(No Model.) 2 Sheets—Sheet 1.

J. C. BURNESON & O. G. RICHEY.

GRATE AND FURNACE.

No. 596,570. Patented Jan. 4, 1898.

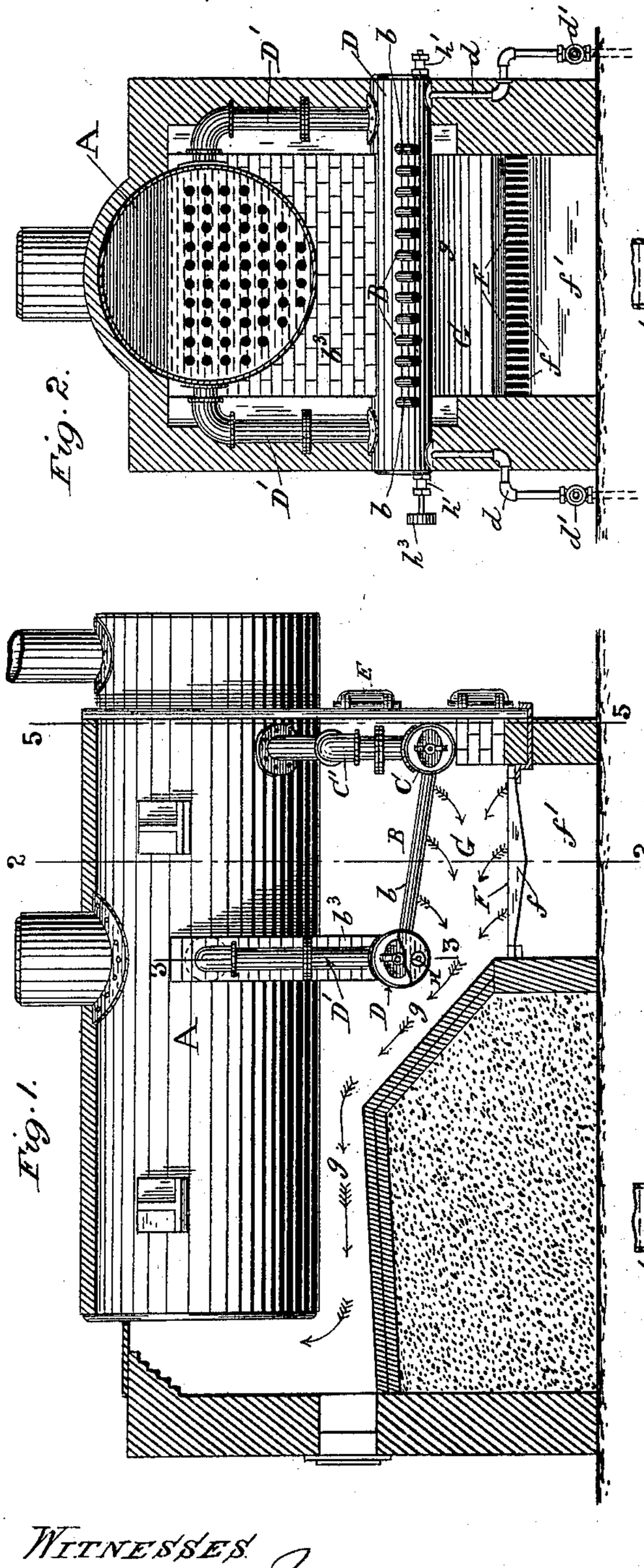

Fig. 1.

Fig. 2.

