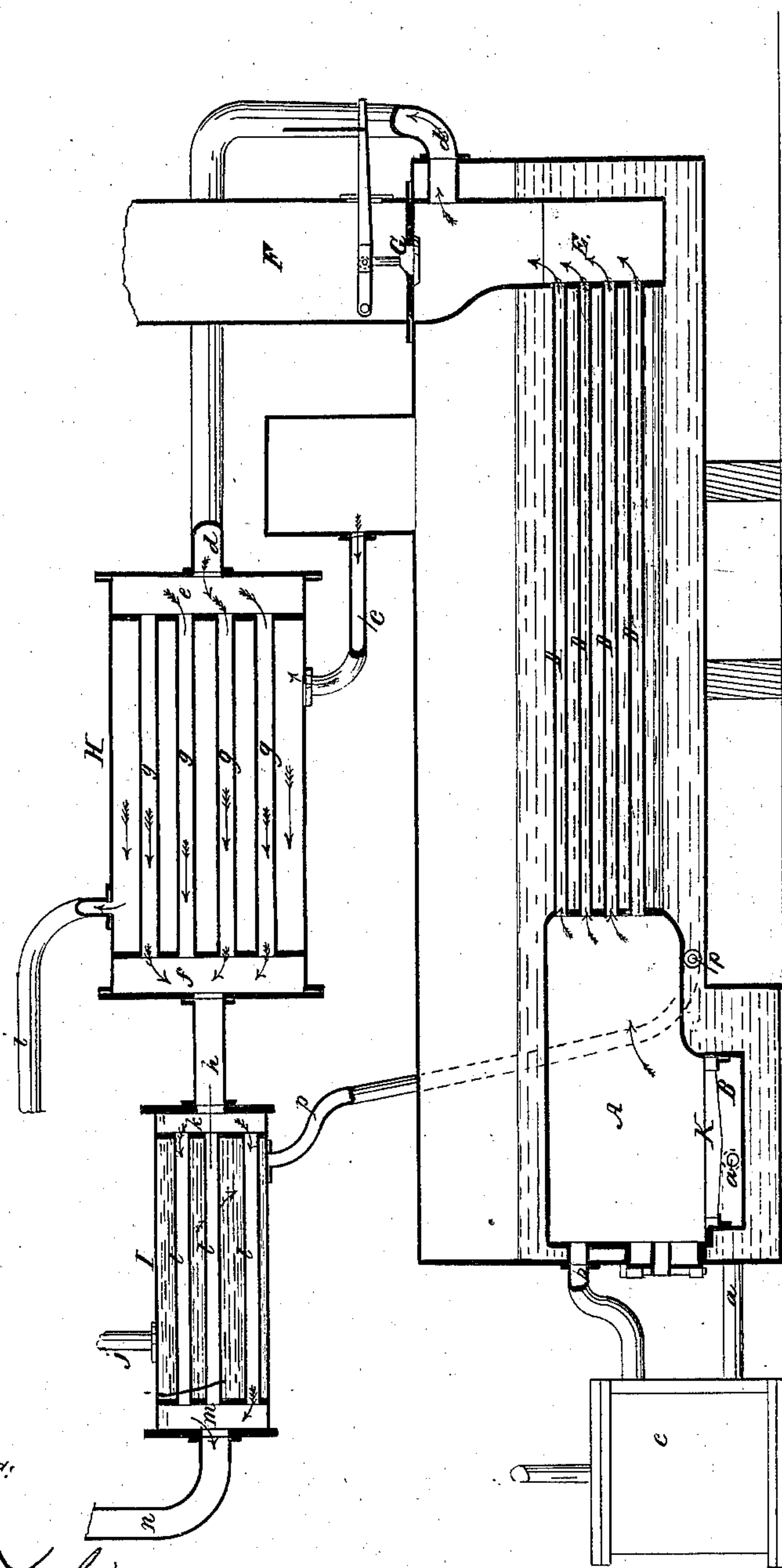


F. B. Blanchard,
Steam-Boiler Superheater.
N^o 31,861. Patented Apr. 2, 1861.



Witnesses:

Wm. Busch
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UNITED STATES PATENT OFFICE.

