

(No Model.)

2 Sheets—Sheet 1.

J. JACKSON.
STEAM GENERATOR.

No. 462,557.

Patented Nov. 3, 1891.

Fig. 3.

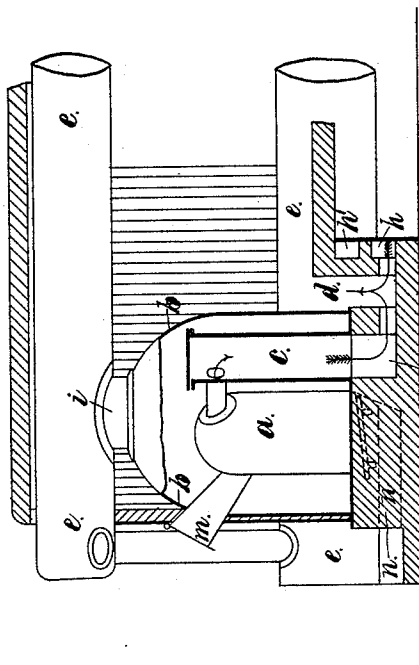


Fig. 4.

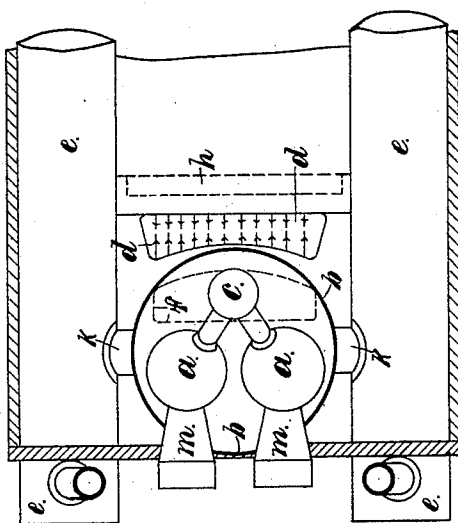


Fig. 1.

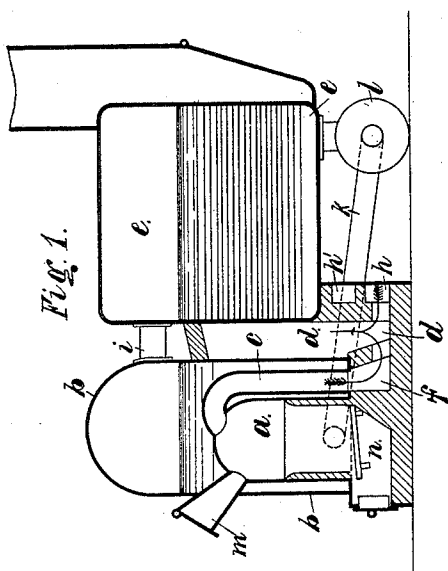
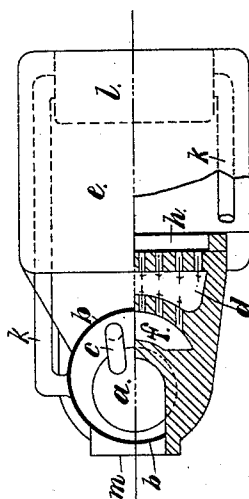


Fig. 2.



WITNESSES.

J. A. Rufferford
J. M. Kelley

INVENTOR.

John Jackson
By James L. Norris
Attorney

(No Model.)

2 Sheets—Sheet 2.

J. JACKSON.
STEAM GENERATOR.

No. 462,557.

Patented Nov. 3, 1891.

Fig. 5.