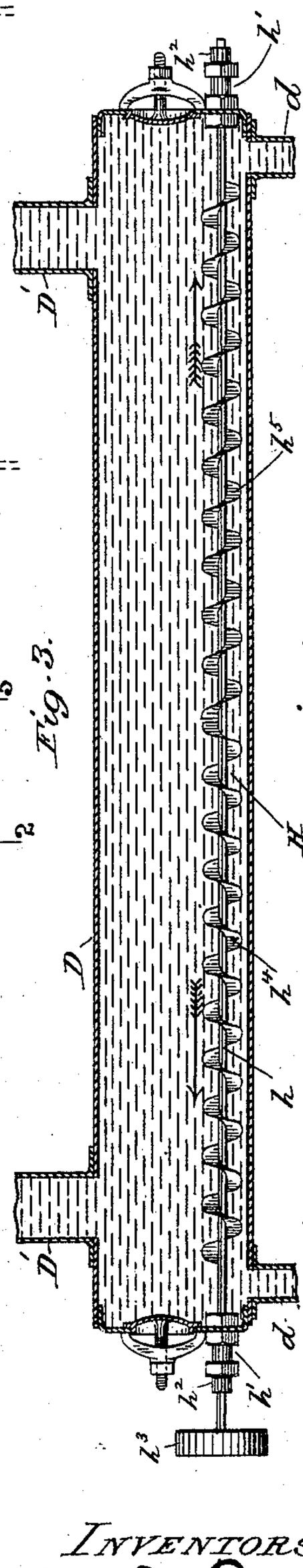

Fig. 3.

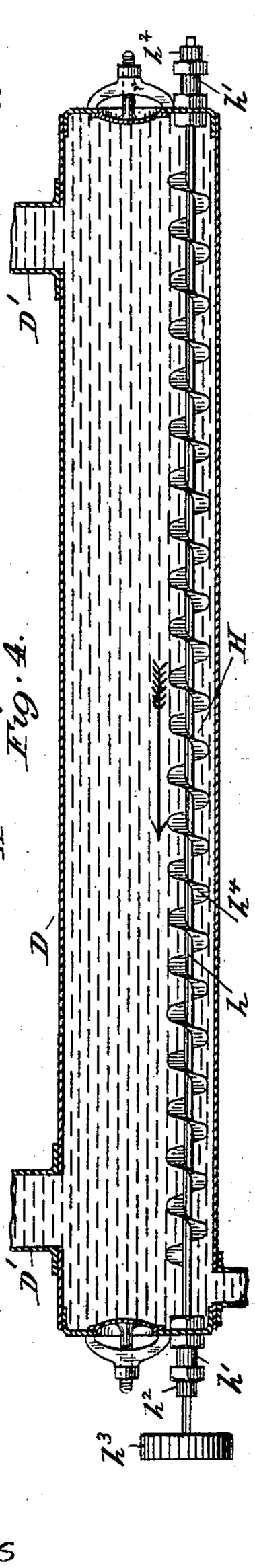

Fig. 4.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 5.

