(No Model.) 2 Sheets—Sheet 1.

E. HAYES.

GENERATOR.

No. 489,002 Patented Jan. 3, 1893.

Fig. 1.

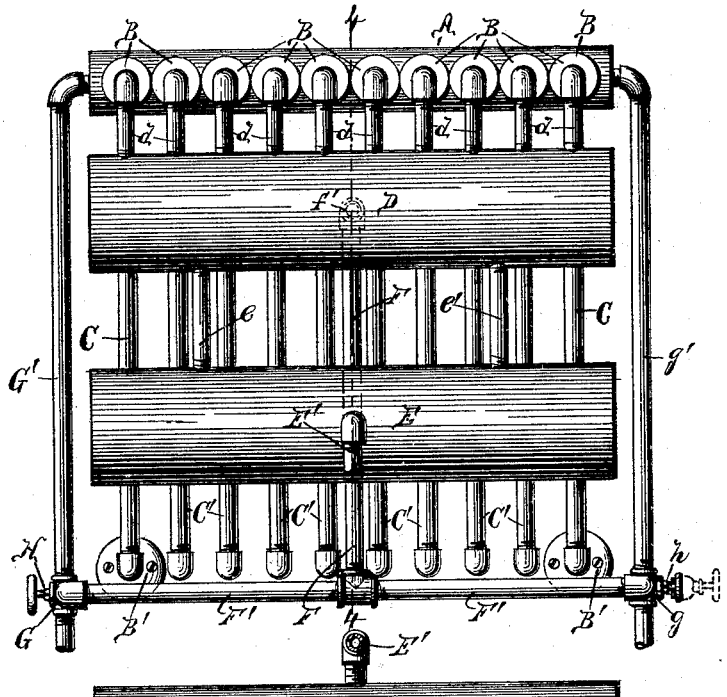
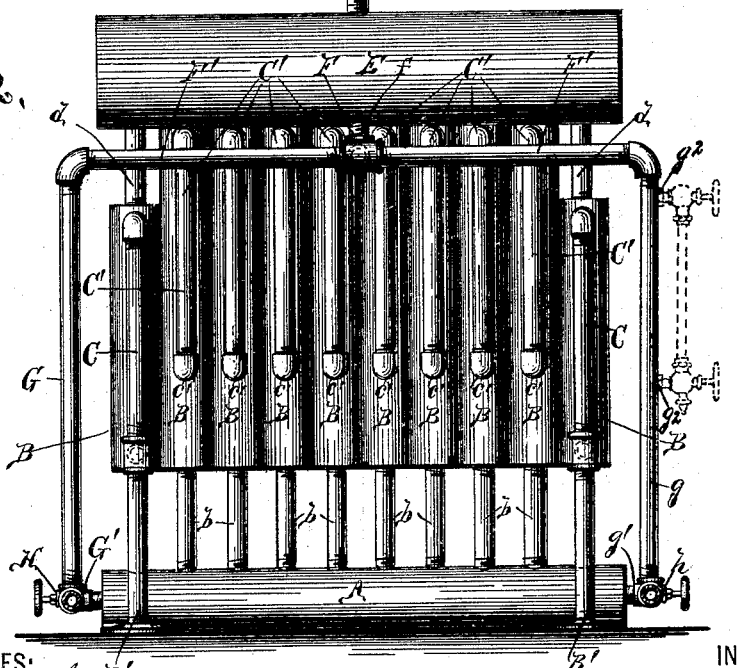