FRANCIS BROWN BLANCHARD, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN STEAM-BOILERS.

Specification forming part of Letters Patent No. 31,861, dated April 2, 1861.

To all whom it may concern:

Be it known that I, FRANCIS BROWN BLANCHARD, of the city of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Steam-Boilers; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, forming part of this specification.

The principal objects sought to be attained by my invention are, first, to obtain in generating steam the full advantage that is to be derived from the combustion of the fuel with a blast, and, second, to abstract from the gaseous products of combustion before their escape to the atmosphere the greatest practicable amount of heat in the most effective manner; and to these ends the nature of my invention consists in the employment, in combination with a steam-boiler of any known or suitable construction having its furnace closed to the atmosphere, but supplied with air by a blast apparatus, and having no chimney, or having suitable appliances for closing its chimney, if any is provided, of a steam-heater and a feed-water heater, through which the gaseous products of combustion are driven in succession by the force of the blast, first, through the steam-heater to convert into steam any water that may have been taken up in suspension from the boiler, and to superheat the steam to a desirable degree, and afterward through the water-heater to raise the temperature of the feed-water before its introduction to the boiler and from thence to the atmosphere, the surfaces of the said heaters being so proportioned as to take up from the escaping gaseous products of combustion nearly all the heat that ordinarily passes off by the chimney.

The accompanying drawing represents a vertical section of a steam-generating apparatus, illustrating the mode of carrying out my invention, the parts of the same being arranged more with a view to the explanation of the connection between the several parts than to their practical operation. The boiler therein represented is of the horizontal multitubular kind.

A is the fire-box, and B the ash-pit, both of which are closed, except to the two pipes *a* and

b of the air-compression pump C, one of the said pipes entering below and the other above the grate K. These pipes may have cocks to regulate the supply of air above and below the grate, as may be necessary.

D D are tubes leading from the fire-box A to the smoke box or chamber E, on the top of which is a chimney, F, which is of ordinary size, but is provided with a valve or valves, G, by which it can be closed at pleasure through the agency of a lever or other suitable apparatus.

H is the steam-heater, which may be variously constructed to expose the steam admitted from the boiler by the pipe *c* to surfaces heated by the gaseous products of combustion admitted from the chamber E by a pipe, *d*. The construction of the steam-heater represented is that of a cylinder with two hollow heads, *e f*, connected by a series of tubes, *g g*, and the steam is admitted by the pipe *c* between the heads and among the tubes, and the products of combustion are admitted by the pipe *d* into the head *e*, from whence they pass along the tubes *g g* into the head *f*, from whence they escape by the pipe *h* to the feed-water heater I, while the steam is conveyed away to the steam-engine or for other use by the pipe *i*.

The feed-water heater I may also be variously constructed to bring the water introduced by the feed-pump through the pipe *j* into contact with surfaces heated by the gaseous products of combustion; but it is represented as constructed like the steam-heater H. The gaseous products of combustion enter by the pipe *h* into the hollow head K and pass from thence through the tubes *l l* into the hollow head *m*, from whence it escapes by the pipe *n* to the atmosphere. The water is introduced by the pipe *j* among the tubes *l l* and between the heads K *m*, and passes from thence to the boiler by the pipe *p*.

The fuel may be introduced into the furnace by a feeder such as is described in the schedule of my Letters Patent No. 13,209, or of other suitable construction which permits it to be introduced without the admission of air or escape of the gases of combustion at the place of its introduction. Such a feeder it is not necessary here to describe, as it forms no part of this invention. Instead of using this