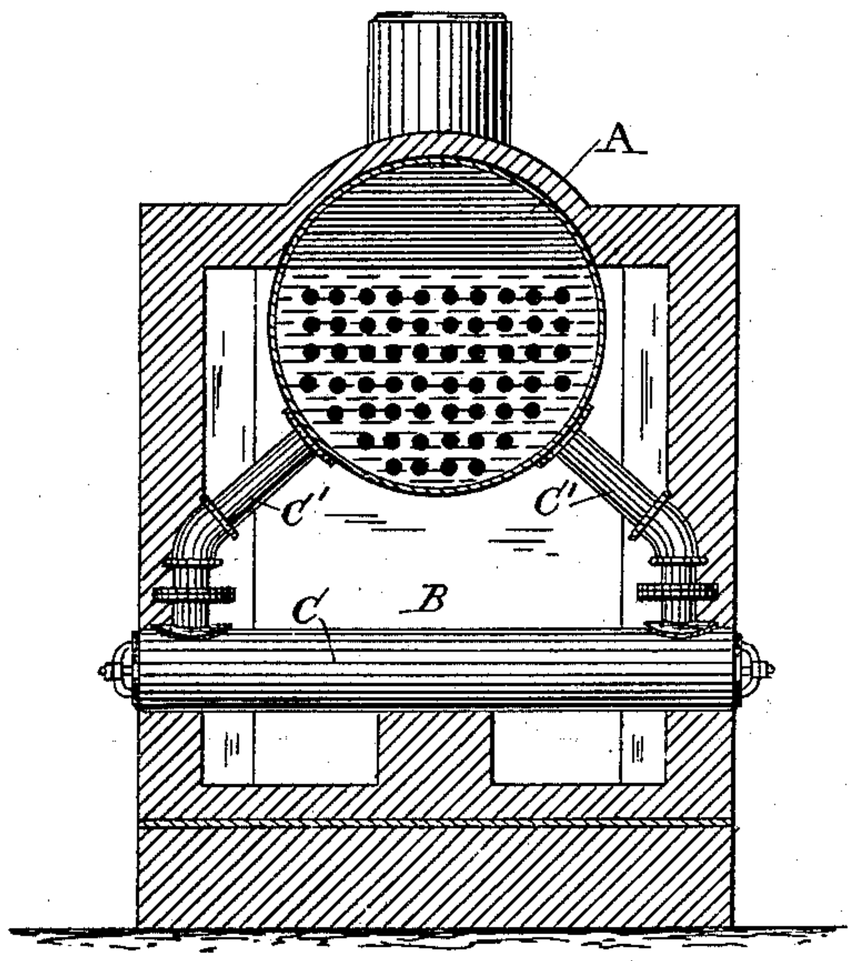
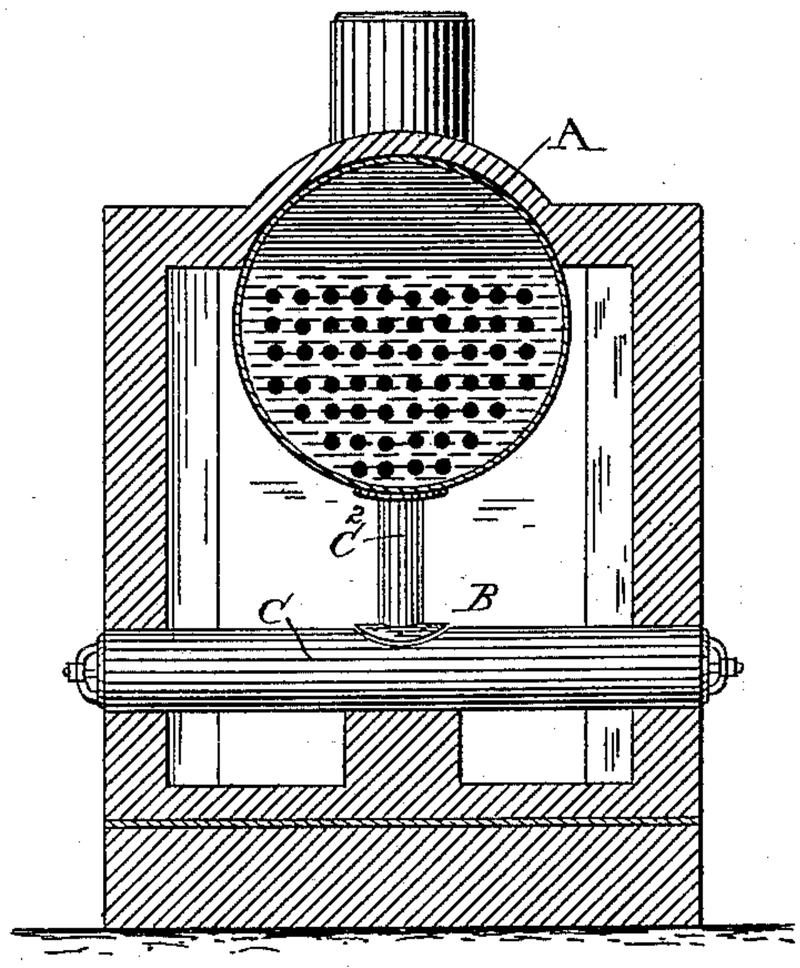


Fig. 6.