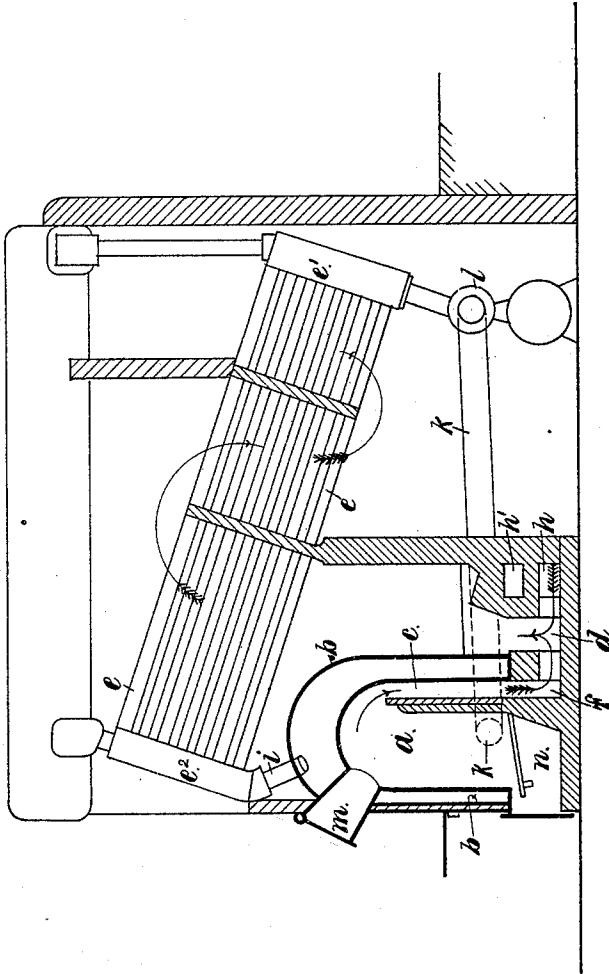
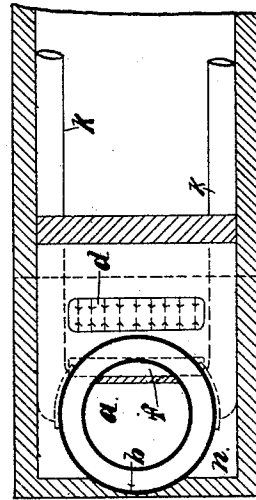


Fig. 6.



WITNESSES.

J. A. Butterford.
J. H. Hester.

INVENTOR.

John Jackson
James L. Norris.
Attorney.

UNITED STATES PATENT OFFICE.

JOHN JACKSON, OF LIVERPOOL, ASSIGNOR TO THE JACKSON (FOREIGN PATENTS) COMPANY, LIMITED, OF LONDON, ENGLAND.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 462,557, dated November 3, 1891.

Application filed April 22, 1891. Serial No. 390,022. (No model.)

To all whom it may concern:

Be it known that I, JOHN JACKSON, a subject of the Queen of Great Britain and Ireland, residing at Liverpool, England, have invented certain new and useful Improvements in or Connected with Steam-Generators; and I 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.

This invention has reference, mainly, to steam-generators; and it consists, chiefly, of certain applications and constructions of gas-producers to horizontal or inclined steam-generators.

Heretofore gas-producers have been used with horizontal steam-generators or inclined water-tube steam-generators and the like, and have constituted a separate portion of such steam-generator; but where such separate gas-producers have been used they have not been employed to generate steam as well as make gas to be afterward burned in the combustion-space of the boiler. By such constructions a large amount of heat is absolutely lost, and it has been proved that although gas-fired steam generators of such a nature should theoretically produce better results than those produced by the ordinary mode of effecting the combustion of the fuel entirely on the grate itself, they have not, on the whole, done so where ordinary boilers have been properly stoked; but I by my invention avoid altogether the said losses of heat and effect a large saving in coal, and thereby enable the theoretical superiority of firing the said types of steam-generators by gas to be realized in actual and every-day working, which, as above stated, has been found impossible heretofore.

According to the present invention the gas-producer is placed within an outer shell, both producer and outer shell being vertical and cylindrical, and the space between them is filled with water. The outer shell is connected to the water vessel or vessels proper of the boiler by suitable conduits for causing the proper circulation of water throughout the structure. The producer and its outer casing may stand upon a suitable brick-work

foundation, and the gas made is led through the water therein by a conduit or conduits into a fire-brick combustion chamber or space, whereinto air, preferably heated, is introduced and used to effect combustion of the gases. The burning gases may act upon a part of the outside of the producer-shell before entering the main steam-generating vessel. By so constructing and arranging the gas-producers all loss of radiation and conduction is avoided, and the whole possible heat of the fuel is utilized, resulting in a large economic effect not hitherto produced. The gas producer or producers is or are by preference arranged eccentrically relatively with the outer shell surrounding them, and both furnace and shell may have semi-spherical domes where room is available. For and purposes the producer with its casing may be partly sunk—that is, set within a pit—and fuel may be supplied to it through a trapped hopper of any known suitable kind. The gas-producing part may be combined with a plain horizontal tubular vessel, or, according to another arrangement or combination of gas-fired steam-generator, the gas-producer is combined, with its outside casing, with a water-tube steam-generator wherein the water-tubes are inclined, the gas-producer being arranged below the front water-casing and front portion of the tubes and set partially in a sunk pit and connected to the end water-casings by circulating-pipes. The gases made in the producer are led by a suitable conduit, pipe, or pipes down through the water therein and then burned in the manner above specified.

