

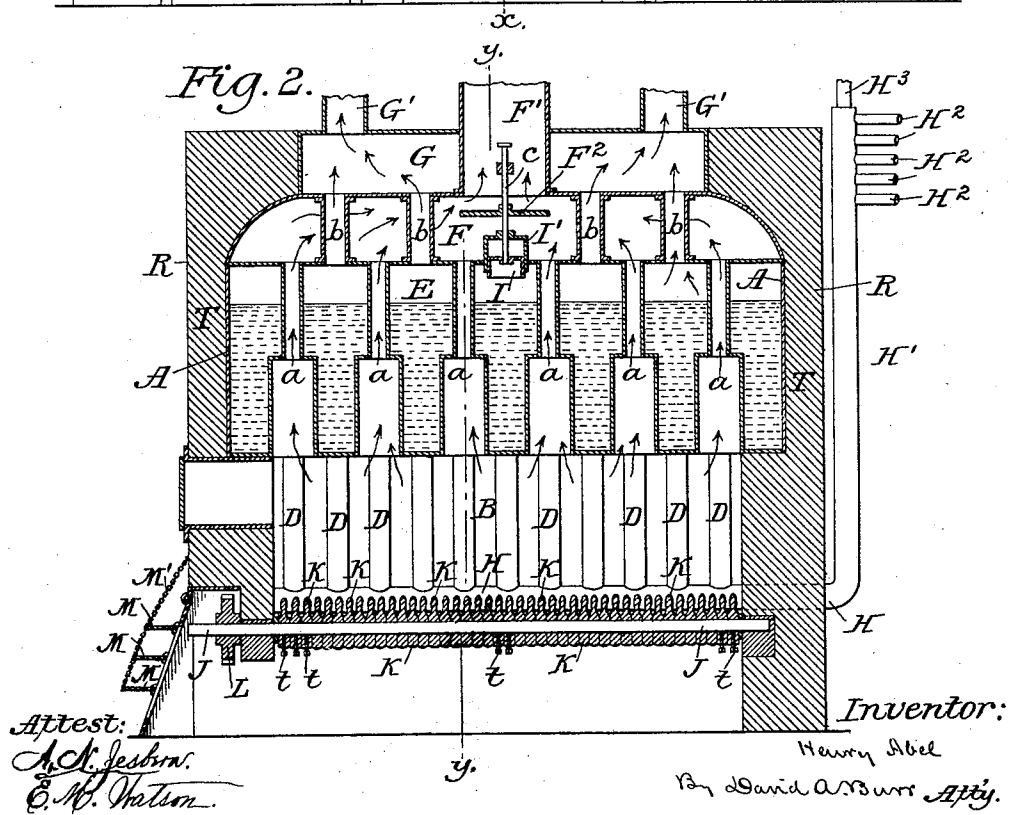
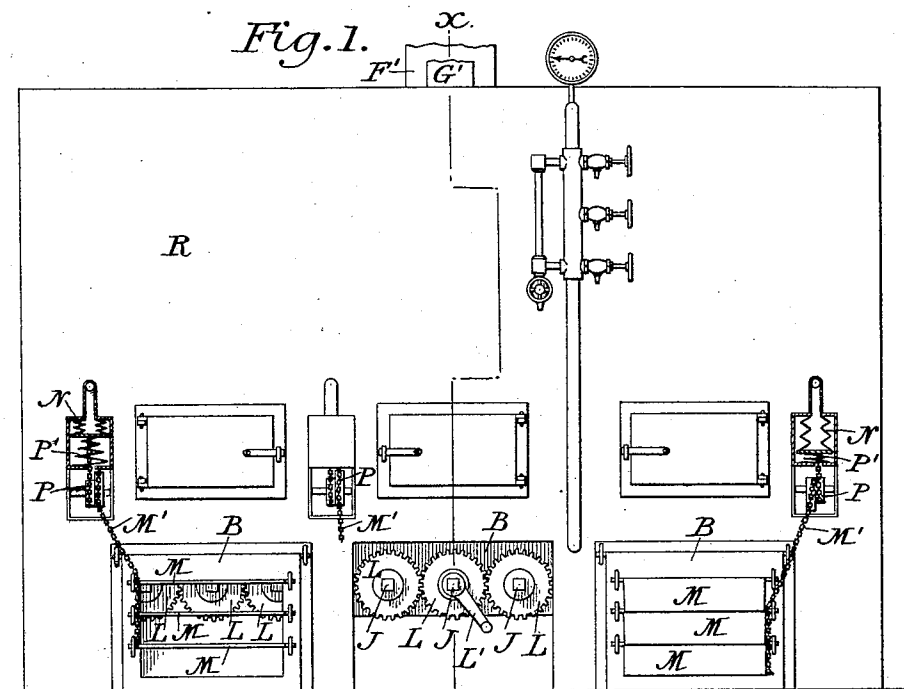
(No Model.)