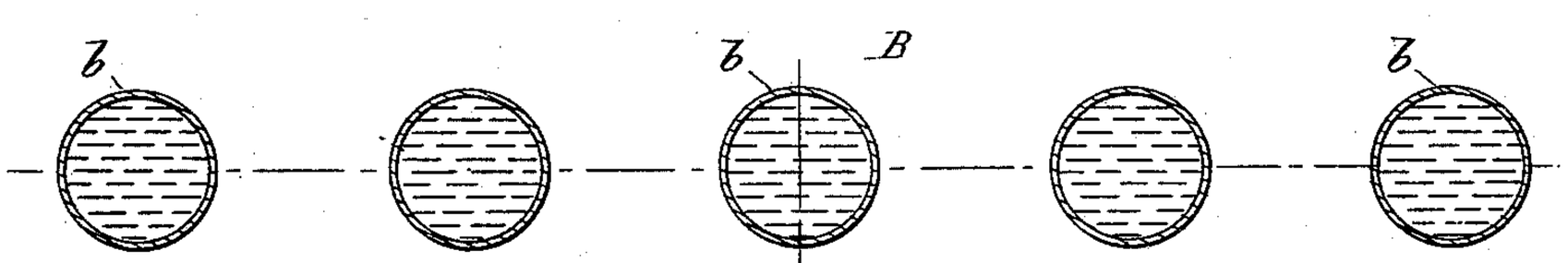
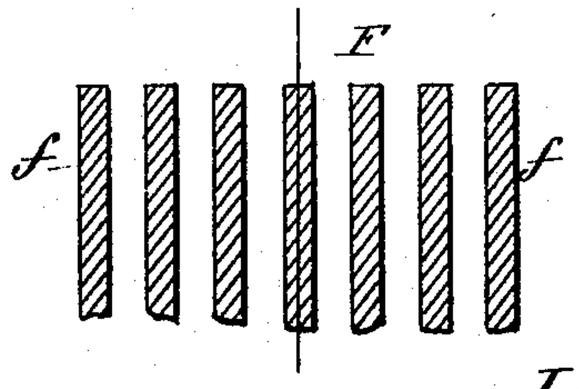


Fig. 7.



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UNITED STATES PATENT OFFICE.

JOHN C. BURNESON AND OLIVER G. RICHEY, OF ST. LOUIS, MISSOURI.

GRATE AND FURNACE.

SPECIFICATION forming part of Letters Patent No. 596,570, dated January 4, 1898.

Application filed March 8, 1897. Serial No. 626,537. (No model.)

To all whom it may concern:

Be it known that we, JOHN C. BURNESON and OLIVER G. RICHEY, citizens of the United States, residing at St. Louis, in the State of Missouri, have made certain new and useful Improvements in Grates and Furnaces, of which the following is a specification.

Our invention relates to boiler-furnaces and water-tube grates for use in such furnaces.

The chief objects of our invention are, first, to improve the circulation through the bars and connections of water-tube grates, and, second, to keep the grate bars and connections clean on the inside and prevent the formation of scale.

We attain these objects by mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of a steam-boiler furnace embodying our improvements, the inclosing wall on the side next the observer being omitted and parts of the mechanism being broken away. Fig. 2 is a vertical transverse section of the apparatus on line 2 2, Fig. 1. Fig. 3 is an enlarged detailed view of a central longitudinal section of the water-chamber, into which the tubular grates of the furnace discharge, showing a right and left hand screw conveyer, in side elevation, arranged in its preferred position in said chamber. Fig. 4 is a similar view of a modification in which a single-bladed screw conveyer is used and in which the pipe leading up from the end of the conveyer next the blow-off pipe is shown larger than the pipe leading up from the opposite end. Fig. 5 is a vertical transverse section, on a reduced scale, on line 5 5, Fig. 1. Fig. 6 is a similar view showing a modification; and Fig. 7 is an enlarged detailed view illustrating the preferred relative spacing of the upper and lower grate-bars, the upper grate-bars being shown in cross-section and the lower bars in plan.

