(No Model.)

H. H. WARD.

STEAM GENERATOR.

No. 326,466. Patented Sept. 15, 1885.

Fig. 1.

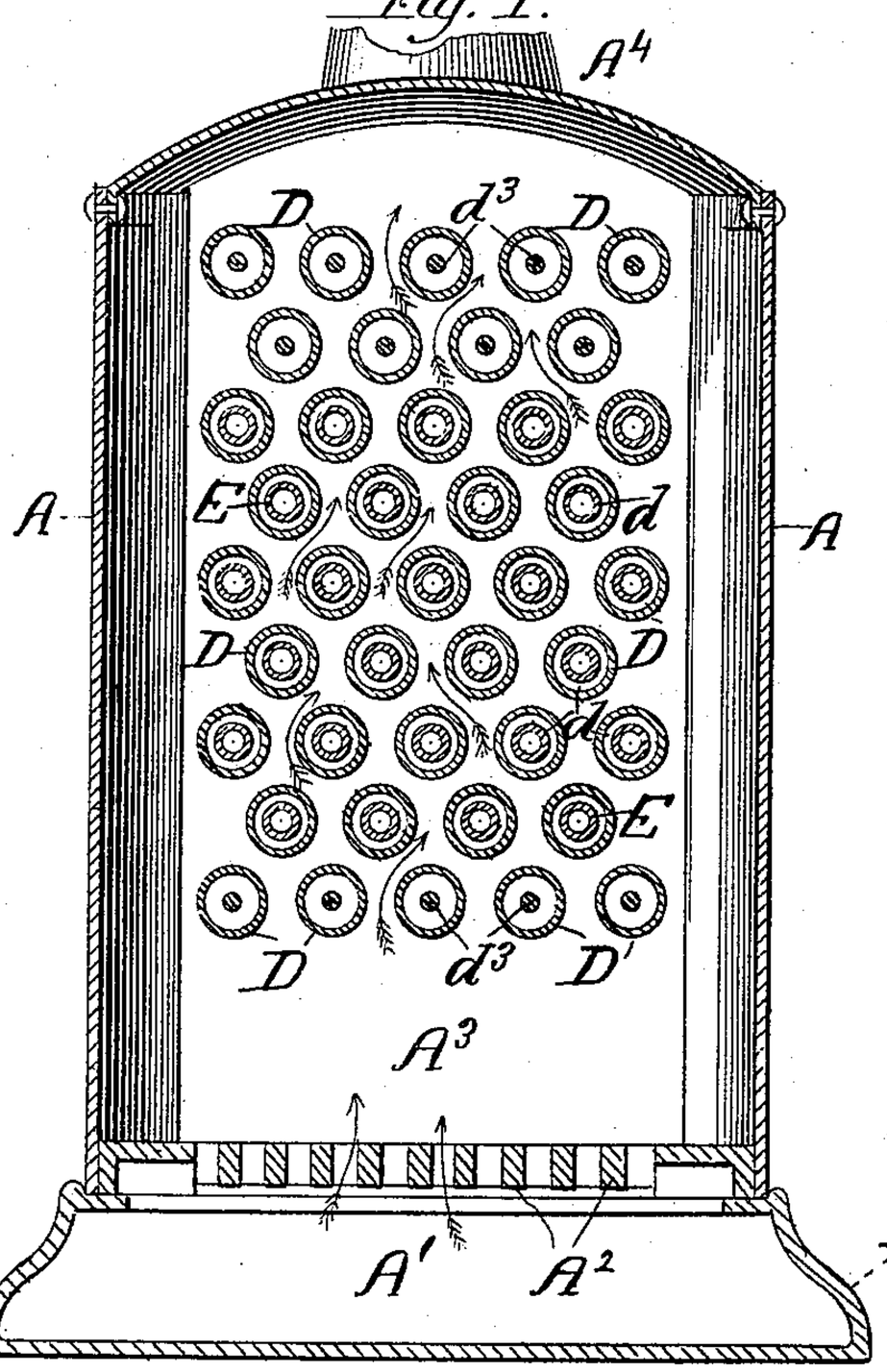


Fig. 2.