2 Sheets—Sheet 1.

H. ABEL.
LOW PRESSURE STEAM BOILER.

No. 475,479.

Patented May 24, 1892.



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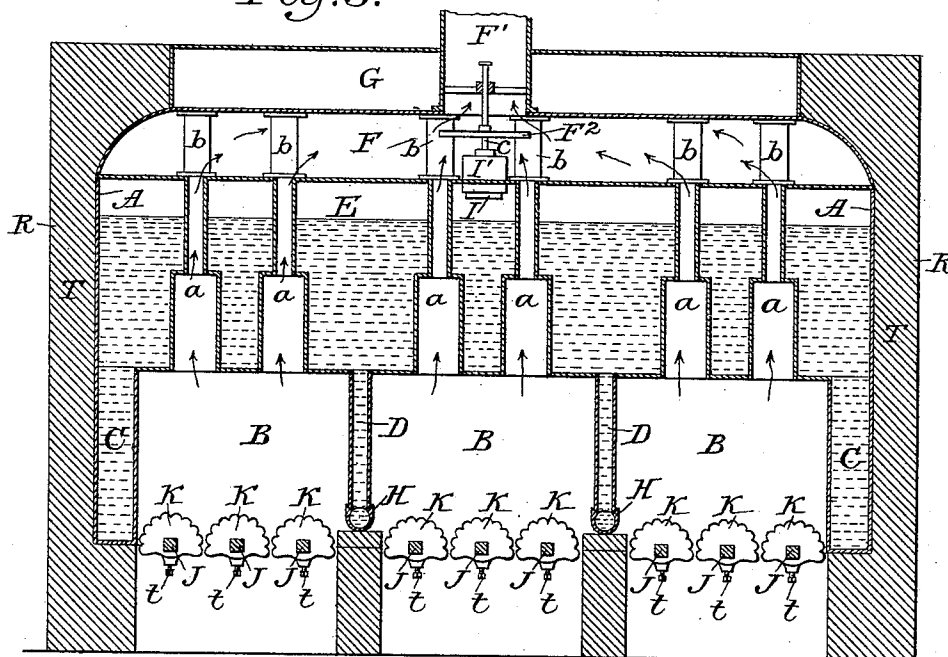
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Fig. 3.



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UNITED STATES PATENT OFFICE.

HENRY ABEL, OF CARLSTADT, NEW JERSEY.

LOW-PRESSURE STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 475,479, dated May 24, 1892.

Application filed March 19, 1891. Serial No. 385,614. (No model.)

To all whom it may concern:

Be it known that I, HENRY ABEL, of Carlstadt, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Low-Pressure Steam-Boilers for Heating Purposes; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, making a part of this specification.

My invention relates to the construction of low-pressure boilers especially adapted for heating conservatories by steam.

It has for its object to provide a boiler which with the least possible height shall furnish a large volume of steam, which may be made to circulate through the heating-pipes of a conservatory at a low pressure.

It consists in the novel combination and arrangement of the several parts of the boiler to attain this end, substantially as is hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a front elevation of my improved boiler with the doors of the central fire-box removed and with two automatic damper-regulators in section, the one on the right being shown as in action to close the dampers and that on the left to open them. Fig. 2 is a longitudinal section in the line *x x* of Fig. 1; Fig. 3, a transverse section in the line *y y* of Fig. 2.

My boiler is constructed of an outer metallic casing *A A*, of properly-riveted steel plates and which may be made of small transverse dimensions, or may be widened, as represented in the drawings, to admit of division into a series of fire-boxes extending from front to rear. It is provided laterally with water spaces or legs *C C*, formed in the outer casing to inclose the furnace, which may be partitioned into longitudinal fire-boxes *B B B* by means of a series of vertical tubes or water-legs *D D*, all communicating with the body or main water-box *E* of the boiler, which is made to extend over and above the fire-boxes. The casing for the boiler is made comparatively very low in height. Its upper end is divided by horizontal partitions into two chambers *F* and *G*, the lower end *F* next to the water-box being designed to serve as a combustion-chamber and the upper one as a

steam-chest. These partitions, together with the top plate of the boiler, are supported by a series of vertical tubes, of which one set (designated by the letters *a a*) extends from the crown-sheet of the furnace or fire-box up through the water-space and opens into the combustion-chamber *F*, and the other (designated as *b b b*) extends from the top of the water-space through the combustion-chamber *F* and opens into the steam-chest *G*.

