(No Model.)

F. C. ROMKEY.

STEAM GENERATOR.

No. 467,835. Patented Jan. 26, 1892.

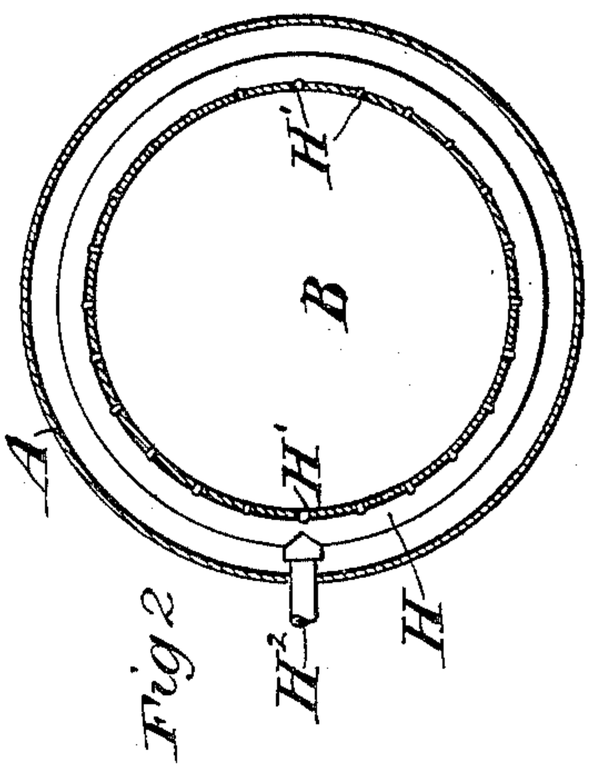

Fig 2

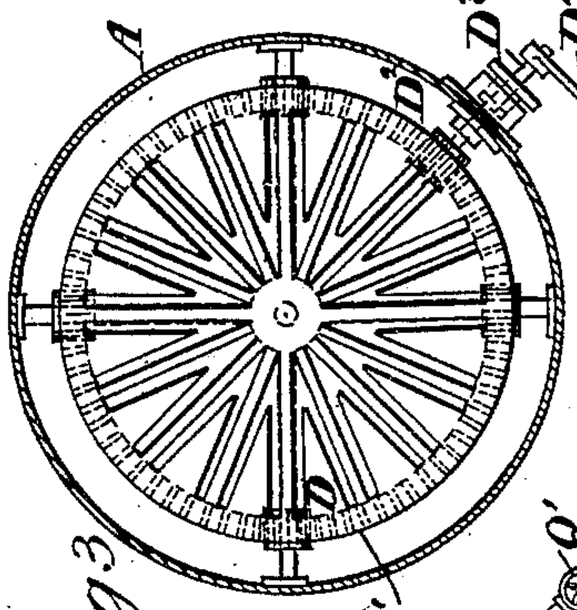

Fig 3

Fig 1

Fig 4.

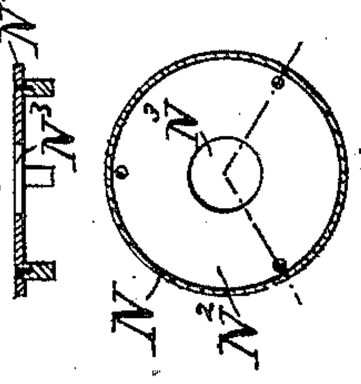

Fig 5.

Fig 6.

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FRANK C. ROMKEY, OF TOLEDO, OHIO.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 467,835, dated January 26, 1892.

Application filed March 27, 1891. Serial No. 387,657. (No model.)

To all whom it may concern:

Be it known that I, FRANK C. ROMKEY, of Toledo, in the county of Lucas and State of Ohio, have invented a new and Improved Steam-Generator, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved steam-generator which is simple and durable in construction and in which the water in jets is evaporated to mix with the products of combustion arising from the burning fuel in a furnace.

The invention consists, principally, in a gas-producing furnace, one or more evaporators connected with the combustion-chamber of the said furnace, and a water-jacket held on the said furnace and discharging into the said evaporators.

