D. C. Howell,

Steam-Boiler Fire-Tube.

No. 54,730. Patented May 15, 1866.

Fig 1.

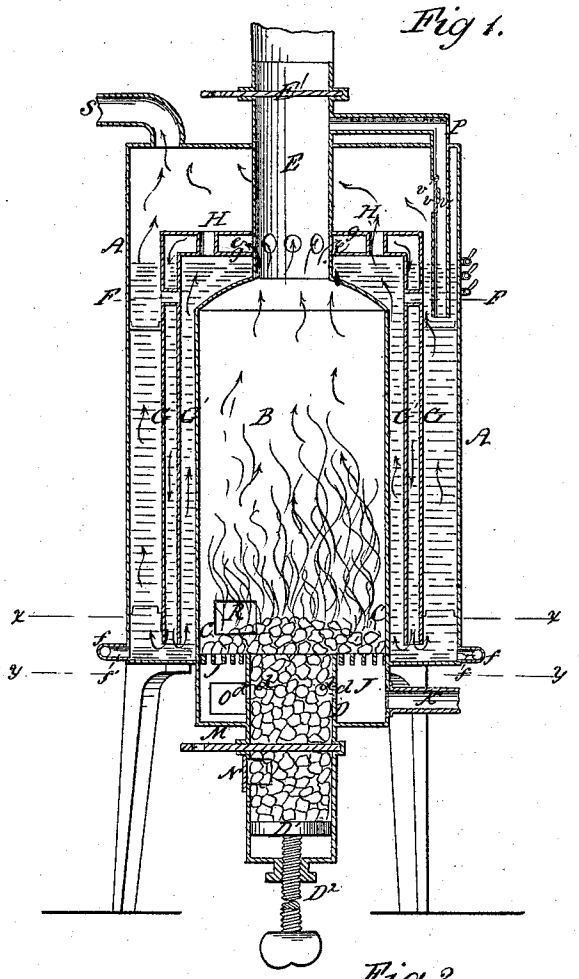
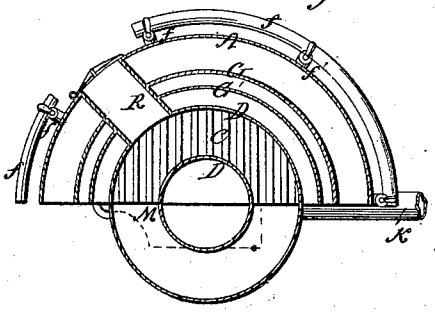


Fig. 2.



Witnesses.

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UNITED STATES PATENT OFFICE.

DEWITT C. HOWELL, OF GOSHEN, NEW YORK.

IMPROVED STEAM-GENERATOR.

Specification forming part of Letters Patent No. **54,730**, dated May 15, 1866.

To all whom it may concern:

Be it known that I, DEWITT C. HOWELL, of Goshen, in the county of Orange and State of New York, have invented certain new and useful Improvements in Steam-Boilers; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a central vertical section of a boiler constructed according to my invention. Fig. 2 is a horizontal section of the same.

Similar letters of reference indicate corresponding parts in both figures.

This invention relates to that class of steam-boilers in which the whole of the gaseous products of combustion of the fuel employed to generate steam are caused to pass through the water in the boiler for the purpose of utilizing to the greatest practicable degree the heat evolved in the combustion of the fuel, and to pass with the steam to the engine or apparatus in which the steam is used. The invention consists in a novel construction of such a boiler whereby the gaseous products of combustion are caused to circulate in an effective manner through the water in the boiler; also, in novel means of supplying fuel to the furnace of such a boiler; and, further, in certain means whereby, in case of the stoppage of the operation of the blower or other forcing apparatus employed to supply the furnace with air for supporting combustion and to drive the gaseous products of combustion into and through the water, the water is prevented from being forced into the fire chamber, and thereby extinguishing the fire.

To enable others skilled in the art to make and use my invention, I will proceed to describe it with reference to the drawings.

The boiler represented is of upright cylindrical form. A is the exterior shell, consisting of a plain cylinder. B is a fire-box, cylindrical and concentric with the shell A, and extending through the bottom thereof to form an ash-pit, J, the grade C, which is of annular form, being on about a level with the bottom of the shell.

