

J. GOULDING.

Improvement in Series of Feed-Water Heaters and Generators.
No. 128,300.

Patented June 25, 1872.

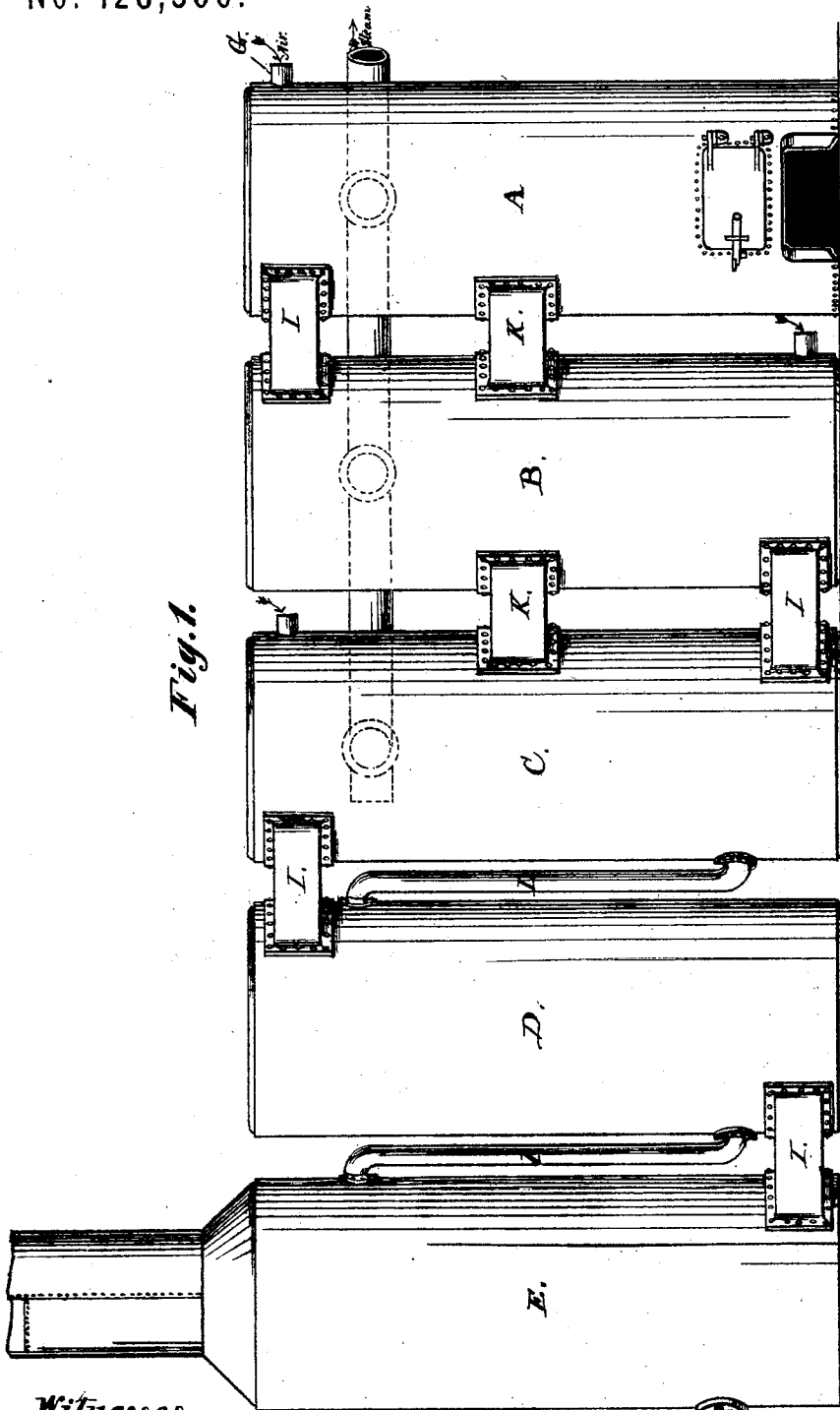


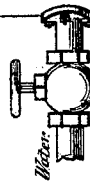
Fig. 1.