feeder, however, means may be provided for shutting off the air to permit the introduction of the fuel at an ordinary door in the fire-box. At the time of lighting the fire the chimney-valve G is to be open to permit a free draft, either natural or artificial, and this valve is to remain open till steam enough is generated to start the engine intended to be supplied by the generating apparatus or to commence the operation intended to be effected by such steam and to set in action the air-pump C or other blowing apparatus when the chimney-valve G is shut and the furnace closed up against the admission of air by any other means than the pipes *a b* from the blowing-cylinder. This pump is intended to be of such capacity and its operation to be so controlled as to supply to the furnace only about the necessary quantity of air to effect the combustion of the necessary quantity of fuel, so that as little heat as possible may be taken up and carried off as so much waste by an excess of air which would pass off unconsumed. The furnace being closed and the blowing apparatus set in operation, air is supplied to the furnace as fast as, and no faster than, is required, and, being supplied among the gases above the fire-bed as well as below the grate, very perfect combustion is effected. The gaseous products of combustion are driven by the force of the blast through the tubes of the boiler and through the pipe *d* to and through the tubes of the steam and water heaters and finally expelled through the pipe *n*, all as indicated by the black arrows in the drawing, and by the extent of surface presented by the heaters the heat of the gaseous products is nearly all used, their temperature being so far reduced that they are practically incapable of contributing any further to the generation of steam. Whenever the steam-pipe which conveys the steam to the engine or other apparatus operated by the boiler is closed, the chimney-valve and the furnace should be opened to permit a sufficient natural draft to prevent the fire going out and to carry off the products of combustion by the chimney, instead of through the heaters, so as to obviate all danger of burning the steam-heater or heating the steam excessively.

By the use of the artificial supply of air or blast in combination with the use of steam and water heaters so applied that the whole of the gaseous products of combustion are driven through them by the blast instead of being permitted to escape by the ordinary chimney, and which have their surfaces so proportioned as to abstract from the said products nearly all their heat, I obtain very important results as compared with what is obtained by the use of the blast with an ordinary open chimney, for in that use of the blast, notwithstanding that a greater amount of available heat is obtained from and more steam generated by a given quantity of fuel than when a natural draft is used, the gas-

eous products escape at a still higher temperature, while I not only obtain all the advantage to be derived from the use of the blast in that way, but save most of the immense amount of heat thereby permitted to escape from the chimney, as the gaseous products after passing the heaters have a temperature far below what would be admissible with a natural draft.

Another important result obtained by the use of the closed furnace and chimney with the artificial supply of air in combination with the steam and water heaters, as described, is that the blowing-cylinder or other blast apparatus driven by the engine can be made to introduce a certain measured quantity of air to the furnace for each revolution of the engine and a certain exact quantity of fuel will be burned and a proportional quantity of water will be converted into steam for each revolution, and this quantity of steam passing into the steam-heaters and being there subjected to the action of gases of quantity, quality, and temperature always the same, will insure a certain temperature of the superheated steam, and hence the heating-surfaces of the boiler and the heater may be properly proportioned to produce any desired constant pressure and temperature of steam, and there is no danger of burning or overheating the superheating-pipes or heating the steam excessively. By thus controlling the temperature of steam I am enabled to use the principle of expansion of gases by heat to the fullest extent that is practicable and maintain proper lubrication of the engine. The natural draft with open chimney is not capable of producing such a constantly-uniform temperature and constant and uniform generation and superheating of the steam, for it is dependent on the condition of the atmosphere and on the mode of firing, and when an artificial supply of air is used with an open chimney the effect is but little improved. By having the steam-heater and the water-heater applied in connection with a separate outlet from the furnace and providing another outlet to an ordinary chimney, which can be opened when the engine is stopped or the steam-pipe closed, at which time, from the cessation of the circulation of the steam through the heater, the great danger of burning it is likely to occur, the liability of burning the heater, which has heretofore been the greatest obstacle to the use of superheated steam, is obviated.

I do not claim, broadly, the use of a closed furnace and chimney applied to a steam-boiler; nor do I claim, broadly, the employment of the escaping hot products of combustion from a steam-boiler furnace to heat a vessel through which the steam is caused to pass after leaving the boiler, for the purpose of evaporating the water that may have been taken up in suspension by it and of superheating it. Neither do I claim the use

of such escaping products of combustion to heat the feed-water before its introduction to the boiler; but

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

The combination, in the manner substantially as herein shown and described, of the

water-heater and steam-heater with each other and with the boiler, air-pump, and chimney, all as set forth.

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Witnesses:

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