W. S. REYNOLDS.

STEAM-BOILER.

No. 176,058. Patented April 11, 1876.

Fig. 2.

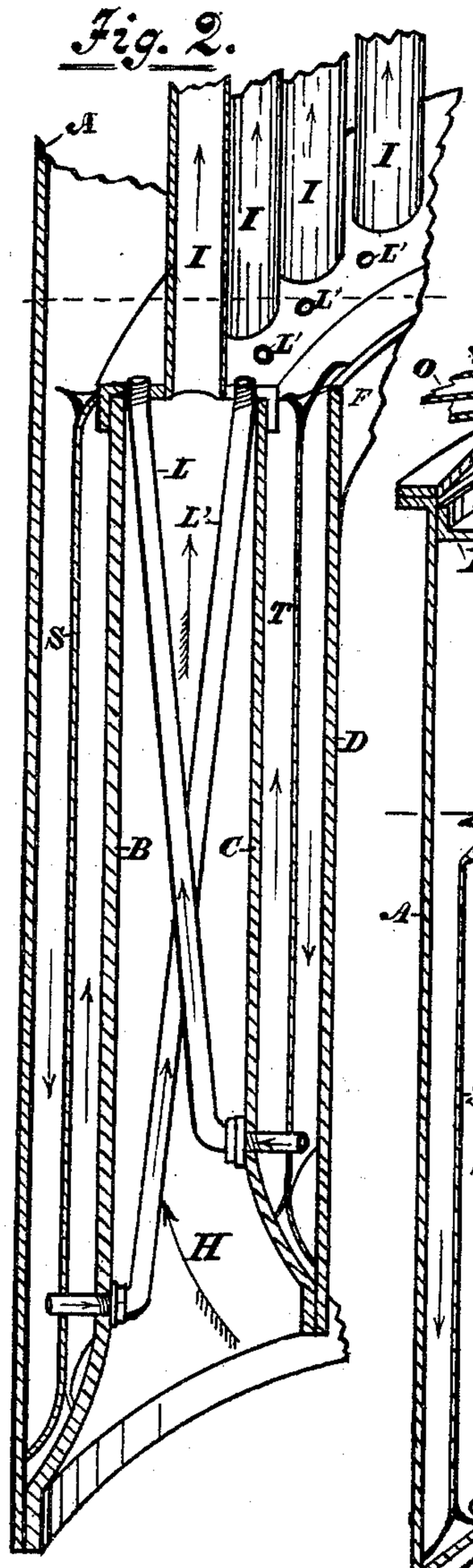


Fig. 1.

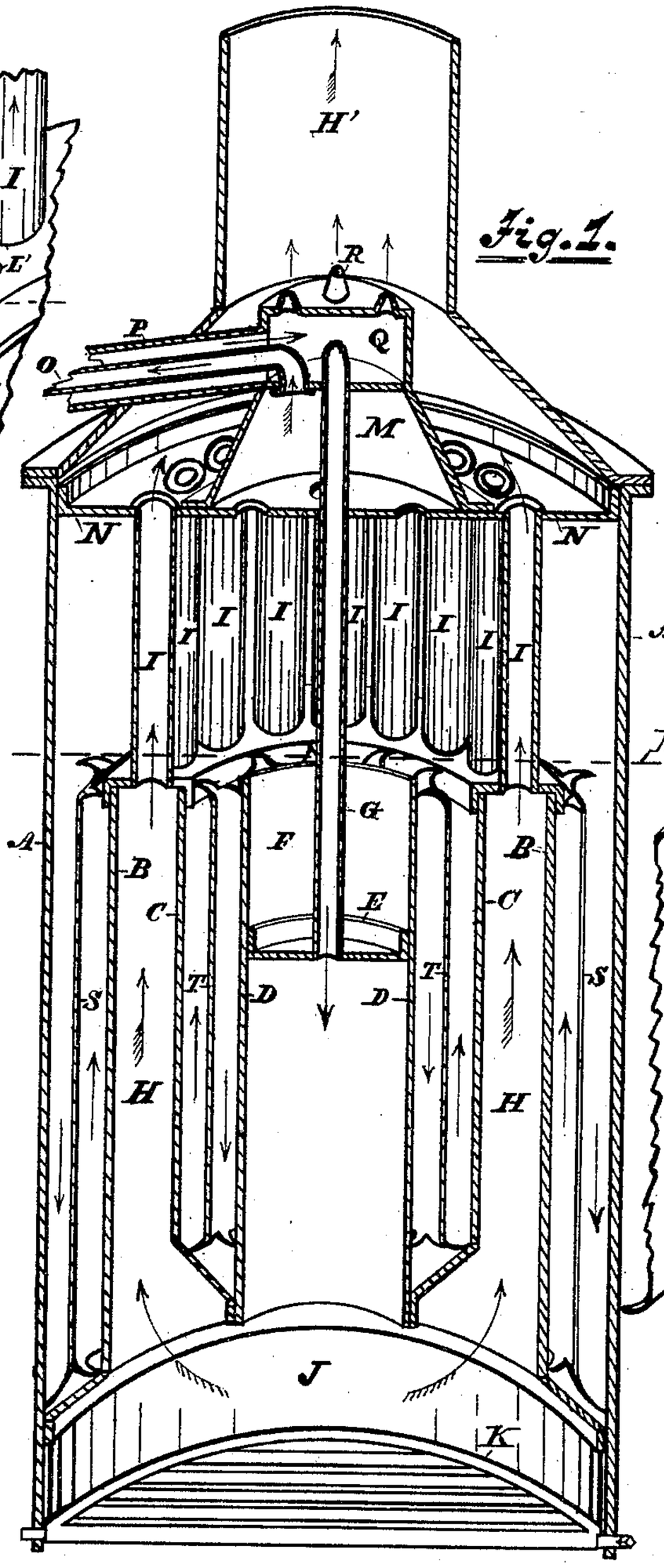
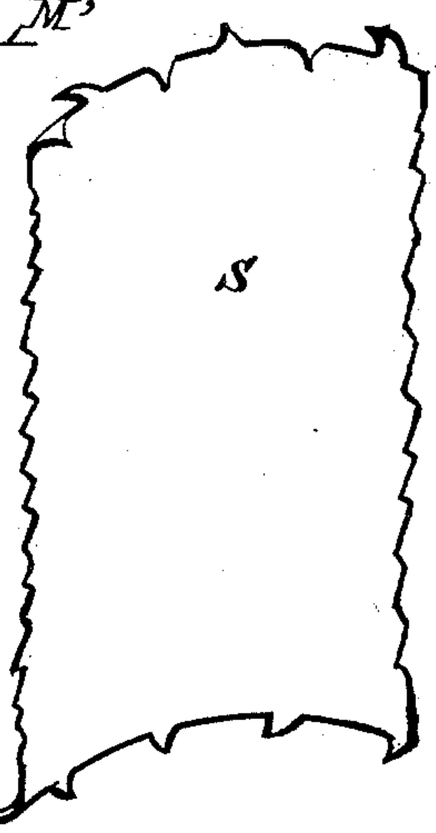