Witnesses.

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Inventor.

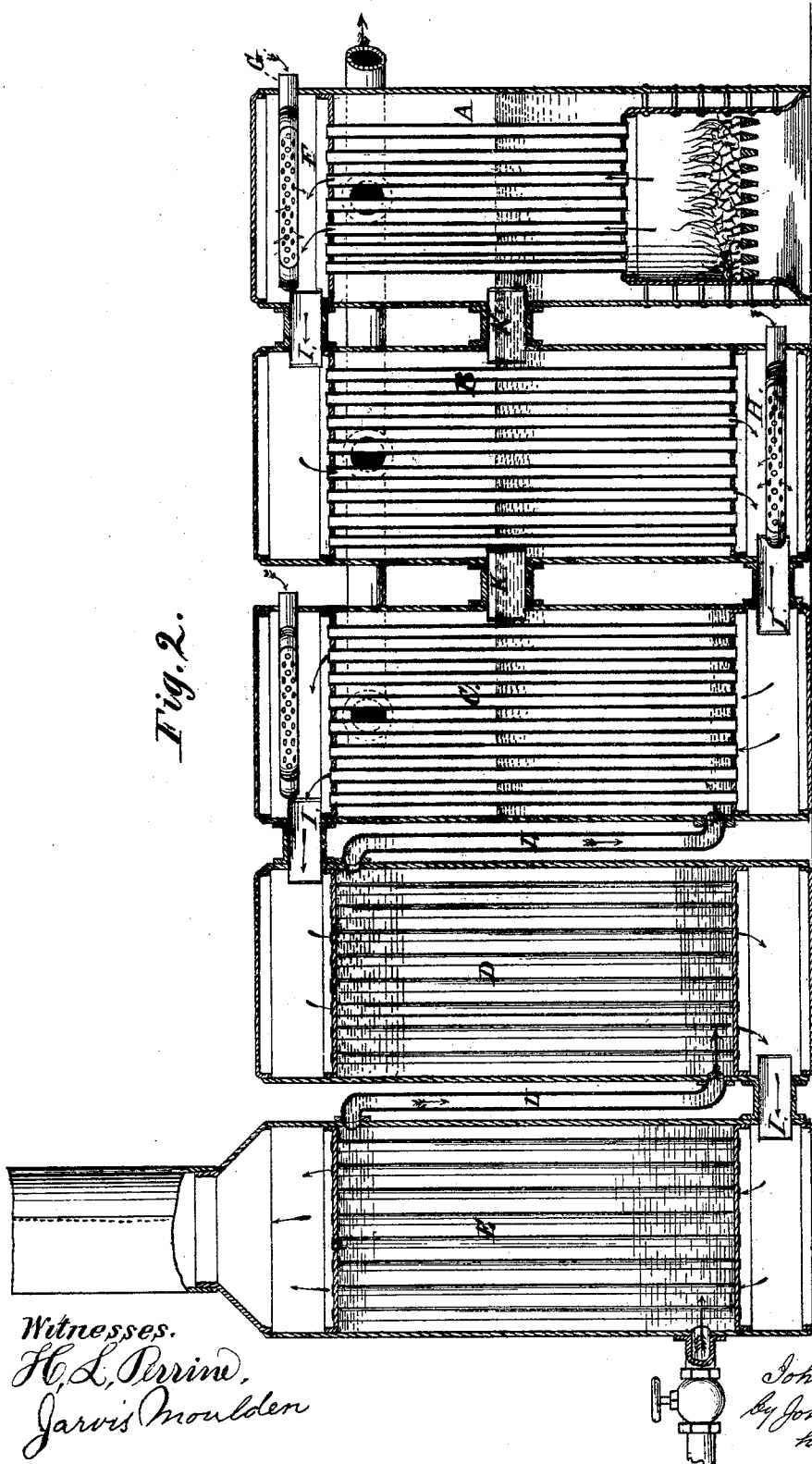
John Goulding.
by John J. Halsted.
his attorney.



