

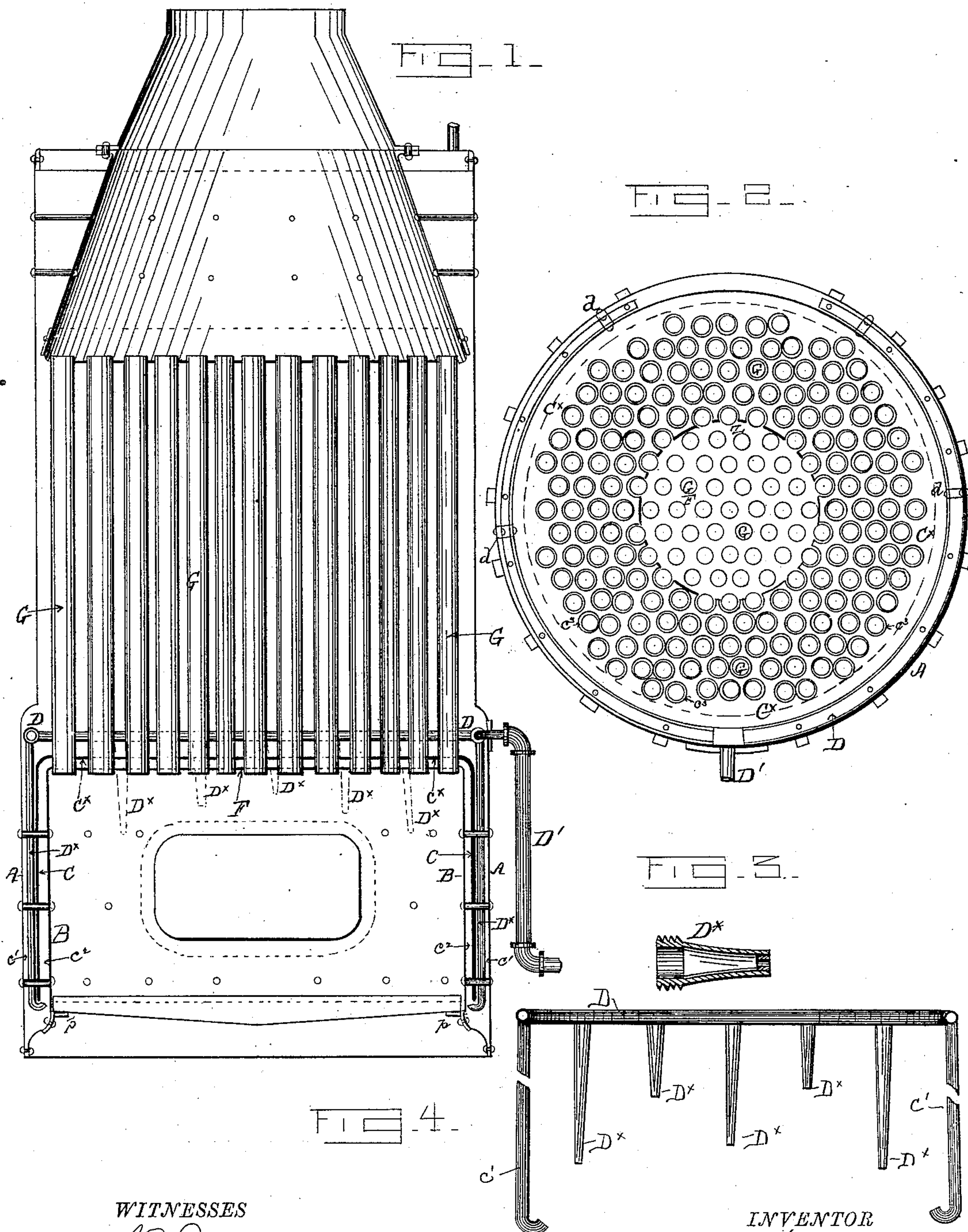
(No Model.)

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CIRCULATION OF FEED WATER IN MULTITUBULAR UPRIGHT BOILERS.

No. 349,046.

Patented Sept. 14, 1886.



WITNESSES

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CIRCULATION OF FEED-WATER IN MULTITUBULAR UPRIGHT BOILERS.