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

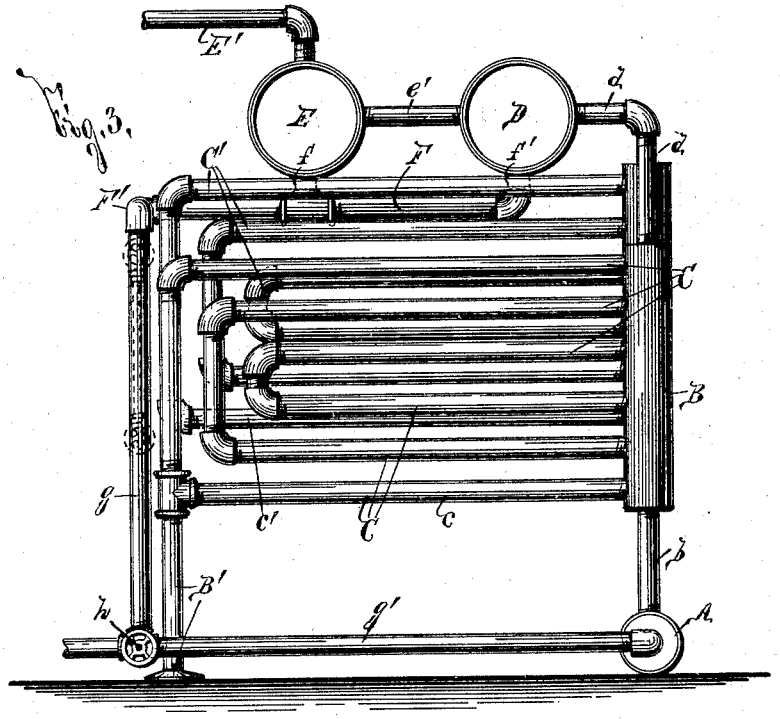
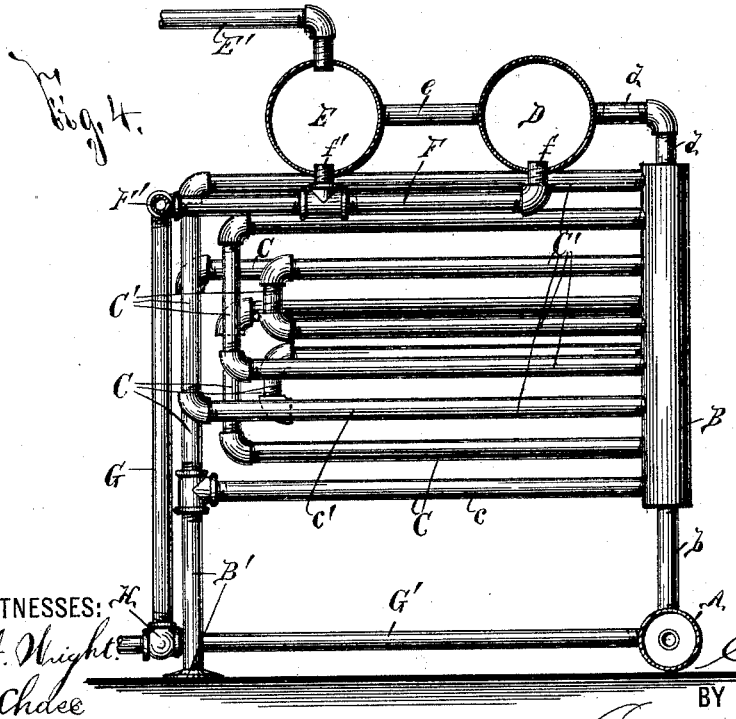


Fig. 4.



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UNITED STATES PATENT OFFICE.

EDWARD HAYES, OF ROCHESTER, NEW YORK.

GENERATOR.

SPECIFICATION forming part of Letters Patent No. 489,002, dated January 3, 1893.

Application filed April 18, 1892. Serial No. 429,599. (No model.)

To all whom it may concern:

Be it known that I, EDWARD HAYES, of Rochester, in the county of Monroe, in the State of New York, have invented new and useful Improvements in Generators, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

My invention relates to improvements in steam generators and has for its object the production of a simple, durable, economical and efficient construction possessing a great amount of heating surface, and capable of being quickly and readily repaired without the exercise of great skill or ingenuity, or the necessity of stopping the operation of the entire boiler while a portion is being repaired.

To this end the invention consists, essentially, in a horizontal water containing drum arranged at one side of the combustion chamber, upright heads connected to the drum, a series of U-shaped pipes arranged in a series one within the other projecting from one side of the separate heads toward the corresponding side of the generator, the lower arms of the outer pipes of the series connected to the end heads, extending downwardly to the corresponding arms of the adjacent central pipes for forming the sides of the combustion chamber, a separation drum arranged transeversely above the generator pipes and connecting from side to side of the generator, connections between the separation drum and the separate heads, a steam drum arranged transversely across the generating pipes in advance of the separation drum and connected thereto, and a pipe connected to the separation and steam drums and to the water containing base: and in the detail construction and arrangement of the parts, all as hereinafter more particularly described and pointed out in the claims.

In describing this invention, reference is had to the accompanying drawings, forming a part of this specification, in which like letters indicate corresponding parts in all the views.

Figures 1, 2 and 3 are, respectively, top plan, front, and side elevations of my improved generator, the outer shell being removed, as it forms no part of my present invention; and Fig. 4 is a longitudinal vertical sectional view, taken on line 4—4, Fig. 1.

(A) is a water containing drum which is preferably disposed in a horizontal plane at the rear side of the generator.