Fig. 3.



Witnesses:

Latta Russell

Ker Russell

Inventor:

William S. Reynolds

By E. J. Russell atty.

UNITED STATES PATENT OFFICE.

WILLIAM S. REYNOLDS, OF LA FAYETTE, INDIANA.

IMPROVEMENT IN STEAM-BOILERS.

Specification forming part of Letters Patent No. **176,058**, dated April 11, 1876; application filed September 13, 1875.

To all whom it may concern:

Be it known that I, WILLIAM S. REYNOLDS, of the city of La Fayette, State of Indiana, have invented an Improvement in Steam-Boilers, of which the following is a specification:

The object of my invention is to circulate the water in a steam-boiler as rapidly and as variously as possible when in use by means of double water-jackets A B and C D, one on each side of an annular fire-flue, H, each water-jacket having serrated annular septums S and T that divide them respectively into two compartments, which communicate with each other freely at top and bottom, the effect of which is to establish a rapid upward current of water in the compartments next the fire-flue, and downward currents in the compartments farthest away from the fire-flue; also, a cross-circulation of water through a net-work of water-pipes, L L′, which take a portion of the water from each of those compartments farthest away from the fire, and in which the water is passing downward, and convey it up and over to the opposite sides of the annular fire-flue H, crossing each other in the midst of the hottest fire, and discharging the water just below the water-line and above the water-jackets. By this ceaseless and compiete circulation of water within a boiler, the rapid and varied exposures of it to the entire heat of the fire, which is concentrated into the smallest possible annular space, has and does generate more steam with a given amount of heat, and generates it in less time than any other device known, especially adapting my invention to the purposes of a steam fire-engine boiler.

Figure 1 is an elevated vertical central section of my invention. Fig. 2 is a partial vertical section, slightly enlarged, showing the X-tubular net-work, for water circulation, across and through the fire-flue H, transferring a portion of the water from the lower end of one water-jacket to the the upper end of the water-jacket on the opposite side of the annular fire-flue; and Fig. 3 is a partial section of one of the water-jacket septums, exhibiting its serrated ends.

A is the body or outside shell of the boiler. B is the inside wall of the external water-jacket. C is the external wall of the inner water-jacket, and D is the inside wall of the same. E is a diaphragm separating the cylindrical space just above the fire-box J from the water-space above, and forming the floor of a central eddy-chamber, the only place in my boiler where there is no circulation in the water, and therefore adapting it as a receptacle for the deposit of concretions, scale, lime, sand, or other harmful substance contained in the water. At all other points below the water-line in my boiler there is a constant motion and circulation of water, which utterly prevents the precipitation of any foreign substance, save in eddy-chamber F, where the absence of motion favors and invites the deposit of anything heavier than water. A hand-hole is made through E to allow this chamber to be cleaned.