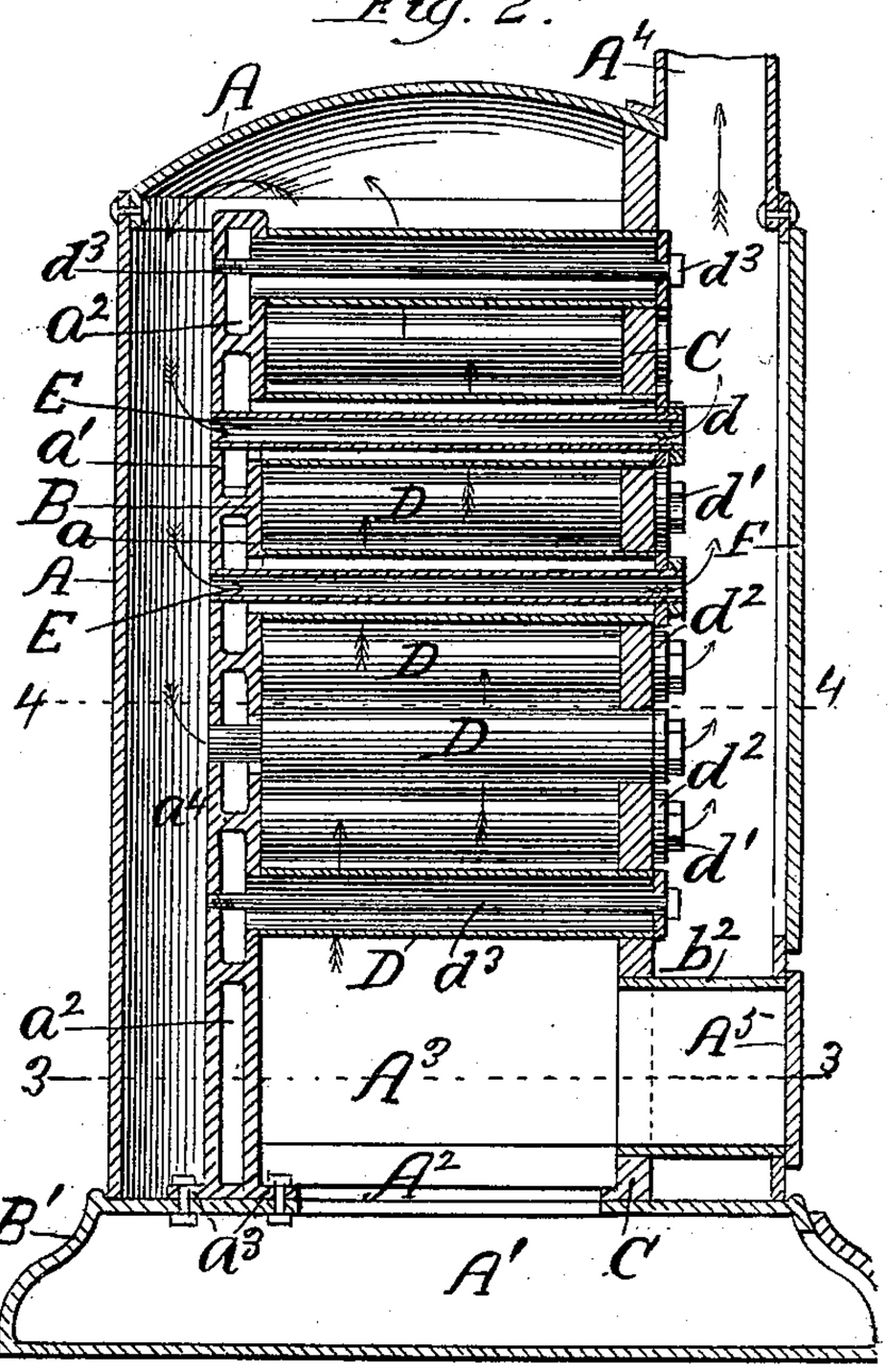


Fig. 3.