(B) represents upright heads each mounted above the drum (A) with its base in close proximity thereto and connected independently to the drum by a short piece of pipe (*b*). Projecting from the front face of the heads (B) at the ends of the drum (A) are generating pipes (C) which are preferably U-shaped and arranged in a series one within the other. The lower arms (*c*) of the outer pipes of the series (C) are disposed in a horizontal plane in close proximity to the corresponding plane of the lower extremities of the end drum carrying said pipes for forming the sides of the combustion chamber.

(B′—B′) are suitable supports at the forward extremity of the arms (*c*—*c*) for adding to the stability of my generator.

(C′) represents generating pipes of similar construction to the pipes (C) with the exception that their lower arms (*c*′) are disposed in a horizontal plane considerably elevated above that of the corresponding arms (*c*) of the pipes (C) for forming the top of the combustion chamber.

(D) is a steam separation drum extending transversely above the pipes (C—C′) from side to side of the generator. Between this drum and the separate heads, are independent connections (*d*) whereby each head discharges its steam into the separation drum.

Directly in advance of the drum (D) is a steam drum (E) also arranged transversely above the generator pipes (C—C′) and extending from side to side of the generator. The opposite ends of these drums (D—E) are connected together by short pipes (*e*—*e*′) for passing the steam from one to the other and equalizing the pressure in both. The steam is withdrawn from the drum (E) by a pipe (E′) connected thereto at any desired point.

(F) represents a pipe connected by upwardly extending branches or arms (*f*—*f*′) to the base of the drums (D) and (E) for withdrawing therefrom any water carried over by the steam. This pipe (F) is preferably arranged between the ends of the generator and is formed with laterally extending arms (F′—F′) in front of the generator pipes.

(G—*g*) represent, respectively, upright pipes

arranged at the front side of the generator and connected at their upper ends directly to the adjacent arms (F'—F') of the pipe (F) and at their lower ends by the pipes (G'—g') to the adjacent ends of the water containing drum (A). A blow-off valve (H) is connected to one of the pipes, as (G), and the feed water valve (h) to the other pipe, as (g), or its branch (g'). One of the pipes, as (g), is also provided with outwardly extending connections (g^2—g^2) to which a water gage may be readily and simply attached.

When in operation, the water within the generating pipes (C—C') is subjected to the heat of the gases and other products of combustion and a rapid circulation is produced in the separate pipes; the steam is then discharged into the upper extremity of the separate heads (B) and conveyed by the connections (d) to the separation drum (D) whence it passes by the connections (e—e') to the drum (E). The steam is then withdrawn through the pipe (E') and any water carried into the drums (E) and (D) quickly passed through the pipe (F), the branch pipes (F'—F'), the pipes (G—g) and their respective branches (G'—g') to the drum (A).

Each head and the generating pipes connected thereto form a separate independent section which may be readily removed by unscrewing the pipes (b) and (d) and upon plugging the openings in the drums (A) and (D) the generator may be then fired until the section is replaced.

The operation of my invention will be readily perceived from the foregoing description and upon reference to the accompanying drawings, and it will be noted that the same is simple, effective and practical, economically manufactured and readily repaired. It is evident however, that the detail construction and arrangement of my generator may be somewhat varied, hence I do not herein limit myself to the exact construction and arrangement.

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

1. In a steam generator, the combination of a horizontal water containing drum, upright heads mounted above the horizontal drum and connected thereto, U-shaped pipes projecting laterally from one of the end heads and arranged one within the other, the lower arm of the outer pipe being in proximity to the base of said head and U-shaped pipes projecting laterally from the central heads and arranged one within the other, the lower arm of the outer pipes of these latter U-shaped pipes being arranged above the former lower arms, substantially as and for the purpose set forth.

2. In a steam generator, the combination of a horizontal water containing drum, upright heads mounted above the horizontal drum, U-shaped generating pipes arranged in a series one within the other projecting laterally from the heads, a steam separation drum extending transversely across the generating pipes, independent connections between the separate heads and the separation drum, and a second drum arranged transversely above the generating pipes in advance of the former drum and connected thereto, substantially as and for the purpose specified.

3. In a steam generator, the combination of a horizontal water containing drum, upright heads mounted above the horizontal drum, U-shaped generating pipes arranged in a series one within the other projecting laterally from the heads, a steam separation drum extending transversely across the generating pipes, independent connections between the separate heads and the separation drum, a second drum arranged transversely above the generating pipes in advance of the former drum and connected thereto, and water connections between the latter drum and the horizontal water containing drum, substantially as and for the purpose set forth.