The invention also consists of certain parts and details and combinations of the same, as will be hereinafter fully described, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a sectional side elevation of the improvement. Fig. 2 is a sectional plan view of the same on the line *x x* in Fig. 1. Fig. 3 is a sectional plan view of the improvement on the line *y y* in Fig. 1, showing the revolving grate. Fig. 4 is a sectional plan view of one of the evaporators on the line *z z* in Fig. 1. Fig. 5 is a like view of the same on the line *w w* in Fig. 1, and Fig. 6 is a sectional side elevation of one of the disks of the evaporators.

The improved steam-generator is provided with a gas-producing furnace A, containing a fire-box B, in which is held fuel C in an incandescent state, said fuel, which is preferably coal, resting on a revolving grate D, below which is arranged the ash-pit E, closed air-tight, so that air and water can be introduced into the same under pressure, as hereinafter more fully described.

The grate D is mounted at its center on a suitable pivot, around which the grate revolves, and the under side of the grate is formed with a gear-wheel D′, in mesh with a pinion D^2, secured on a radially-extending shaft D^3, passing through the shell of the furnace to the outside and carrying on its outer end a crank-arm D^4 for conveniently revolving the said grate D, so as to agitate and regulate the burning fuel.

The fire-box B is surrounded by a water-jacket F, provided with an inlet-pipe G, having a valve G′, the said jacket being also provided near its upper end with an outlet-pipe G^2, passing through or discharging into the outlet-flue B′ of the combustion-chamber of the fire-box B. The water in the jacket F is heated by the heat generated in the fire-box B. The jacket F contains a circular pipe H, fitted closely around the fire-box B and provided with inwardly-extending short pipes or nipples H′, which pass or extend into the combustion-chamber of the fire-box B—that is, a short distance above the burning fuel—as is plainly shown in Fig. 1.

The pipe H is connected with a pipe H^2, leading to the compressing-cylinder of an air-compressor J of any approved construction. When the air-compressor is set in motion, the compressed air passes through the pipe H^2 into the pipe H, and from the latter through the nipples H′ into the combustion-chamber of the fire-box B, so as to mix with the gases arising from the burning fuel. In order to regulate the amount of air passing through the pipe H the pipe H^2 is provided with a valve H^3. From the pipe H^2, near the valve H^3, leads a branch pipe K, which discharges into the air-tight ash-pit E, the said pipe being provided with a valve K′ for regulating the amount of air taken from the pipe H^2. Into the branch pipe K, below the valve K′, opens a small water-pipe L, having a valve L′, and connected with a globe or dome L^2, arranged on top of the water-jacket F, so that steam or water from the water-jacket can pass to the dome L^2, then through the pipe L, past the valve L′, into the branch pipe K, to mix with the air therein, the mixture being discharged into the ash-pit E, from which it passes through the grate D and through the glowing coal C to produce carbonic oxide, which is mixed with the compressed air from the nipples H′, whereby complete combustion of the burning fuel is obtained, the oxygen being combined with the carbon and the hy-

drogen of the steam being set free to be burned in the combustion-chamber.

