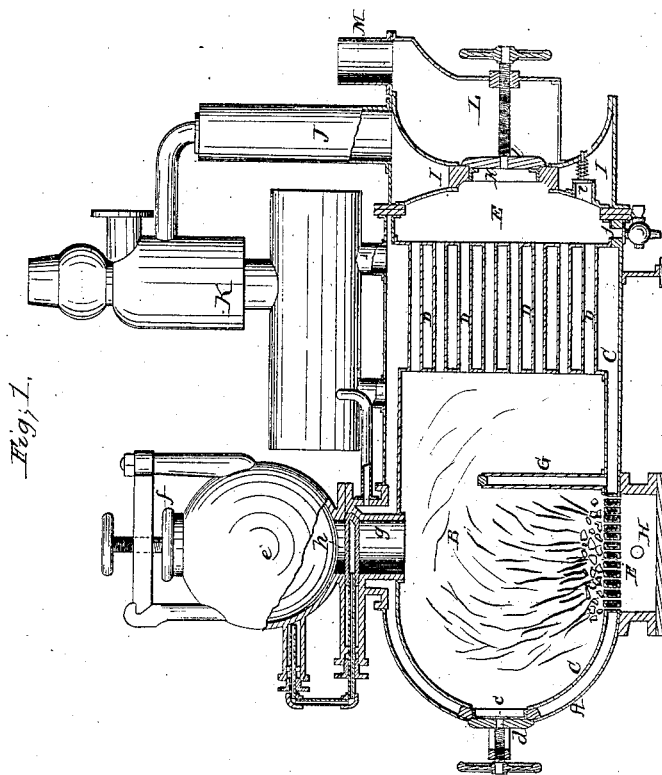
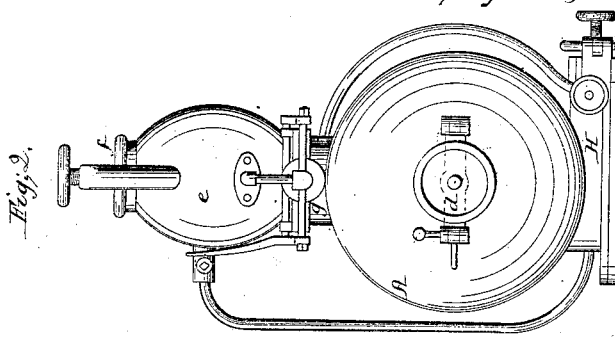


G. Sill,

Steam-Boiler Furnace.

N<sup>o</sup> 50,174.

Patented Sep. 26, 1865.



Witnesses;

Thos. Inoch  
Jas. Cunningham

Inventor;

G. Sill  
By Wm. C. Allen

# UNITED STATES PATENT OFFICE.

GEORGE SILL, OF WILKINS, PENNSYLVANIA.

## IMPROVEMENT IN STEAM-GENERATORS.

Specification forming part of Letters Patent No. **50,174**, dated September 26, 1865.

### *To all whom it may concern:*

Be it known that I, GEORGE SILL, of Wilkins, in the county of Allegheny and State of Pennsylvania, have invented a new and Improved Steam-Generator; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 represents a sectional side elevation of this invention. Fig. 2 is an end view of the same.

Similar letters of reference indicate like parts.

The object of this invention is to employ the heat which generally escapes from a steam-boiler uselessly into the smoke-stack for the purpose of raising the temperature of a mass of water, and eventually to generate steam.

The invention consists in the application of an additional boiler or water-space in combination with the smoke-chamber and fire-place of a steam-generator, and communicating therewith by means of suitable check-valves, in such a manner that the heated gases evolved by the fire in the fire-place, after having spent a portion of their inherent heat in raising the temperature of the water in the main boiler, pass from the smoke-chamber through the water in the additional boiler or water-space and their remaining heat is employed in raising the temperature of this water, and is not allowed to escape through the smoke-stack. In order to impart to the heated gases the necessary force or pressure to enable them to pass from the smoke-chamber of the main boiler through the water in the additional boiler, it is necessary to close the furnace air-tight and inject a current of air requisite to support combustion by means of a suitable pump or other equivalent device, and as this air and the heated gases in the combustion-chamber expand the products of combustion attain the requisite pressure.

A represents a steam-boiler, the combustion-chamber B of which is surrounded by the water-space C, and communicates by means of a series of flues or tubes, D, with the smoke-chamber E.

F is the fire-grate, which is composed of a series of hollow tubular grate-bars that are filled with water or air, so that the same are

able to resist the injurious influence of the fire, and between the fire-grate and the inner tube-sheet rises the bridge G, whereby the heat is prevented from escaping in a direct course through the tubes D.