G is a small pipe, perforating E with its lower end, while its upper end reaches up into the small exhaust-chamber Q, from whence the exhaust steam can be blown down into fuel-chamber J to promote combustion. At the same time that exhaust steam is blown down upon the fuel through this pipe, it also blows upward through nozzles R, causing an increased draft upward and out through smoke-stack H′. These blasts, in concert, cause rapid combustion of fuel, and perfect draft up annular fire-flue H, and thence through the circular phalangeal flues I. The lower ends of flues I are set into a double-flanged annular plate, secured to B and C in such a manner as to cut off connection between the fire draft and the water-spaces in the boiler.

Annular fire-flue H passes up between the water-jackets A B and C D. Each one of these water-jackets is divided annularly into two water-compartments by sheet-iron septums S and T, which are serrated, as shown in Fig. 3, at both ends, the serrations turned outward and inward alternately, so as to hold them in the middle of the water space in each water-jacket. These serrations, at the lower end, form openings that allow the free passage of water from one compartment into the other.

The water line of this boiler is a short distance above the upper end of these water-

jackets, as shown by the broken line M′ in Figs. 1 and 2, and therefore the water flows freely from one compartment to the other.

N is the crown-sheet of the steam-space just above water-line M′. The draft-flues I are secured at their upper end to this crown-sheet.

M is the upper steam-chamber, for dry steam, somewhat conical in shape, and forms the base upon which the exhaust-steam chamber Q rests. The dry steam rises into this chamber through openings in its floor, and is conveyed from it to the engine through steam-pipe O.

The chambers M and Q may be made of cast-iron, and bolted to crown-sheet N.

The pipe P conveys the exhaust steam back into chamber Q from the engine, when so desired, and steam-pipe O carries live steam to the engine, passing out in the midst of this exhaust-pipe, as shown in Fig. 1. Nesting the live steam-pipe within the dead (exhaust) steam-pipe, down to the steam-chest, prevents condensation and preserves its expansive power.

The water-pipes L and L′ start out from the lower end of those compartments in water-jackets A B and C D that are farthest from the fire in flue H, and, crossing, pass each other near the center of the flue to opposite sides of H, entering the sheet that supports flues I at the upper end of the water-jackets. These pipes may be slightly flattened on the sides that are parallel to a radial line running from pipe G to the periphery of the boiler, so as to offer but slight obstruction to fire-draft in H. Two of these pipes are used to each one of flues I, and alternate with the flues, as shown in Fig. 2.

The arrows in J, H, I, and H show the course and direction of fire-draft from grate K to the place of egress above.

The arrows in the water-compartments of water-jackets A B and C D, and in pipes L and L′, show the direction and circulation of water-currents in the respective parts.

The arrows in M and O, P and G, show the course of live, dry, and exhaust steam.

The fire, rising from J up through the narrow annular flue H, is brought in contact with one of the compartments in each water-jacket A B and C D. The water, becoming heated, rises up into the open water-space above the water-jackets, while that in the compartment on the other side of the septum follows down and passes under the lower end of S and T, and then rises up as before, and thus a ceaseless round of circulation is maintained, flowing down on one side of the septum and up on the other, keeping up a rapid repetition of exposures to the influence of the fire. While this is going on another circulation of water is established in the pipes L and L′. These pipes lie directly within the flame of the fire, in H, and, receiving the descending water from the compartments farthest away from the fire, the heat forces it to rise rapidly in the pipes to be discharged at the top, on sides opposite from whence it was taken. This circulation is very rapid, and a very large percentage of the water flowing through these pipes is converted into steam in its upward passage.

The extraordinary steam-generating power growing out of the complex circulation of water, as described, and the rapid and ceaseless exposures of the same to a concentrated fire in flue H, is so manifest that farther elaboration of description is unnecessary.

Suitable cocks, gages, and cut-offs are applied, as in other boilers, and fuel is fed to the furnace through a door just above grate K.

Any kind of tilting, revolving, or vibrating grate may be used.

I claim—

1. In combination with a boiler constructed with annular water-chambers, the septums S T, having their upper and lower edges serrated and bent alternately inward and outward so as to support the septum in the central part of the annular water-chambers, and allow the water to freely circulate above and below, as shown, and for the purposes set forth and described.

2. In combination with a boiler constructed, as shown, with an exhaust-chamber, Q, the live-steam pipe O, arranged to pass through the exhaust-steam pipe P, and connected with the live-steam space M of the boiler, as and for the purposes set forth and described.

3. Eddy-chamber F in combination with duplex water-jackets A B and C D, and water-pipes L and L′, substantially as shown, and for the purposes described.

4. Circulating water-pipes L and L′, in combination with the cooler water compartments in the duplex water-jackets A B and C D, substantially as shown, and for the purposes described.

WM. S. REYNOLDS.

Witnesses:

ALF CARNAHAN,

DAVID MURPHY.