In the drawings which serve to illustrate my invention, Figure 1 is a sectional elevation, and Fig. 2 is a plan, partly in section, of one form of my improved steam-generator. Figs. 3 and 4 are sectional elevation and plan, respectively, of another form of the invention; and Figs. 5 and 6 are sectional elevation and plan, respectively, of a water-tube steam-generator constructed according to the invention.

In the figures, *a* is the gas-producing retort-furnace.

b is the shell or vessel within which the producer *a* is arranged.

c is a conduit by which the gases made in *a* are conveyed to the combustion-chamber, which is designated *d*.

e designates the tubulous portion or portions of the steam-generator, which is or are subjected to the heat resulting from the combustion of the gases made in the producer *a*.

In Fig. 1 the portion *e* consists of a cylindrical vessel having horizontal tubes running from end to end and through which the gases pass from the combustion-chamber *d*. In Figs. 3 and 4 this tubular portion consists of two outer or winged main tubes and an upper main tube, the upper and winged tubes being connected by a number of upright tubes through which the water circulates and in which it is heated. This type of steam-generator is frequently employed in torpedo-boats, and is generally called a "Thornycroft" boiler.

In Figs. 5 and 6 the tubulous portion consists of inclined water-tubes, the hot gases passing outside the tubes.

Referring now to Figs. 1 and 2 particularly, the gases from the gas-producer pass by the conduits *c* into the gas-chamber *f*, through and from which the gases pass by apertures into *d*, and here air enters from the conduit *h* through apertures in opposite streams, and this air being heated the gases mix with it and perfect combustion results. These gases pass up between the shell *b* and the tube-plate of the portion *e* and then through the tubes in *e*. Communication above the water-line is made between *e* and *b* by the pipe *i*, and water communication between *e* and *b* is made by the pipe *k*, which leads from the water and mud separating vessel *l*, which is in communication with the lower portion of *e*. The water is thus caused to pass to the lower part of *b*. The air delivered to the combustion-chamber through the conduit *h* may be heated before introduction thereto. This may be done by passing it through passages, such as *h'*, before it enters *h*, or through other conduits in the brick-work of the boiler. *m* is the hopper through which the gas-producer *a* is fed with fuel, and *n* is the ash-pit.

In the arrangement in Figs. 3 and 4 two producing retort-furnaces *a* are arranged within the shell *b*, and this shell is entirely filled with water, it being in direct communication at its upper part with the upper tube of the boiler proper. Its lower portion is connected to the lower or winged main tubes by connecting-pipes *k*.

In the steam-generator shown in Fig. 5 practically the same arrangement exists as in Figs. 3 and 4, except that in this example one producing retort-furnace *a* only is provided in the shell *b*; but any number of producers or producer-furnaces may be used in any case where desired. The shell *b* is in this example provided with water-inlet circulating-pipes *k* and outlet-pipes *i*, leading, respectively, from the lower chamber *e'* of the tubes *e* and to the upper chamber *e''* of the tubes *e*.

In all the figures the same letters are used to designate the same or like parts wherever they occur, and therefore where particular parts are not particularly mentioned with reference to the different arrangements the letters of reference thereon are to be taken as explanatory of such parts.

It is to be understood that the invention is not confined to the particular examples given in the drawings, as it is susceptible of modification without departing from the controlling features and nature of the invention; but What I claim in respect of this invention is—

In a steam-generator, the combination, with the main steam-generating portion *e*, of the gas-producing retort-furnace *a*, vertically disposed and adapted to contain a large depth of fuel for the conversion of the same into combustible gases, the conduit *c*, by which the combustible gases in the gas-producing retort-furnaces are conducted downward to the base of the producer, the combustion-chamber *d*, disposed outside of the producer and into which the combustible gases are introduced and burned with air, the air-conduit *h*, by which the air for burning the combustible gases is introduced into the combustion-chamber, and the shell *b*, disposed outside of and inclosing the producer retort-furnace, adapted to contain water therein and having the upper and lower portions of its interior in communication, respectively, with the steam and water spaces of the main steam-generating portion *e* through the medium of the upper and lower pipes *i* and *k*, substantially as described.

In testimony whereof I hereunto affix my signature in presence of two witnesses.

JOHN JACKSON.

Witnesses:

ERNEST R. ROYSTON,
JAMES ANDREW CONBROUGH,
Both of 15 Water Street, Liverpool.