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Fig. 3.

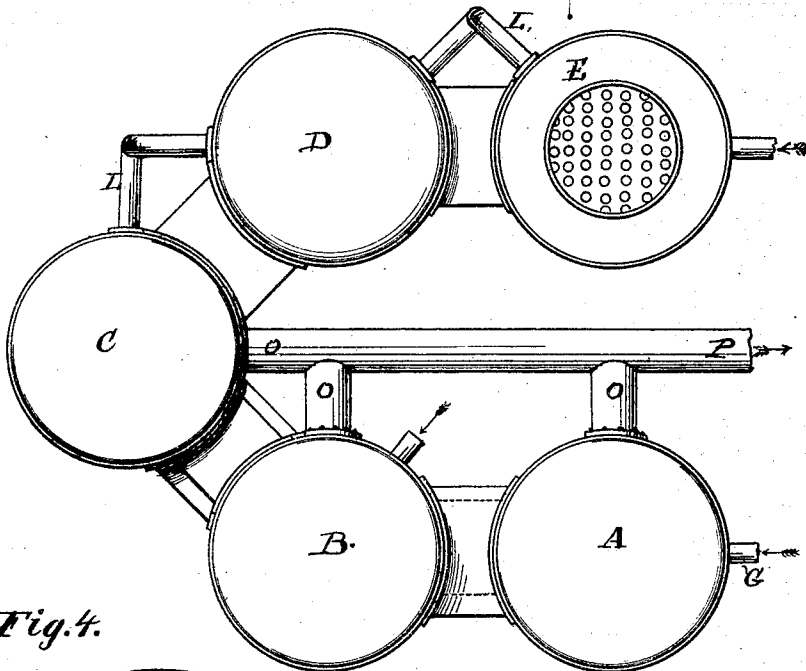


Fig. 4.

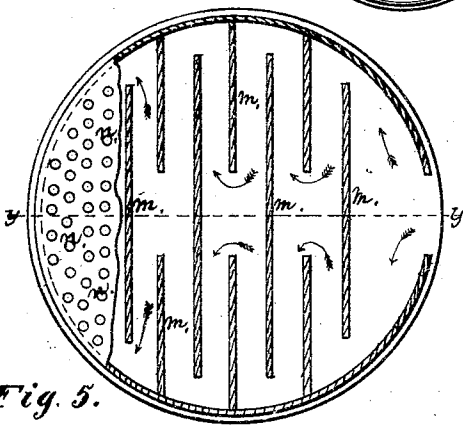
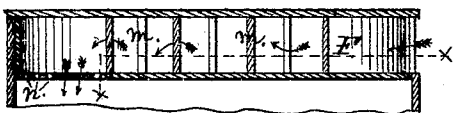
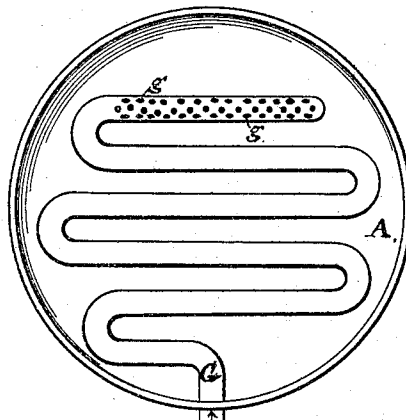


Fig. 5.



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Fig. 6.



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UNITED STATES PATENT OFFICE.

JOHN GOULDING, OF WORCESTER, MASSACHUSETTS.

IMPROVEMENT IN SERIES OF FEED-WATER HEATERS AND GENERATORS.

Specification forming part of Letters Patent No. 128,300, dated June 25, 1872.

SPECIFICATION.

To all whom it may concern:

Be it known that I, JOHN GOULDING, of Worcester, in the State of Massachusetts, have invented certain Improvements in Steam-Generators; and I do hereby declare that the following, taken in connection with the drawing which accompanies and forms part of this specification, is a description of my invention sufficient to enable those skilled in the art to practice it.