SPECIFICATION forming part of Letters Patent No. 349,046, dated September 14, 1886

Application filed January 27, 1886. Serial No. 189,944. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM DAVIS HOOKER, a citizen of the United States, residing in the city of St. Louis, State of Missouri, have invented certain new and useful Improvements in Circulation of Feed-Water in Multitubular Upright Boilers; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to means for securing a more perfect circulation in steam-boilers, and has particular reference to upright multitubular boilers for use on fire-engines where the circulation must be quick and powerful, in order to get up steam rapidly and keep it up evenly and effectively at a high pressure. I have devised means whereby I can secure a forced circulation when it is desired to make steam rapidly, and at the same time insure a good natural circulation when the forced circulation is not necessary or desired. To attain this object I provide, in connection with the circulation-sheet which lies between the fire-box and the boiler-shell, a coil of feed-pipe which has downwardly-projecting nozzles at suitable intervals projecting between the circulation-sheet and the outer shell, through which the feed-water is delivered under pressure obtained from the usual pump. The water delivered from these nozzles will be precipitated in the space between the circulation-sheet and the boiler-shell, and will rise in the space between the circulation-sheet and fire-box. The force with which this circulation is made will depend upon the number and size of the nozzles and the velocity of the pump. To facilitate the examination, removal for repair or cleaning, and the replacement of the nozzles, I provide a plug in the shell of the boiler opposite each nozzle. In conjunction with this forced feed around the circulation-sheet, I provide means for carrying the feed-water which rises between the circulation-sheet and fire-box over the tube-sheet and discharging it well in toward the center of the group of tubes, the forced circulation of

course continuing over said tube-sheet and out among the tubes when the force feed or circulation is in operation. To effect this end I continue the circulation-sheet over the top of the tube-sheet to a distance well in toward the center thereof, leaving an opening in said circulation-sheet in the center equal in diameter to about one-third of the tube-sheet. This will insure the delivery of the rising water centrally over the fire-box, whence it will be scattered to the sides and again descend to continue the circulation. A great amount of steam will be freed from the water circulating thus rapidly and exposed as it is to such a great extent of heating-surface. To further aid in securing the liberation of the steam from the water, I provide for the escape of a small portion of it around each tube covered or encompassed by the horizontal portion of the circulation-sheet. The tubes pass through the circulation-sheet in holes a trifle greater in diameter than the tubes themselves, thus leaving a small annular space for the escape of the water through the circulation-sheet, where it will rise round the tubes and be subjected to the radiation therefrom. The steam which frees itself from the water in this process of circulation will rise into the steam-chamber around the smoke-box at the top of the boiler, where it is dried and taken to the engine. The nozzles may extend to any depth into the space between the circulation-sheet and the outer shell of the boiler. I prefer to make them of differing lengths, as will be seen, and some of them to be extended past the lower end of the circulation-sheet and slightly turned up.

The accompanying drawings illustrate what I consider the best means for carrying my invention into practice.

Figure 1 is a central vertical section of a boiler constructed in the manner pursued by me in carrying out this invention. Fig. 2 is a horizontal section of the same, taken on the line *xx*, Fig. 1, looking down. Fig. 3 is an enlarged sectional view of a nozzle, taken longitudinally. Fig. 4 is a detail view of the feed-pipe, which lies inside the outer shell of the boiler with the nozzles of different lengths attached to it.

Similar letters of reference indicate corre-

sponding parts in all the figures where they occur.

A is the boiler-shell.

B is the fire-box shell secured to the shell A at the base, and provided with lugs p , at proper height, on which the grate rests.

C is a circulation-sheet secured between shells A and B by bolts o , which extend through all three parts, A C B, and hold the sheet about midway between the shells A and B, or perhaps a little nearer to shell B than to shell A. A circulating-space, c' , is thus produced between shell A and sheet C for the descent of the feed-water, and a space, c'' , between sheet C and shell B for the ascent for the same, the sheet C having its lower edge raised a suitable distance above the bottom of the water-chamber.

Secured over space c' by lugs d to the outer shell, A, of boiler is the circular feed-pipe D, which receives water through pipe D', with which a pump is connected. The feed-pipe D may extend entirely around the boiler, or, if desired, only partially, in which latter case its ends will be suitably capped or sealed. Into the under side of this pipe D are secured the nozzles D*, which project down into the space c' .

In shell A opposite each nozzle D* is placed a removable plug, A*, which can be removed and a pair of pipe-tongs inserted to remove the nozzle for repair, cleaning, &c. The nozzles D* may have preferably a tapering bore of any capacity desired, and upon the size of this bore and the velocity of the pump connected with pipe D' depends the extent or degree of force given to the circulation.

Through or about the parts thus far described the circulation is as follows: From nozzles D* down space c' and around the foot of sheet C and up space c'' .

The construction of the upper portion of the boiler consists in the usual smoke-box, the bottom of which forms the upper tube-sheet, E, while the top of fire-box forms the lower tube-sheet, F, in which sheets are secured in any ordinary or suitable manner the group or set of tubes G, numerous and close together, as in the case of the ordinary multitubular boiler.

