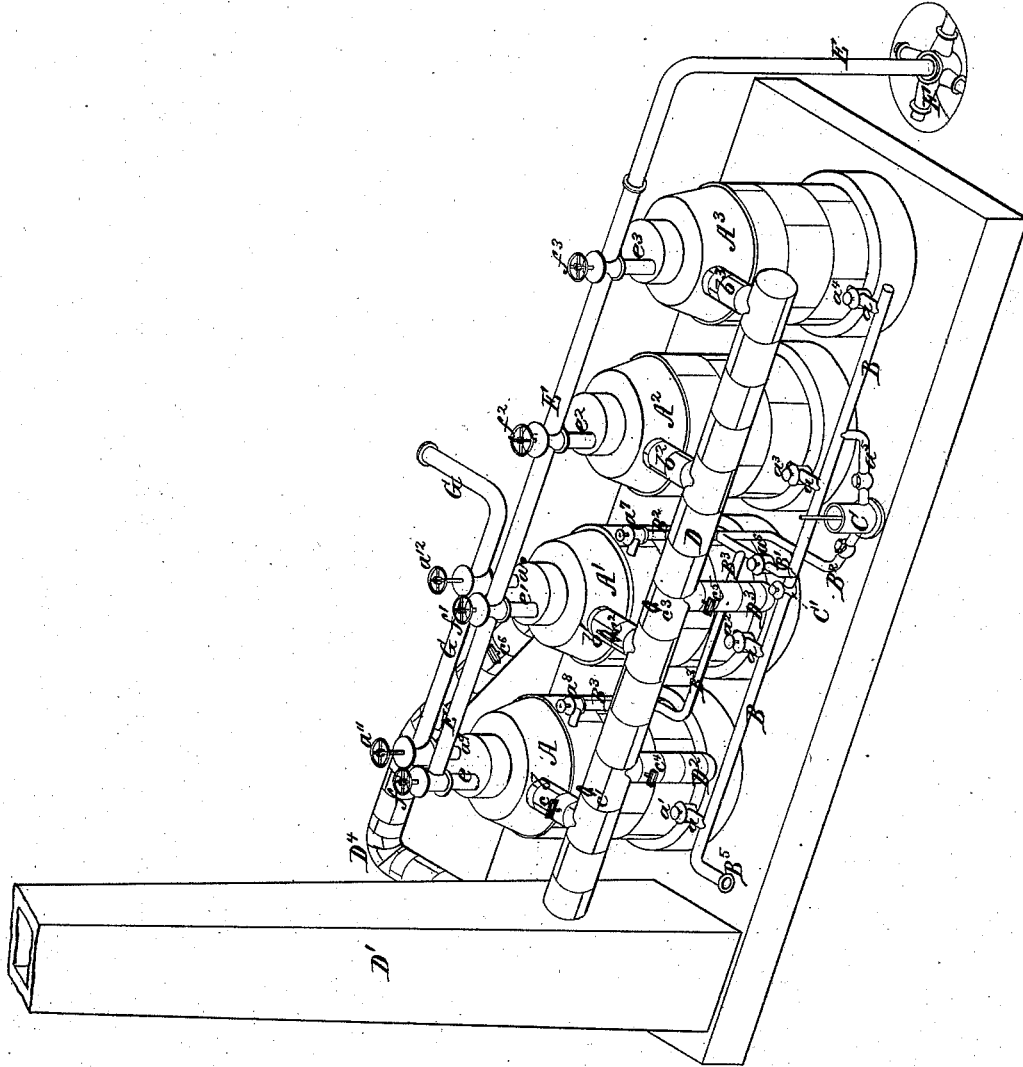


B. HOLLY.

STEAM-GENERATORS FOR WARMING BUILDINGS, &c.

No. 193,085.

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Witnesses.  
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# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN STEAM-GENERATORS FOR WARMING BUILDINGS, &c.

Specification forming part of Letters Patent No. 193,085, dated July 17, 1877; application filed May 14, 1877.