In the consumption of coals and other fuel used to generate steam a very large portion of the carbon evolved is not utilized, but absolutely lost. The degree of this waste varies with the character of the material used for fuel, and also with the character of the apparatus employed, but much more than one-half is usually considered as lost, and with anthracite coal, which contains about ninety per cent. of carbon, fully seventy-five (75) per cent. is wasted.

The object of my improvements is to avoid this great loss as far as practicable, and to utilize and appropriate to heating purposes in the steam-generating apparatus those products of combustion which have so hitherto been wasted. To effect this object, my invention consists in a system of boilers provided with superheating apparatus, whereby the most of the carbon and combustible matter which pass from the fire shall themselves be consumed and used, in connection with a system of heaters for heating the water fed to the boilers, such water acquiring its heat from the heat which remains after such complete, or nearly complete combustion. My invention further consists in certain devices whereby these ends are attained, and in certain details of construction hereinafter set forth; and also, if desired, in connection with the boilers, superheaters, and heaters, a blowing and suction apparatus of any known construction to keep the fire up to any required degree of heat, and also any well-known damper apparatus to keep the steam to the degree of pressure to which it is set.

I will now proceed to describe one form of apparatus embodying my invention, and which is illustrated in the drawing, in which—

Figure 1 is an elevation; Fig. 2, a vertical section; Fig. 3, a plan view, showing a more compact grouping of the boilers and heaters;

Figs. 4 and 5, details, showing the under side, and a vertical section of one construction of superheaters; and Fig. 6, an under-side view of another form of construction of superheater.

A, B, and C represent vertical boilers, in the lower part of the first one of which, A, is the grate or fire-pot, with a proper ash-pit beneath. The other boilers require no fire-pot or grate. D and E represent heating-vessels, to be each entirely filled with water, as hereinafter set forth. The boilers as well as the heaters are supplied with as many vertical and parallel flue-tubes as their size will permit. While the number and nearness to each of these tubes may vary with circumstances, yet I prefer to have as many as practicable, and close to each other. The chamber F receives the carbonaceous and other unconsumed products of combustion, and in order to consume as much as possible of this before it leaves the chamber, and in this way create a heat much more intense than that in the grate or fire-pot, I force into the chamber a supply of atmospheric air, or air mixed with steam or gas, by means of a serpentine or winding pipe, G, as shown; this pipe and its contained air (or air and steam) being, from its location, highly-heated, so as to be ready to part with its oxygen, and having no outlet at its inner end, which is closed, but instead thereof being provided with a series of small outlets, *g*, on the under side of the tube near such closed end, for the discharge of the air or steam-air so heated therein, (see Fig. 3.) By this means the oxygen is brought to a proper condition and temperature at once to unite with the heated carbon with which the chamber is supplied, and to cause them to burn with an intensely-hot flame thus newly created. The holes should be sufficiently fine and enough in number to spread the gases discharged therefrom over as large a surface as practicable, in order that as much as may be requisite shall be free at once to unite with the carbon. This superheating apparatus and operation, it will be seen, while furnishing a degree of heat far more intense than that in the fire-pot, requires no more or other fuel than that already there, but merely uses material which, under ordinary constructions of boilers, would pass out through the smoke-stack or chimney and be utterly lost.

The second boiler (as also each other of the

series however many may be used) I construct similarly with the first one above described, with the exception that it has and needs no fire-pot or ash-pit, and every other one has its superheating-chamber at its bottom; and I connect the superheating-chamber of the first boiler with the superheating-chamber H beneath the flues of the second boiler by means of the heat-conveying tube or flues, passages I being provided which carry over from one to the other the heat and flame created by the combustion of the gases in such first superheater. Supposing that of the carbon of the coal one-quarter or twenty-five per cent. only shall have been used in keeping up the fire in the grate, and that of the remaining seventy-five another twenty-five per cent. shall have united with the oxygen in the superheater and been there consumed, the remaining fifty per cent. passes over into the second boiler, where, in the same manner, say another twenty-five per cent., is consumed in its superheater, the remaining twenty-five per cent., or whatever may be left, then passing to the third boiler to be consumed in its superheater. In this manner the entire stock of carbon originally contained in the fuel may not only be all used to advantage, but be made to generate a proportionately-larger amount of heat and steam with no more cost of fuel.