In order to attain the desired circulation and effect the freeing of the greatest possible amount of steam, I extend the circulation-sheet C up over the lower tube-sheet, F, as shown at C*, and carry it inward toward the center, as shown, leaving an opening or central hole, Z, equal in diameter to about one-third of the diameter of the boiler or tube sheet F. This extension C* causes the water to be carried inward well toward the center of the group of tubes and delivered there to be dispersed or thrown outward toward the sides of the boiler, and again descend to travel the path of circulation before marked out, freeing itself of a vast amount of steam in this thorough circulation. The tubes G pass through the part C* of the circulation-sheet in holes or

openings c^3 , somewhat greater in diameter than the tubes themselves, leaving a small annular space or opening around each tube embraced by the extension C*, through which openings a small quantity of the rising water escapes and passes upward around the tubes G to receive a yet intenser degree of heat and throw off a greater quantity of steam. It will be understood that the same path of circulation will be pursued naturally by the water as is occasioned by the force-feed described, and it will be also understood that the forced circulation may be omitted at any time and the natural circulation kept up; but, as stated in the opening of this specification, this boiler is designed for use upon fire-engines where a rapid and powerful circulation is necessary, and where the forced circulation will be found to be very desirable. The nozzles are made of varying lengths, as shown, some of them preferably extending to the bottom and turning up slightly in the space between the circulation-sheet and the fire-box shell, as shown in Fig. 1. The nozzles D* are preferably made or bored out in the form of a contracted vein, the outlet ends being smaller in their bore than the small part of the bore in the contracted vein, so as to discharge the feed-water forcibly; but I do not claim, broadly, this form of nozzle, as they are old in hose-pipes. The circular feed-pipe will be located far enough above the top of the circulation-sheet so as not to obstruct the descent of the return currents between the circulation-sheet and boiler.

Modifications may be made in many of the details without departing from the spirit or sacrificing the advantages of my invention. As already stated, the pipe D may extend entirely or only partly around. The force-feed may be used in connection with a circulation-sheet not having the extension C*. The extension C* may have its openings c^3 fitting snugly around the tubes without any annular space, as described, and the size of the center opening, Z, may be varied as desired. The plugs A* may be omitted, if desired, and the boiler-shell made solid. The number and size of tubes G may be varied as desired, and many of the minor details of construction may be changed as will readily suggest themselves to one skilled in this art.

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

1. In a steam-boiler of the kind described, the combination, with the boiler and fire-box shells and interposed circulation-sheet, of a force-feed for the water arranged above the space between the boiler-shell and circulation-sheet to project the water downward in said space, as set forth.

2. In a steam-boiler, the combination, with the boiler and fire-box shells and interposed circulation-sheet, of an annular force-feed pipe extending partially or entirely around the boiler, and provided with nozzles projecting

down into the space between the boiler-shell and circulation-sheet, as set forth.

3. In a steam-boiler, the combination, with the boiler and fire-box shells and interposed
5 circulation-sheet, of the force feed-pipe extending partially or entirely around the boiler, and provided with nozzles projecting down into the space between the boiler-shell and circulation-sheet, and a plug in the shell of the
10 boiler opposite each nozzle, as and for the purpose set forth.

4. In a steam-boiler, the combination, with the fire-box and boiler-shell, of the circulation-sheet, extending over the top of the fire-box
15 and provided with the central opening or hole, as described.

5. In a steam-boiler, the combination, with the fire-box, tubes, and boiler-shell, of the circulation-sheet, as described, extending partially over the top of the fire-box, and provided with openings, through which the tubes
20 pass, a little larger in diameter than the tubes, as and for the purpose set forth.

6. In a steam-boiler, the combination, with

the fire-box, boiler-shell, and circulation-sheet, 25 of the feed-pipe having nozzles of differing lengths extending down between the boiler-shell and the circulation-sheet, as set forth.

7. In a steam-boiler, the combination, with the fire-box, boiler-shell, and circulation-sheet, 30 as described, of a feed-pipe having nozzles extending down between the boiler-shell and the circulation-sheet, one or more of which nozzles extend below the said sheet and slightly turn up, so as to throw the water around it, as set 35 forth.

8. In a steam-boiler, the combination, with the fire-box, boiler-shell, and circulation-sheet, of the feed-pipe having nozzles made or bored in the form of a contracted vein, and having 40 a still further contracted discharge-opening.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM DAVIS HOOKER.

Witnesses:

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C. A. MAGEE.