### CASE B.

*To all whom it may concern:*

Be it known that I, BIRDSILL HOLLY, of Lockport, in the county of Niagara and State of New York, have invented a new and useful Combination of Steam-Generating and Feed-Water-Heating Boilers for use with Apparatus for Warming Districts of Dwellings with Steam, and for other purposes; 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, in which a perspective view of a train or series of boilers combined in accordance with my invention is shown.

This invention relates specially to the steam-generating and feed-water-heating boilers which are to be used for supplying steam for the steam warming apparatus described in my Letters Patent therefor, bearing even date herewith.

The nature of my invention consists in certain combinations of pipes, flues, and valves or dampers with a connected train or series of boilers which are supplied as usual with feed-water from a "doctor" or steam-pump in such a manner that the whole train or series of boilers may, at certain seasons of the year, be fired and started for generating steam at high pressure, and at other seasons of the year a portion only of the train or series may be used for heating the feed-water which is to be supplied to the other portion or to as many of them as are in use for generating high-pressure steam; and while this use of a portion of the boilers for heating feed-water is going on, the waste heat alone from the fires of the high-pressure boilers may be utilized for heating the feed-water, and thus a great saving effected in the consumption of fuel for heating the feed-water to a proper temperature for entering the high-pressure boilers:

Another result secured by one of the combinations above referred to is that of utilizing one or more of that portion of the boilers which are used for heating feed-water for generating steam of a low pressure at such times as necessity may require, while the high-pressure steam-boilers and the feed-water

heating boiler or boilers are performing their proper functions.

In the accompanying drawing, four steam-boilers, A A<sup>1</sup> A<sup>2</sup> A<sup>3</sup>, are shown as one illustration of my invention. There may be any number greater than two of these boilers, as the necessities of the case may require. These boilers are connected together by a feed-water pipe, B, and branch pipes *a*, provided with cocks *a*<sup>1</sup>, *a*<sup>2</sup>, *a*<sup>3</sup>, *a*<sup>4</sup>, and C', and this pipe B is connected to a small steam-pump, C, by a branch pipe, *a*<sup>5</sup>. The smoke-pipe D of the fire-boxes of the boilers, which connects with a stack, D<sup>1</sup>, runs along all these boilers and connects with them respectively by branch pipes *b* *b*<sup>1</sup> *b*<sup>2</sup> *b*<sup>3</sup>. A steam-conveying pipe, E, passes along the steam-domes of all the boilers, and connects with each respectively by branch pipes *e* *e*<sup>1</sup> *e*<sup>2</sup> *e*<sup>3</sup>, cocks *f* *f*<sup>1</sup> *f*<sup>2</sup> *f*<sup>3</sup> being arranged in the pipe E for letting steam pass into pipe E, or stopping the escape of steam from the respective boilers into said pipe. This steam-conveying pipe E will connect with a two, three, or four way branch, F, which is underground, and each branch may connect with one of the street steam-mains of a district of dwellings to be warmed, or a pipe may extend out underground before it terminates in either a two, three, or four way branch in the same manner as is set forth in my Letters Patent before referred to herein.

The train or series of boilers thus far described, aside from the pump C, pipe *a*<sup>5</sup>, and cock C', does not differ in construction and operation from any other train or series of upright boilers which may be used at a given point for generating a great quantity of steam for driving large works.

Now, to make the train or series described capable of use for generating high-pressure steam and heating its own feed-water by waste heat passing to the stack D<sup>1</sup>, two auxiliary smoke-pipes, D<sup>2</sup> D<sup>3</sup>, are connected with the main smoke-pipe D and carried down into the combustion-chamber or flue-space of the boilers A A<sup>1</sup> above the fire-grate thereof, and another auxiliary smoke-flue, D<sup>4</sup>, is connected with the combustion or flue space of the boiler A<sup>1</sup> and with the smoke-stack D<sup>1</sup>. In the main