G G′ *g g′* is the conductor through which the hot gaseous products of combustion are conveyed from the upper part of the fire-box downward into the water. This is formed of two concentric open-bottomed cylinders, G G′, attached, by their heads *g g′* to the central flue, E, which ascends from the top of the fire-box through the top of the shell and leads to a chimney. A number of openings, *e e*, are provided in and around the flue E to make a free communication between the fire-box and the interior spaces of the conductor. Several short tubes, F F, a short distance apart and a little below the water-line, connect the cylinders G G′ and pass through the conducting-space between the said cylinders for circulation of water. Similar tubes H H, but arranged vertically, also connect the heads of the said cylinders and pass through the intervening conducting-space to allow the steam to pass upward. The water occupies the annular space between the fire-box and the outer shell, A, and is kept high enough to cover the top of fire-box. The flue E is fitted above the top of the shell with a valve, E′, which closes steam-tight. Below this valve a pipe, P, leads from the flue E down into the water-space, and in the part of this pipe within the steam-space, above the water, there is an opening, *v*, fitted with a valve, *v′*, which opens inward to the said pipe.

K is the tube through which the air is driven by the blowing apparatus into the ash-pit to support combustion.

D is an upright cylindrical fuel-reservoir from which the coal or other fuel is supplied to the grate. This reservoir, which is concentric with the annular grate, is closed at the bottom but open at the top, which is situated at a level with the grate, and it is fitted with a piston, D′, which is worked by a screw, D^2, passing through the bottom of the reservoir. Below the ash-pit the reservoir is fitted with an air-tight slide-valve, M, to shut off the upper from the lower part, and below this valve there is an air-tight door, N, for the introduction of fuel.

The operation is as follows: In starting the fire the piston D′ is run down to the bottom of the cylinder D, the slide E′ is drawn, and the air-tight ash-pit door O is opened to admit air below the grate. A natural draft is thus obtained to start the fire. The fuel is supplied through an air-tight door, R, connecting the shell with the fire-box above the grate. The reservoir D is also filled with fuel. As soon as the water is sufficiently heated to generate steam freely the slide E′ and doors R and N are closed. Air to support combustion is then

forced through the pipe K into the ash-pit and up through the grate, and through openings *d d* in the reservoir, so that the fuel immediately over the latter will burn as well as that in the grate. The heat which is not absorbed by the water immediately surrounding the fire-box rises with the gaseous products of combustion into the flue E, passes through the openings *e e* into the conductor G G′ *g g′*, and expels the water, which up to this time has filled the lower part of the conductor as far up as the water-level, and finally escapes at the bottom of the conductor into the water itself, and all that is not absorbed escapes with the gases into the steam-space above, as indicated by arrows in Fig. 1, the gases mixing with the steam and passing off with it by the steam-pipe S. All ashes and particles of grit that are discharged through the conductor into the water become saturated and remain at the bottom of the water-space, between the fire-box and outer shell, whence they can be discharged through blow-off cocks *f′ f′* through a pipe, *f*.

When additional fuel is required it is forced up in the reservoir and caused to pass over the upper edge thereof onto the grate by raising the piston D′ until the latter arrives just below the slide M, and when more is needed the said slide is closed and the piston run down, the door N is opened, and through it the reservoir is filled up with fuel below the slide M. The door N is then closed, the slide M drawn out again, and fresh fuel forced up into the fire by the piston D′.

Should the blowing apparatus be stopped for any considerable time, the pressure of the steam might exceed that of the air and gases within the fire-box and cause the water to return through the conductor G G′ *g g′*, enter the flue E, and extinguish the fire were this not provided against by the valve *v* and pipe P; but the said valve would then be opened by the steam, which would then pass through the tube P and through the water and enter the fire-box to equalize the pressure.

Petroleum may be used as fuel for this boiler by arranging the burners to take the place of the grate and connecting them with a petroleum-tank by a pipe having a cock to regulate the supply. The tank should be of metal, and so placed that its bottom would be a little higher than the burners, and from its top a pipe should connect with the steam-space of the boiler to force a flow to the burners under any pressure. The air to support combustion would be supplied by a blowing apparatus in substantially the same manner as for burning coal or other solid fuel.

A modification of the conductor may be made by substituting for the two cylinders G G′ a series of tubes connected with the openings E E and descending into the water with open bottoms nearly to the bottom of the boiler. These tubes I consider equivalent to the conductor constructed as first described.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The conductor G G′ *g g′*, constructed and connected with the fire-box, and arranged with reference to the fire-box and surrounding portion of the boiler substantially as herein described, for the purpose set forth.

2. The fuel-reservoir D, piston D′, and slide-valve M, applied in combination with the grate C or fire-bed, substantially as herein specified.

3. The pipe P and valve *v′*, applied substantially as and for the purpose herein set forth.

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Witnesses:

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