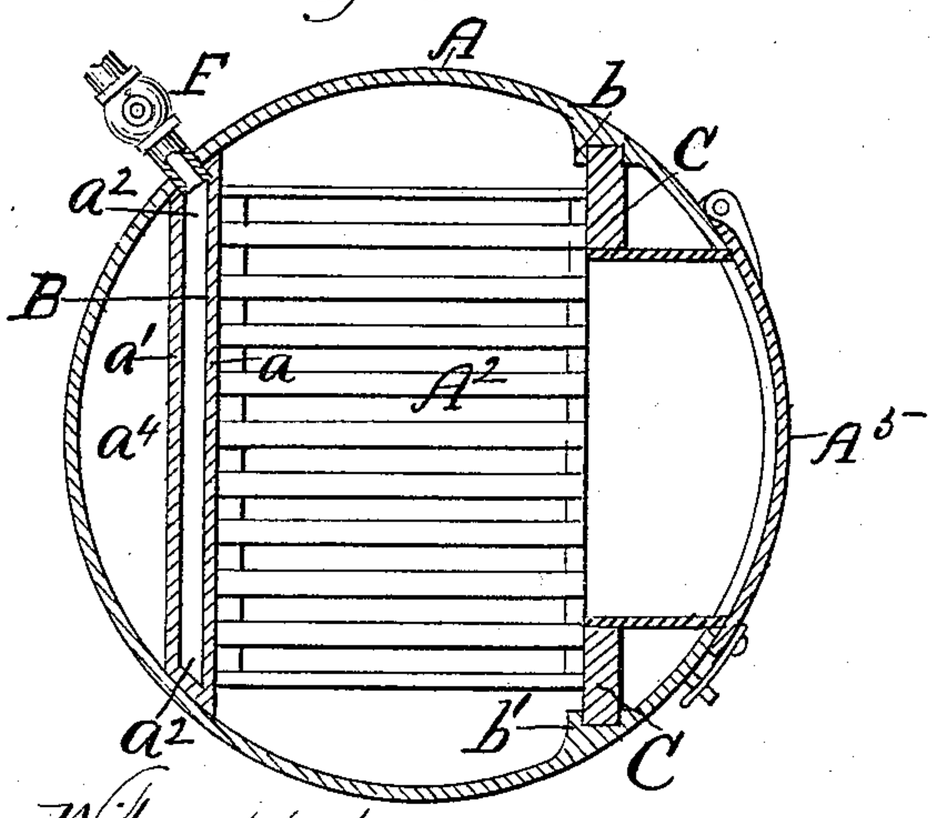
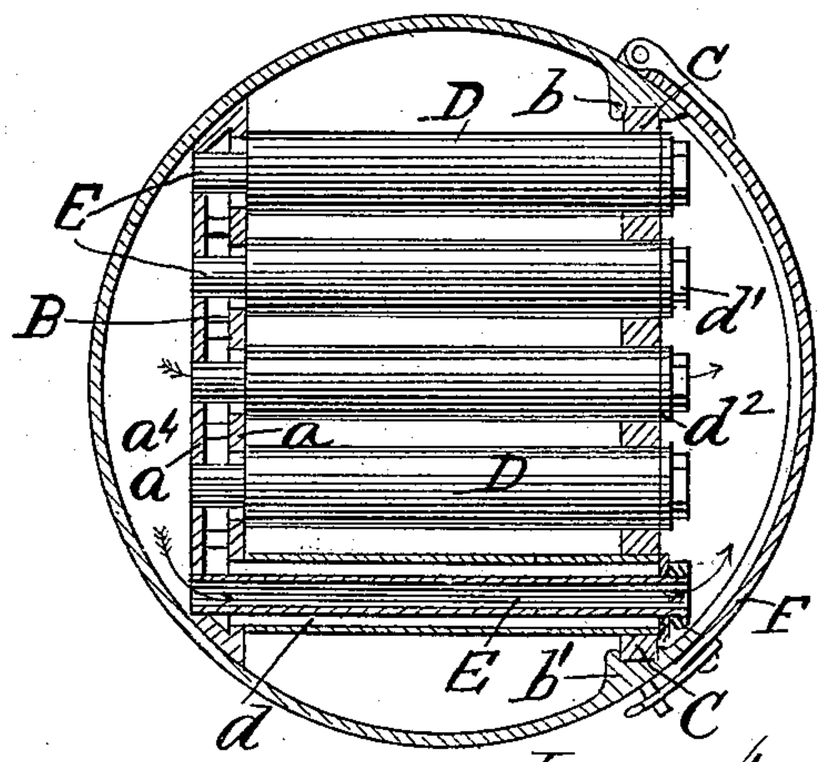


Fig. 4.



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UNITED STATES PATENT OFFICE.

HENRY H. WARD, OF BATAVIA, ILLINOIS.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 326,466, dated September 15, 1885.

Application filed April 8, 1885. (No model.)

To all whom it may concern:

Be it known that I, HENRY H. WARD, a citizen of the United States, residing at Batavia, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in a Steam-Generator, of which the following is a full, clear, and exact description, that will enable others to make and use the same, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to that class of steam-generators which are composed of a number of tubes or pipes; and it consists of certain novel features in the construction, arrangement, and combination of the several parts, as will be hereinafter set forth.

