the inner member at one end thereof, a discharge aperture for said gases at the same end of said member, and means for delivering the gases from the first mentioned aperture to the opposite end of the said inner member positioned centrally within the inner tube-like member and occupying substantially the entire space between the innermost points of the water tubes to cause the hot gases to flow in passing from the gas delivery point to the gas outlet, in a path substantially annular in cross section from the point of gas delivered to the point of gas egress, all of the hot gases being caused thereby to flow close to the wall of the inner chamber and between the water tubes projecting therefrom.

2. The combination set forth in claim 1, in which the radial thickness of the annular stream of heated gases is approximately equal to the length of the water tubes.

3. A water heater of the class described, including in combination, inner and outer elongated tubular wall-members, vertically

disposed and enclosing between them a water and steam space, a series of water tubes supported in the inner wall-member and projecting inwardly therefrom, said tubes opening into the water space between said wall-members and having closed inner ends, an aperture through which hot gases may be introduced into the interior of the inner member at one end thereof, a discharge aperture for said gases at the same end of said member, and means for delivering the gases from the first mentioned aperture to the opposite end of the said inner member positioned centrally within the inner tube-like member and occupying substantially the entire space between the innermost points of the water tubes to cause the hot gases to flow in passing from the gas delivery point to the gas outlet, in a path substantially annular in cross section from the point of gas delivery to the point of gas egress, all of the hot gases being caused thereby to flow close to the wall of the inner chamber and between the water tubes projecting therefrom, the means for delivering the gas and means for guiding it in its passage comprising a single tubular member.

4. A water heater of the class described, including in combination, inner and outer elongated tubular wall-members, vertically

disposed and enclosing between them a water and steam space, a series of water tubes supported in the inner wall-member and projecting inwardly therefrom, said tubes opening into the water space between said wall-members and having closed inner ends, an aperture through which hot gases may be introduced into the interior of the inner member at one end thereof, a discharge aperture for said gases at the same end of said member, and means for delivering the gases from the first mentioned aperture to the opposite end of the said inner member positioned centrally within the inner tube-like member and occupying substantially the entire space between the innermost points of the water tubes to cause the hot gases to flow in passing from the gas delivery point to the gas outlet, in a path substantially annular in cross section from the point of gas delivery to the point of gas egress, all of the hot gases being caused thereby to flow close to the wall of the inner chamber and between the water tubes projecting therefrom said means being substantially coextensive in length with that portion of the inner member from which water tubes project.

In testimony whereof I have signed my name to this specification.

THOMAS CLARKSON.