The hot-air tubes *a a* are of special construction, being contracted midway of their length, so as to be very much larger in their lower than in their upper ends, (see Figs. 2 and 3,) thereby increasing the radiating-surface therein and rendering the same much more effective than is possible with the use of parallel-sided tubes.

The water-legs *C C* of the casing and water-tubes *D D* in the furnace-partitions are all connected at their lower ends on a common level with a transverse pipe or manifold *H* (see Fig. 2) at the rear of the furnace, which communicates with a vertical feed and circulating pipe *H'*, to which are connected the return-pipes *H² H² H²* of the circulating system, and also a feed-water-supply pipe *H³*. The steam-chest *G* connects with the same system by means of the delivery-pipes *G' G'*.

The combustion-chamber *F* communicates with the chimney of the furnace by means of a smoke-flue *F'*, which extends up centrally through the steam-chest. This smoke-flue is governed by a damper *F²*, which consists of a disk secured within the combustion-chamber under the mouth of the flue upon a vertical rod *c*, moving freely in suitable bearings, so that the disk may be carried up into the mouth of the flue to close it, or be allowed to drop away therefrom to open it. Its movement is produced automatically by means of the pressure of the steam in the boiler, which is left free to act against a piston *I*, fitted in a cylinder *I'*, mounted in the top of the water-chamber and properly packed and secured in all its joints to prevent an escape of steam thereat. This piston *I* is connected directly to the valve-rod *c*, so that when the pressure in the water-space of the boiler becomes abnormal it will operate to lift the piston *I*, and thereby close the damper *F²* in the smoke-flue, the valve being so weighted as to

drop when the pressure under the piston I is normal.

The furnace is fitted with a revolving grate, which is constructed of two or more rotary bars J, each angular in cross-section, extending the length of the fire-box and mounted in suitable bearings at each end to permit of its free rotation. Upon each bar are strung a series of independent duplicate sector-shaped plates or sections K K, enlarged in thickness at their narrow ends and serrated on their curved edges. Each toothed grate-plate is formed with an angular aperture to receive the angular bar and be thereby made to revolve with it, and may be secured by means of a set-screw *t*, engaging the bar.

To produce movement of the grate-bars the outer end of each at the front of the furnace is fitted with a pinion L, (see Fig. 1,) meshing with a counterpart pinion on the adjacent bar, so that by rocking or rotating any one of the bars by means of a crank L', applied thereto, they will all be made to move in unison. When it is desired to dump the grate, the bars are caused to make a complete revolution.

To increase the efficiency and utility of my boiler each furnace-door is provided with a set of dampers M M M, pivoted to swing upon horizontal axes. These dampers are connected together by a chain M', which also extends to the lower end of a water-bellows (or an equivalent piston) N, fitted in a suitable case or cylinder placed at the front of the boiler (see Fig. 1) and which communicates with the water-space in the boiler. The chain M' is made to pass over a differentially-grooved pulley P, whereby as the pressure in the boiler increases beyond the normal point and the bellows are thereby expanded the dampers will be allowed to close by their gravity, while the contraction of the bellows under the stress of a spring P', operating against them, will as the pressure is reduced cause the dampers to open. These dampers M M in the doors of the furnace will thus operate in harmony with the action of the damper F² in the smoke-flue F' to regulate the degree of combustion in

the furnace by controlling the admission of oxygen thereto, and will thus determine automatically the pressure of steam in the apparatus so long as the furnace is properly supplied with fuel.

The boiler thus constructed admits of being placed for use in connection with conservatories, graperies, and other structures which are of low altitude and without the need of altering the general arrangement of such as are already erected and in use; and it will produce a large volume of steam at low pressure with great economy of fuel, and consequently a uniform heat, without the need of the constant care or supervision of an attendant.

I claim as my invention—

The combination, in a low-down low-pressure boiler, with its fire box or furnace and its outer walls, of a water-box having lateral water-legs inclosing the fire-box and intermediate tubular water-legs dividing the fire-box from front to rear into sections, a combustion-chamber above the water-box, vertical flues enlarged at their lower ends and contracted at their upper ends, extending through the water-box from the fire-box to the combustion-chamber, a steam-chest above the combustion-chamber, vertical flues extending through the combustion-chamber and connecting the water-box with the steam-chest, a smoke-flue extending through the steam-chest and communicating with the combustion-chamber, a manifold pipe at the rear of the furnace communicating with the lower ends of the several water-legs, and a system of circulating-pipes connected with said manifold and with the steam-chest, all substantially in the manner and for the purpose herein set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HENRY ABEL.

Witnesses:

A. N. JESBERA,
J. M. CAREW.