From the upper end of the fire-box B leads an outlet-pipe B′, connected with the upper end of an evaporator N, into which discharges the jacket outlet-pipe G^2 and which contains sets of alternating disks N′ and N^2, arranged horizontally therein. Each disk N′ is arranged centrally, so as to form at its outer edge an annular space with the inner shell of the evaporator, the next disk N^2 being secured to the shell of the evaporator, and having a central opening N^3 by which the mixture passes upon the next following disk N′, to be spread by the latter to the outer edge and to pass through the annular space down to the next following disk N^2, and so on until the mixture finally passes into a pipe O, connecting the lower end of the evaporator N with the lower end of a second evaporator P, also provided with sets of disks P′ and P^2, similar in construction to the disks N′ and N^2 in the evaporator N. The upper end of the evaporator P is provided with an outlet-pipe P^3, through which the motive power is carried to the machinery to be driven. From the upper end of the evaporator P also leads a small pipe Q, provided with a valve Q′, and discharging into the cylinder of the compressor J, so as to actuate the latter. The pipe Q is further provided with an automatically-operating valve Q^2, on the stem of which is secured a crank-arm Q^3, connected by a link Q^4 with the lever R′ of a diaphragm R, connected with the evaporator P, so that the mixture from the evaporator presses on the diaphragm, whereby the lever R′ of the latter controls the movement of the valve Q^2. The lever R′ is also connected by a link R^2 with an arm G^5 on the stem of the valve G′ controlling the inlet of the water to the water-jacket F. From the upper end of the evaporator P also leads a short pipe S, provided with a valve S′ and connecting with a pipe T, which is connected with a water-supply and discharges into the jacket discharge-pipe G^2, leading to the upper end of the evaporator N. The pipe T is provided with a valve T′. The pipe G^2 is provided with a branch pipe G^3, connected with the evaporator P and containing a valve G^4, as is plainly shown in Fig. 1.

The top of the furnace A is provided with a removable cover U, through which fuel is introduced into the fire-box B whenever necessary. A similar cover is arranged on the ash-pit E, so that the ashes can be removed at certain intervals at a time when the pressure within the ash-pit and the combustion-chamber is zero.

The operation is as follows: The air-compressor J forces air under pressure into the fire-box B above the burning fuel, and also air under pressure is forced into the air-tight ash-pit E, the air passing upward through the burning fuel with the water or steam entering the pipe K by the pipe L. Complete combustion is thus obtained in the fire-box B, the gas passing from the latter through the outlet-pipe B′ into the evaporator N, in which the heated water from the water-jacket is discharged in a continuous stream and is completely evaporated by the heated gases, thus forming steam. Complete evaporation, if necessary, takes place by forcing the mixture through the second evaporator P, so that the motive power in the upper end of the evaporator P is in a very dry state and can be readily utilized for various purposes. The amount of compressed air passing into the furnace A is regulated by the valves H^3 and K′, and the amount of water or steam permitted to pass into the pipe K is regulated by the valve L′, so that a perfect mixture for the complete combustion is under the control of the operator. The water-supply to the water-jacket F is automatically regulated from the diaphragm R, and in a similar manner the supply to the air-compressor J is regulated from the same diaphragm, as the latter controls the valves G′ and Q^2. The temperature of the motive power in the upper end of the evaporator P is measured by a suitable thermometer V. (Shown in Fig. 1.)

The ash-pit E is preferably made sufficiently large so that the process can be carried on uninterruptedly for several hours before it will be necessary to open the ash-pit for the removal of the ashes—at a time, however, when the pressure in the said ash-pit has been reduced to zero. In a like manner additional fuel is introduced into the fire-box B through the cover U after the pressure in the upper end of the fire-box has likewise been reduced to zero.

In case it is desired to clean the evaporators N and P of sediment or other impurities, a pipe O′ is provided in the connecting-pipe O containing a valve O^2. By opening the latter the impurities are washed out through the pipe O′. The fuel C in the furnace A can be regulated at any time by the operator turning the handle D^4, so as to impart a revolving motion to the grate D.

The disks N′ and N^2, P′, and P^2 are secured in their evaporators in any suitable manner, preferably, however, by forming each disk on its under side with posts resting on the next following disk. (See detail view, Fig. 6.)

It is understood that the heated water from the water-jacket F passes into the pipe G^2, and through the lower end of the pipe T into the upper end of the evaporator N, whereby the products of combustion from the fire-box B thoroughly heat the disks N′ and N^2, and thereby cause a rapid evaporation of the hot water, the steam thus produced mixing with the said products of combustion.

In case the water from the jacket F is not all evaporated or turned into steam at the time it reaches the lower end of the evaporator P, then the valve G^4 is wholly or partly opened to permit the surplus water to pass

from the jacket F to the evaporator P directly, to be changed therein into steam on the disks P′ and P², heated by the products of combustion passing upward in the said evaporator and coming from the evaporator N.