The requisite amount of air for the purpose of supporting combustion is introduced through a pipe leading into the ash-pit H, and said air is forced in by means of a pump or other suitable device capable of imparting to it the requisite pressure.

The combustion-chamber B is closed air-tight, the fuel being introduced either through the aperture *c*, which is closed by the cover *d*, or when the boiler is in full operation the fuel may be introduced through the globe *e*. This globe is provided with an aperture in its top, which can be closed by the cover *f*, and it communicates with the combustion-chamber through the pipe *g*, which can be opened and closed by a slide, *h*. While the globe *e* is being charged the slide *h* remains closed, and when the cover *f* has been refastened the slide is opened and the fuel descends into the chamber B, by reason of its inherent gravity.

The smoke-chamber E connects by means of check-valves *i* with the secondary boiler or water-space I, and the heated gases, after having been expanded in the combustion-chamber and attained a considerable pressure, rush through the tubes D and valves *i* into the water-space I, and all the heat still retained by said gases is transmitted to the water in the secondary boiler. Said water is converted into steam, which rises through the drum J to the steam-dome K.

The smoke-chamber E is provided with a valve, *j*, for the purpose of blowing out soot and ashes, and access can be had to said smoke-chamber by means of a man-hole, *k*, which is closed air-tight by the plate or cover *l*. This cover opens into a jacket, L, which communicates with the smoke-stack M, and when said cover is open the products of combustion pass freely through the smoke-chamber and jacket L to the smoke-stack, and the boiler acts in the ordinary manner.

The coal-feeding apparatus on top of the boiler is only intended to be used where there is but a single boiler required and where it is sometimes necessary to work the boiler up to its full capacity for generating steam. For instance, suppose a boiler with a furnace of

sufficient capacity to hold enough coal to generate steam for five hours. If the boiler is not worked up to its full capacity the man-hole cover leading to the smoke-chamber may be opened and the confined gases within the furnace allowed to escape, the furnace-door *c* may be opened and coal introduced into the furnace; but if it should be necessary to work the boiler sometimes up to its full capacity for six hours instead of five, it would not perhaps generate enough steam while feeding coal through the door *c*, and in this case the furnace-door must be kept closed and the coal fed to the furnace by the coal-feeding apparatus on top of the boiler.

Where there are two or more boilers there is no necessity for a coal-feeding apparatus, for while the furnace of one boiler is being filled with coal the other boiler or boilers may be worked up, if necessary, to their full capacity for generating steam. In all cases sufficient coal should be introduced into the furnace to last at least three or four hours.

If desired, the furnace may be filled to the depth of two or three feet, and two or three tons may be put into the furnace at one time, or even more, according to the size of the furnace. By allowing the proper amount of air to be forced through the incandescent fuel and also through the combustion-chamber above the fire, perfect combustion can be effected, and the boiler will prove to be a perfect smoke-consumer except when filling the furnace with coal, the heat being nearly as intense in the flues and combustion-chamber as in the furnace. The heat which is not extracted or taken up by the flues, &c., is not lost, as in other boilers, but it is expanded into the auxiliary boiler in the form of heated gases, and these gases rise through the water, forming steam. The steam and gases are then carried to the main boiler and mingle with the steam in it.

If a nest of boilers should be used in connection with a condensing-engine, it would be

necessary to connect all the main boilers together, and the steam from them would have to be carried directly to the condensing-engine. It would also be necessary to connect all the secondary boilers by a steam-pipe and carry the steam and gases to an auxiliary engine working with expansion; but when a non-condensing engine is used the gases, &c., may be allowed to mingle with the steam in the main boilers, and steam and gases carried directly to the engine.

It will be observed that there is no connection between the water in the main boiler and that in the secondary boiler, and consequently the dirt which will be certain to form in the secondary boiler cannot get into the main boiler. The dirty water may, however, be blown out frequently.

This boiler is simple in construction, not liable to get out of order, and easily operated. There is no heat lost except a very small amount required to force air into the furnace and what is lost by radiation. It will not require near as much fuel to do a given amount of work as will be required by boilers of the most approved constructions now in use. All the gases generated in the furnace are used as a motive power. The combustion of the fuel is more perfect in this than in ordinary boilers, and my boiler can be made smaller in proportion to the amount of steam required than boilers of the ordinary construction.

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

The application of an additional boiler or water-space in combination with the smoke-chamber and with the hermetically-closed fireplace of a steam-generator, constructed and operating substantially as and for the purpose set forth.

GEORGE SILL.

Witnesses:

R. W. THOMAS,  
ORRIN N. NEGLEY.