The several boilers I connect with each other by water-passages K of such size vertically as to permit the water to assume the same level in all the boilers at all times when they are in use. The boilers thus always level themselves without the need of any appliances for the purpose, and they should be kept about half filled with water, any ordinary glass gauge being used to indicate its height. The advantage of this leveling is that there is no need of any pump, unless it may be for that one which supplies the feed-water.

Now, supposing the carbon to have been all consumed in the several boilers and their superheaters, it is evident that there will still be left a great amount of heat in the last of the series of boilers, and a portion of which, by my new method and construction, I also utilize as follows: I employ, in addition to the series of boilers above described and their superheaters, a series of heating-vessels or cylinders, D E, &c., for heating the water which supplies the boilers, and while it is on its passage to them. These heaters I provide with flue-tubes similarly with the boilers. I also, in case the carbon shall not have all been consumed in the last of the series of boilers, provide such of the heaters as need be with superheaters to consume the remainder of the carbon. These heaters I keep entirely filled at all times with water when using my apparatus, and it will be understood that they are not designed for the generating of steam, but the water in them is capable of being heated to any degree required.

In supplying these heaters, (which are connected together by pipes L passing from the top of each feeding one into the bottom of the next one to be fed, as seen,) I introduce the water first at or near the bottom of the water-chamber of the heater E, as shown. From the top of this heater it is conveyed by pipe L to the bottom of the next heater, and so on from heater to heater, and from the last of the heaters to the boiler next to it in the same manner. A regulating water-supply pipe should be applied to the bottom of heater E.

A blower and suction apparatus of any well-known construction may be employed in connection with my improvements—the blower for the purpose of blowing in air, or air and steam, below the fire-pot under the grate, and the suction apparatus applied to the first of the supply-heaters, to insure, if need be, a sufficient draft and supply of air to keep the fire up to any degree of heat desired. The blower and suction apparatus may be so connected by any well-known damper devices as to automatically keep the steam at the pressure to which it is set.

As a modification in the construction of the superheating-chamber, the tubes may be dispensed with, and in such case I make the chamber with a range of vertical partitions, *m*, each running less than all across, so as to give a zigzag course to the entering current of atmospheric air or air and steam, which, when thus superheated, as heretofore described, passes out from the chamber through a series of small perforations, *n*, in the bottom of the chamber, all as shown in Figs. 4 and 5.

By my improvements I can make a much larger amount, say twice as much, more or less, of steam with the same amount of fuel, as in ordinary boilers.

I do not confine myself to locating the superheating-chambers only in the positions shown, inasmuch as in different forms of apparatus they may be otherwise located, as circumstances may demand or convenience dictate, so long as the principle of operation remains substantially the same.

In Figs. 1 and 2 of the drawing I have shown the boilers and the water-heaters in continuous line. They may, however, for convenience, be placed more compactly, as, for instance, ranged in a curved or circular order, as shown in Fig. 3, or otherwise.

The steam-pipes O from the several boilers should all unite into one, as shown at P in Fig. 3, or in any other convenient manner.

I claim—

1. In a steam-generating apparatus, a system of boilers, one or more of which is provided with a superheating apparatus, combined with a system of water-heaters, the combination being substantially as shown and described.

2. I also claim the described arrangement of a series of independent vertical heaters and vertical boilers in which the feed-water enters

at the bottom of the first or receiving-heater and makes its exit at the top of the same, then enters at the bottom and passes out at the top of the next heater, and so on with each of the series of heaters, the last or discharging one delivering from its top into the bottom of the boiler.

3. I also claim the arrangement herein de-

scribed of supplying a boiler or system of boilers with water heated in vessels entirely filled with the water.

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Witnesses:

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