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

1. A steam-generator comprising a gas-producing furnace, one or more evaporators communicating with the said furnace, and a water-jacket held on the said furnace and discharging into the said evaporators, substantially as shown and described.

2. A steam-generator comprising a gas-producing furnace, an evaporator connected with the outlet-flue of the furnace, and a water-jacket on the furnace and discharging into the evaporator through the said outlet-flue of the furnace, substantially as described.

3. A steam-generator comprising a gas-producing furnace, one or more evaporators connected with the combustion-chamber of the said furnace and each provided with evaporating-disks adapted to discharge one upon the other, and a water-jacket held on the said furnace and discharging upon the uppermost disk of the said evaporator, substantially as shown and described.

4. A steam-generator comprising a gas-producing furnace, one or more evaporators connected with the combustion-chamber of the said furnace and each provided with evaporating-disks adapted to discharge one upon the other, a water-jacket held on the said furnace and discharging upon the uppermost disk of the said evaporator, and a supply-pipe for the said water-jacket and containing a valve controlled by the pressure of the generated steam, substantially as shown and described.

5. A steam-generator comprising a gas-producing furnace, one or more evaporators connected with the combustion-chamber of the said furnace and each provided with evaporating-disks adapted to discharge one upon the other, a water-jacket held on the said furnace and discharging upon the uppermost disk of the said evaporator, and an air-compressor for supplying air under pressure to the combustion-chamber and the closed ash-pit of the said furnace, substantially as shown and described.

6. A steam-generator comprising a gas-producing furnace, one or more evaporators connected with the combustion-chamber of the said furnace and each provided with evaporating-disks adapted to discharge one upon the other, a water-jacket held on the said furnace and discharging upon the uppermost disk of the said evaporator, an air-compressor for supplying air under pressure to the combustion-chamber and the closed ash-pit of the said furnace, and a water-supply pipe leading from the said water-jacket and connected with the pipe discharging air from the air-compressor into the said ash-pit, substantially as shown and described.

7. A steam-generator comprising a gas-producing furnace, one or more evaporators connected with the combustion-chamber of the said furnace and each provided with evaporating-disks adapted to discharge one upon the other, a water-jacket held on the said furnace and discharging upon the uppermost disk of the said evaporator, an air-compressor to supply air under pressure to the combustion-chamber and the closed ash-pit of the said furnace, and a pipe connecting one of the said evaporators with the said air-compressor to furnish the latter with motive power, substantially as shown and described.

8. In a steam-generator, a gas-producing furnace comprising a fire-box connected with a closed ash-pit, a water-jacket surrounding the said fire-box, a main air-supply pipe connected with an air-compressor and discharging into the combustion-chamber of the said fire-box, a branch air-pipe leading from the said main air-pipe into the said closed ash-pit, and a water-supply pipe leading from the said water-jacket and discharging into the said branch air-pipe, substantially as described.

9. In a steam-generator, a gas-producing furnace comprising a fire-box connected with a closed ash-pit, a water-jacket surrounding the said fire-box, a main air-supply pipe connected with an air-compressor and discharging into the combustion-chamber of the said fire-box, a branch air-pipe leading from the said main air-pipe into the said closed ash-pit, a water-supply pipe leading from the said water-jacket and discharging into the said branch air-pipe, and valves held in the said pipes for controlling the flow of air and water to the ash-pit and combustion-chamber, substantially as shown and described.

10. A steam-generator comprising a furnace having a water-jacket, an evaporator communicating with the combustion-chamber and into which the water-jacket discharges, and an air-compressor for supplying air to the furnace above and below the grate, substantially as described.

11. A steam-generator comprising a furnace having a water-jacket, an evaporator communicating with the combustion-chamber and into which the water-jacket discharges, an air-compressor, pipes leading from the compressor to the upper and lower parts of the furnace, and a pipe for conveying the steam from the water-jacket to the pipe which delivers air to the lower part of the furnace, substantially as herein shown and described.

FRANK C. ROMKEY.

Witnesses:
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OTTO AUGSBACH.