smoke-pipe D and its branches  $b$   $b^1$  dampers  $c$   $c^1$   $c^2$   $c^3$  are provided, and in the auxiliary smoke-pipes dampers  $c^4$   $c^5$   $c^6$  are provided, as shown. The feed-water pipe B is provided with an auxiliary pipe, B<sup>1</sup>, which is connected with an auxiliary pipe, B<sup>2</sup>, leading from the small steam-pump C into the water-space of the boiler A<sup>1</sup>, and by another auxiliary pipe, B<sup>3</sup>, into the water-space of the boiler A. The pipes B<sup>1</sup> B<sup>2</sup> B<sup>3</sup> are provided with cocks  $a^6$   $a^7$   $a^8$ .

With this addition of auxiliary smoke-flues and feed-water pipes the water from the pipe B can be first passed into the boilers A A<sup>1</sup> through cocks  $a^1$   $a^2$ , and there heated by the waste heat from the boilers A<sup>2</sup> A<sup>3</sup>, and then caused to pass into the boilers A<sup>2</sup> A<sup>3</sup>, as will be set forth in describing the operation of the boilers.

In order to make use of one or more of the boilers for generating steam at low pressure, as occasion may require, a supplemental steam-conveying pipe, G, with branch pipes  $a^9$  and  $a^{10}$ , and with cocks  $a^{11}$   $a^{12}$ , is connected with the steam-domes of the boilers A A<sup>1</sup>, the damper  $c^6$  being kept open, but cock  $a^7$  closed, in carrying out this part of the invention.

Operation: If the boilers are all fired and making steam at a high pressure, the feed-water will enter pipe B at B<sup>5</sup>, cock C' being open, and cocks  $a^6$   $a^7$   $a^8$  closed. The pressure in pipe B will be kept above that in the boilers, so that the water can be forced into any or all the boilers through cocks  $a^1$   $a^2$   $a^3$   $a^4$  accordingly as these cocks are adjusted. If boilers A<sup>2</sup> A<sup>3</sup> are fired and making steam at, say, sixty pounds, and boilers A A<sup>1</sup> are making steam at only five or ten pounds, the water will still enter the boilers the same as just described; but if boilers A A<sup>1</sup> are used merely to heat the feed-water, the feed-water will enter pipe B at B<sup>5</sup>, as above, cocks C'  $a^6$   $a^7$   $a^8$  being closed, but  $a^1$  being still open. The pressure in pipe B and boilers A A<sup>1</sup> will be kept above the pressures in boilers A<sup>2</sup> A<sup>3</sup>, so that when cocks  $a^6$   $a^7$   $a^8$  are open, and  $a^1$   $a^2$  closed, hot water can be drawn into boilers A<sup>2</sup> A<sup>3</sup> through cocks  $a^3$   $a^4$  from boilers A A<sup>1</sup>; or, instead of keeping the pressure in pipe B and boilers A A<sup>1</sup> above that in boilers A<sup>2</sup> A<sup>3</sup>, the water may be kept at the usual height for making steam, and without pressure, and the water taken out through pipes B<sup>2</sup> B<sup>3</sup> and pumped into boilers A<sup>2</sup> A<sup>3</sup> through pipe B, cocks C',  $a^1$  and  $a^2$  being closed, and cocks  $a^3$   $a^4$   $a^6$   $a^7$   $a^8$  being open, and the small pump shown at C being used for that purpose.

When the boilers A A<sup>1</sup> are used as just described, the water is made hot by the heat that would otherwise pass off into the smoke-stack, such heat being turned down through boilers A A<sup>1</sup> by closing dampers  $c^1$   $c^2$  and opening dampers  $c$ ,  $c^3$ ,  $c^4$ ,  $c^5$ , and  $c^6$ . The spent heat escapes into the stack D<sup>1</sup> after passing through the boilers through pipes  $b$  and D<sup>4</sup>.