Similar letters refer to similar parts throughout the several views.

A is a horizontal cylindrical multitubular boiler of common form, in connection with which our improvements are illustrated. The particular form of boiler shown is not essential, however, to the operation of our improvements. They are useful in connection with all forms of steam-boilers.

B represents a grate composed of widely-spaced bars in the form of water-tubes *b*, which at their front ends preferably connect with a transverse water-chamber C, which is in practice usually constructed in the form of a drum, as shown. Where the form of boiler shown is used, two pipes C′ preferably extend down from near the bottom of the boiler in the neighborhood of the front end thereof and connect with the water-chamber C near opposite ends of said chamber, substantially as shown in Figs. 1 and 5. Other methods of connecting the chamber C with the boiler may be used, however. One of these is shown in Fig. 6, in which the connection consists of a single vertical pipe C^2.

The rear ends of the tubular bars *b* of the grate B connect with a transverse water-chamber D, whose form is not an essential feature of our improvement, but which we preferably construct in the form of a drum, as shown in Figs. 1, 2, 3, and 4. The water-chamber D is preferably larger in cross-section than the chamber C and longer than the width of the grate and preferably projects beyond it on each side, substantially as shown in Fig. 2, and these projecting ends are preferably either partially or wholly shielded from the heat of the furnace. It is preferably connected with the boiler by means of a pair of pipes D′, which extend upward from near opposite ends of said chamber and preferably connect with opposite sides of the boiler above the level of the points at which the pipes C′ connect with it. This particular form of connection is not essential, however, and may be varied in many ways, as will be obvious, without departing from the essence of our improvements.

The chamber D is preferably provided with an outlet for scale and sediment near each end thereof and preferably through its bottom. These outlets are preferably in the shape of common blow-off pipes *d*, each provided with an ordinary blow-off cock *d′* for opening and closing the outlet substantially as shown in Figs. 2 and 3, and each end of

the chamber is preferably, but not necessarily, provided with a manhole d^2 to afford convenient access to its interior.

The space, if any, between the chamber D and the boiler A is preferably closed by brickwork b^3 or other suitable means, so as to force the products of the combustion of fuel upon the grate B to find an exit downward between the tubular bars b, which, together with the front of the water-chamber D, are in consequence subjected to a very intense heat.

E, Fig. 1, is a door through which fuel can be thrown upon the grate B.

At some distance below the grate B an ordinary updraft-grate F, with bars f more narrowly spaced than those of the former grate, is preferably located. Beneath the grate F there is an ash-pit f', and between said grate and the grate B there is a combustion-chamber G, from which a flue g is shown leading back to the rear end of the boiler. The grate F is supplied with fuel by the upper grate B, between whose widely-spaced bars a considerable quantity of partially-consumed fuel falls and is consumed upon said lower grate. The heat between the two grates and beneath said chamber D and on the rear side of said chamber is so intense that the bars and water-chamber D can only be preserved from destruction by keeping up a constant current of water through them and preventing the formation of scale therein. The formation of scale either in the chamber D or one of the bars b is almost always followed by its being either injured or destroyed by the heat.