4. In a steam generator, the combination of a horizontal water containing drum, arranged transversely at the rear side of the combustion chamber, upright heads mounted above the horizontal drum, U-shaped generating pipes arranged in a series one within the other projecting from the front side of the heads to the front side of the generator, a steam separation drum extending transversely across the generating pipes from side to side of the generator, and a second drum arranged transversely above the generating pipes in advance of the former drum and connected thereto, substantially as and for the purpose specified.

5. In a steam generator, the combination of a horizontal water containing drum, upright heads mounted above the horizontal drum, U-shaped generating pipes arranged in a series one within the other projecting laterally from the heads, a steam separation drum extending transversely across the generating pipes, independent connections between the separate heads and the separation drum, a second drum arranged transversely above the generating pipes in advance of the former drum, connections between the opposite ends of said drums, and a connection between the base of said drums and the water containing base, substantially as and for the purpose specified.

6. In a steam generator, the combination of a horizontal water containing drum, upright heads mounted above the horizontal drum, U-shaped generating pipes arranged in a series one within the other projecting laterally from the heads, a steam separation drum extending transversely across the generating pipes, independent connections between the separate heads and the separation drum, a second drum arranged transversely above the generating pipes in advance of the former drum, connections between the opposite ends of said drums, a pipe connected to the base of said drum and oppositely arranged branches con-

nected to said pipe and to the opposite extremities of the water containing base, substantially as and for the purpose set forth.

7. In a steam generator, the combination of a horizontal water containing drum arranged transversely at the rear side of the combustion chamber, upright heads mounted above the horizontal drum, U-shaped generating pipes arranged in a series one within the other projecting from the front side of the heads toward the front side of the generator, a steam drum extending transversely across the generating pipes from side to side of the generator, a steam outlet pipe connected to said drum, a second outlet pipe connected to the base of the drum and provided with laterally extending arms connected to the opposite ends of the water containing drum, substantially as and for the purpose set forth.

8. In a steam generator, the combination of a horizontal water containing drum arranged transversely at the rear side of the combustion chamber, upright heads mounted above the horizontal drum, U-shaped generating pipes arranged in a series one within the other projecting from the front side of the end heads to the front side of the generator, the lower arms of the outer pipes being in proximity to the base of the heads for forming the sides of the combustion chamber, U-shaped pipes projecting from the front face of the central heads toward the front of the generator for forming the top wall of the combustion chamber, the lower arms of the outer pipes of these latter U-shaped pipes being arranged above the former lower arms, a steam drum above the generating pipes extending from front to side of the generator, and a connection between the steam drum and the water containing drum, substantially as and for the purpose specified.

9. In a steam generator, the combination of a horizontal water containing drum arranged transversely at the rear side of the combustion chamber, upright heads mounted above the horizontal drum, U-shaped generating pipes arranged in a series one within the other projecting from the front side of the heads toward the front side of the generator, a steam drum extending transversely across the generating pipes from side to side of the generator, a steam outlet pipe connected to said drum, a second outlet pipe connected to the base of the drum and provided with laterally extending arms, upright pipes at the extremities of the front side of the generator connected to the adjacent ends of the water containing drum and of said arms, substantially as and for the purpose set forth.

10. In a steam generator, the combination of a horizontal water containing drum arranged transversely at the rear side of the combustion chamber, upright heads mounted above the horizontal drum, U-shaped generating pipes arranged in a series one within the other projecting from the front side of the heads toward the front side of the generator, a steam drum extending transversely across the generating pipes from side to side of the generator, a steam outlet pipe connected to said drum, a second outlet pipe connected to the base of the drum and provided with laterally extending arms, upright pipes at the extremities of the front side of the generator connected to the adjacent ends of the water containing drum and of said arms, a blow-off valve connected to one of said upright pipes, and connections for the water gage connected to the other of said pipes, substantially as and for the purpose set forth.

11. In a steam generator, the combination of a horizontal water containing drum arranged transversely at the rear side of the combustion chamber, upright heads mounted above the horizontal drum, U-shaped generating pipes arranged in a series one within the other projecting from the front side of the heads toward the front side of the generator, a steam separation drum extending transversely across the generating pipes from side to side of the generator, and a second drum arranged transversely above the generating pipes in advance of the former drum and connected thereto, a steam outlet pipe connected to the steam drum, and a second outlet pipe connected to the base of said drums and provided with laterally extending arms connected to the opposite ends of the water containing drum, substantially as and for the purpose set forth.

In testimony whereof I have hereunto signed my name, in the presence of two attesting witnesses, at Rochester, in the county of Monroe, in the State of New York, this 18th day of March, 1892.

EDWARD HAYES.

Witnesses:
HAMPDEN HYDE,
ROY C. WEBSTER.