Figure 1 is a vertical transverse section of an apparatus embodying my improved features; Fig. 2, a vertical longitudinal section; Fig. 3, a horizontal section just above the line of the grate-bars in the plane 3 3, Fig. 2, and Fig. 4 a horizontal section in the plane 4 4, Fig. 2.

Referring to the drawings, A represents the jacket or walls inclosing the generating apparatus; A′, the ash-pit; A^2, the grate-bars; A^3, the combustion-chamber; A^4, the smoke-flue leading to the outer atmosphere, and A^5 the fire-door.

The back part of the generator consists of the double hollow perforated plate B, *a* representing the inside plate, and *a′* the outside plate, with the water-circulating space a^2 between the two, as shown in Figs. 2, 3, and 4. The lower part of this double plate is provided with the flange a^3, and bolted to the hollow base B′, as shown in Fig. 2. The vertical edges are beveled so as to fit closely to the circular inclosing-jacket A, as shown in Fig. 3, and thus provide the heat-compartment a^4, sufficient space, a^5, being left at the top between the inclosing-jacket and the plate B for the products of combustion to pass over into the compartment a^4.

The front perforated plate, C, is supported in a vertical position by engaging with grooves in the lugs *b b′* of the jacket A, the upper part extending clear to the top of the jacket and forming a partition between the space a^5 and the chimney A^4. The lower part of the plate C is cut out in the center and rests on the dead-plate b^2, while the two edges on each side of the cut-out part extend down and set on the base B′.

The front plate, C, is perforated for the insertion of the series of horizontal water-tubes D, which extend back and abut against the inner surface of the inside plate, *a*, provided with corresponding perforations, but of a less diameter, so that the abutting ends of the water-tubes will surround and inclose the same. The front ends of the water-tubes come flush with the outside surface of the front plate, C. These tubes are arranged alternately, as shown in Fig. 1, so as to form circuitous passages for the distribution of the heat, and thereby increase the heating-surface.

The tubes D may be of any desired diameter and length, and of any number, in accordance with the generating capacity required.

The series of flues E are arranged inside of the tubes D, and are of a less diameter, in order to provide the water-space *d* between the two, as shown. These flues are of a greater length than the inclosing-tubes, the back ends passing through and screwing into perforations in the outside part, *a′*, of the back plate, B, as shown in Fig. 2. The front ends of the flues are threaded, and project far enough to receive the correspondingly-threaded clamping-nuts *d′* and the washers d^2, placed between said clamping-nuts and the plate C.

The washers have a bearing on the front ends of the water-tubes, which are faced, as well as all the bearing parts, so as to form tight joints.

By the arrangement and means described all the parts entering into the construction of the generator proper are drawn closely together, firmly locked, and strongly supported in proper position relative to each other. This construction also enables repairs to be executed with facility and dispatch, as any one of the flues and tubes may be conveniently removed and replaced without reference to the others.

F is the feed-water pipe, connected with the lower part of the hollow plate B, and from thence the water circulates through the tubes.

The clamping stay-bolts d^3 are substituted for the flues in a number of the upper and

lower water-tubes. These stay-bolts are of a much less diameter than the flues, and increase the steam and water space at these points.

This construction and arrangement presents a large amount of heating-surface, as the products of combustion must pass up between and around the water-tubes to the top and over the double hollow plate into the compartment a^4, and then return through the flues to the front and pass out into the chimney. It will thus be seen that the greater part of the heat is utilized, and that but a small percentage is lost.

The door F′ in the front part of the jacket conveniently permits of access to make repairs, or for any other purpose.

The clamping-nuts and the washers may be formed integral and then faced up on the washer side to form a tight joint.

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

1. In a steam-generating apparatus of the character hereinbefore described, the combination, with an inclosing-jacket provided with inwardly-projecting lugs, of a perforated front plate, a double hollow perforated back plate, and a supporting-base, substantially as set forth.

2. In a steam-generating apparatus, the combination, with a double back plate, as described, of a front plate, the water-tubes loosely inserted between said plates, the flues inclosed by said tubes and having threaded projecting ends, one end of said flues being adapted to screw into the outside back plate and the opposite ends to receive a screw-threaded clamping-nut, whereby the parts are drawn together to form a tight joint, substantially as set forth.

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