Water circulates through the grate B from front to rear, and the bars b discharge into the chamber D. While steam is being raised the circulation through said grate and the water-chambers with which it connects is very rapid and there is little danger at such times of either the bars or drums burning; but when the steam-pressure in the boiler becomes great the circulation of water in the grate and water-chambers is interfered with and becomes sluggish and sometimes temporarily stops. At such times scale is liable to form in said tubular grate-bar sand the water-chamber D and cause serious trouble. In order to prevent the stoppage of the circulation of water through said water-tube grate at any time and to make its circulation more rapid when there is a high steam-pressure in the boiler, we introduce a pump into said boiler system for forcing water to flow rapidly through said water-chambers and tubular grate-bars. The pump which we prefer to use is in the form of a screw conveyer H, Figs. 1, 3, and 4, and in order to enable it to not only increase said circulation, but also assist in preventing sediment from accumulating near the center of the chamber D by constantly forcing it toward one or both ends of said chamber and causing it to accumulate where it can be readily blown off through the blow-off pipe or pipes connected with the chamber D, we preferably arrange said conveyer in said chamber near the bottom thereof and journal its shaft h in bearings h', which are preferably in the form of glands located in the ends of said chamber, as shown in Figs. 3 and 4. End motion is preferably prevented by collars h^2, and to one end of said shaft h we preferably attach a pulley h^3 or other means for communicating motion to the conveyer, which is preferably kept in constant motion after steam is raised and while it is being actively generated and supplied. The screw conveyer H is preferably provided with a right-hand blade h^4 and a left-hand blade h^5, which each extend from about midway between the ends of the chamber D toward opposite ends, so that when the conveyer is caused to rotate in the proper direction the conveyer-blades will tend to force water and sediment from the central portion of the chamber toward opposite ends thereof and thence up through the pipes D′ into the boiler A, at the same time drawing water from the tubular grate-bars b into said water-chamber, and thus strongly assisting the grate circulation. The sediment forced away from the central portion of the chamber D is caused to accumulate around the inner ends of the blow-off pipes d, Fig. 3, and may be discharged from the chamber D by merely opening the blow-off cocks d', which should preferably be done where the water is very bad every four hours and in all cases where any sediment is deposited at least once a day.

In Fig. 4 we have shown a conveyer H, having a single blade h^4, extending substantially from one end of the chamber D to the other and adapted to create a current along the bottom of the chamber D from end to end toward the single blow-off pipe d shown. This form of the device is designed for use where, because of the arrangement of the boiler in a battery or for some other reasons, only one blow-off pipe can be conveniently applied to the water-chamber D. In such cases we prefer to make the pipe D′, nearest the blow-off pipe, larger than the one leading from the opposite end of said chamber, substantially as shown in Fig. 4. We have described the preferred forms of our improvements, but do not wish to be confined thereto. We desire our claims to be construed broadly.

We claim—

1. The combination of a steam-boiler; a grate having tubular bars; means for the passage of water from the boiler to the front ends of said bars; a transverse water-chamber with which the grate-bars connect at their rear ends and into which they discharge; means for the upward passage of water from said water-chamber to the boiler, an outlet near one end of the water-chamber for the escape of sediment; means for opening and closing said outlet; and a revoluble screw conveyer in said water-chamber for forcing water and sediment toward said outlet for sediment, and for drawing water into said chamber and forcing it thence into the boiler.

2. The combination of a steam-boiler; a downdraft-grate having tubular bars, a transverse front water-chamber, with which each grate-bar directly connects at its front end, and from which each receives water; a rear transverse water-chamber with which each of said bars directly connects at its rear end and into which they discharge; an outlet for scale near one end of the rear water-chamber; means for opening and closing said outlet; a pipe connected at its lower end with said rear water-chamber in the neighborhood of said outlet for scale but at a higher level than said outlet, and at its other end with the interior of said boiler; means for the passage of water from said boiler to said front water-chamber; and mechanism within said rear water-chamber for drawing water into said chamber from said grate-bars and for forcing scale toward said outlet for scale, substantially as described.

3. The combination of a steam-boiler; a downdraft-grate composed of water-tubes widely spaced apart; means for connecting the front end of the grate with the boiler; a transverse water-chamber at the rear end of the grate with which said water-tubes connect and into which they discharge; an outlet for sediment at one end of said chamber; means for connecting said chamber with the boiler; a revoluble screw conveyer for drawing water into said chamber from the grate-bars and forcing it into the boiler and for creating a current of water along the bottom of said water-chamber toward said outlet; an updraft-grate beneath said water-tube grate, with bars closer together than those of the latter grate; a combustion-chamber between said grates; and an escape-flue leading from said combustion-chamber and passing beneath said water-chamber, substantially as described.

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Witnesses:
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