If steam is made at a low pressure in boilers A and A<sup>1</sup>, the cocks  $f$   $f^1$  and  $a^6$   $a^7$   $a^8$  will be closed, and the steam will pass out into pipe

G through cocks  $a^{11}$   $a^{12}$  and be conveyed where wanted. If low-pressure steam is made in boiler A<sup>1</sup>, and feed-water heated in boiler A, then only cock  $a^{12}$  will be opened to pipe G, and cock  $a^7$  closed at all times. All the steam made at high pressure will pass out through pipe E, which turns down and terminates in the four-way branch F underground, and in proper connection with the street-mains.

I have shown the branch smoke-pipes D<sup>2</sup> and D<sup>3</sup> as entering the boilers above the grates. This will answer with or without fire on the grates; but if the boilers A A<sup>1</sup> are only to be used to heat feed-water these pipes may enter the boilers below the grate. In that case the boilers will not have to be constructed specially for that purpose, as the flues can enter the ash-pits.

The pressure of steam in boilers A and A<sup>1</sup> may be increased by combining the heat of a fire on the grate of the fire-boxes with the waste heat, but this cannot as well be done if the waste-heat pipes enter below the grates of the boilers.

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

1. A train or series of steam-boilers connected together, and to a feed-water-supplying apparatus, and to a draft-flue, by pipes and flues furnished with cocks or valves and dampers, substantially as described, whereby, at the will of the engineer, all of the boilers can be used for generating high-pressure steam, or a portion of the train or series be used for generating high-pressure steam, and the others for heating and supplying feed-water for those generating high-pressure steam, as set forth.

2. A train or series of steam-boilers connected together, and to a feed-water-supplying apparatus, and to a draft-flue, by pipes and flues furnished with cocks or valves and dampers, substantially as described, whereby, at the will of the engineer, all of the boilers can be used for generating high-pressure steam, or a portion of them be used for generating high-pressure steam, and the other portion for generating low-pressure steam, as set forth.

3. A train or series of boilers connected together, and to a feed-water-supplying apparatus, and to a draft-flue by pipes and flues furnished with cocks or valves and dampers, substantially as described, whereby, at the will of the engineer, all of the boilers can be used for generating high-pressure steam, or a portion of them be used for generating high-pressure steam, a portion for generating low-pressure steam, and a portion for heating and supplying feed-water for the high and low pressure boilers, as set forth.

4. The combination of the smoke-flue D  $b^1$   $b^2$ , waste-heat pipes D<sup>3</sup> D<sup>4</sup>, and the dampers  $c^1$ ,  $c^2$ ,  $c^3$ ,  $c^5$ , and  $c^6$ , with two or more boilers, A<sup>1</sup> A<sup>2</sup>, and stack D<sup>1</sup>, substantially as described.

5. The combination of the smoke-flue D  $b$   $b^2$ ,

having dampers  $c c^1$ , waste-heat pipe  $D^2$ , and its damper  $c^4$ , two or more boilers,  $A A^2$ , and stack  $D^1$ , substantially as described.

6. The combination of the boilers  $A A^1 A^2$ , smoke-flue  $D b b^1 b^2$ , waste-fues  $D^2 D^3 D^4$ , and the dampers  $c c^1 c^2 c^3 c^4 c^5 c^6$ , and the stack  $D^1$ , substantially as described.

7. The combination of the pump  $C$ , pipe  $B$ , train or series of boilers, and the feed-water pipes and cocks belonging to boiler  $A^1$ , substantially as described.

8. The combination of the pump  $C$ , pipe  $B$ , train or series of boilers, and the feed-water pipes and cocks belonging to boiler  $A$ , substantially as described.

9. The combination, with a train, series, or battery of boilers, of the high and low pressure steam conveying pipes  $E$  and  $G$  and their cocks, substantially as and for the purposes set forth.

Witness my hand in the matter of my application for a patent for a combination of steam-generating and feed-water-heating boilers, for use with apparatus for warming districts of dwellings with steam, and for other purposes, this 21st day of April, 1877.

BIRDSILL HOLLY.

Witnesses:

SAML. ROGERS,  
I. H. BABCOCK.