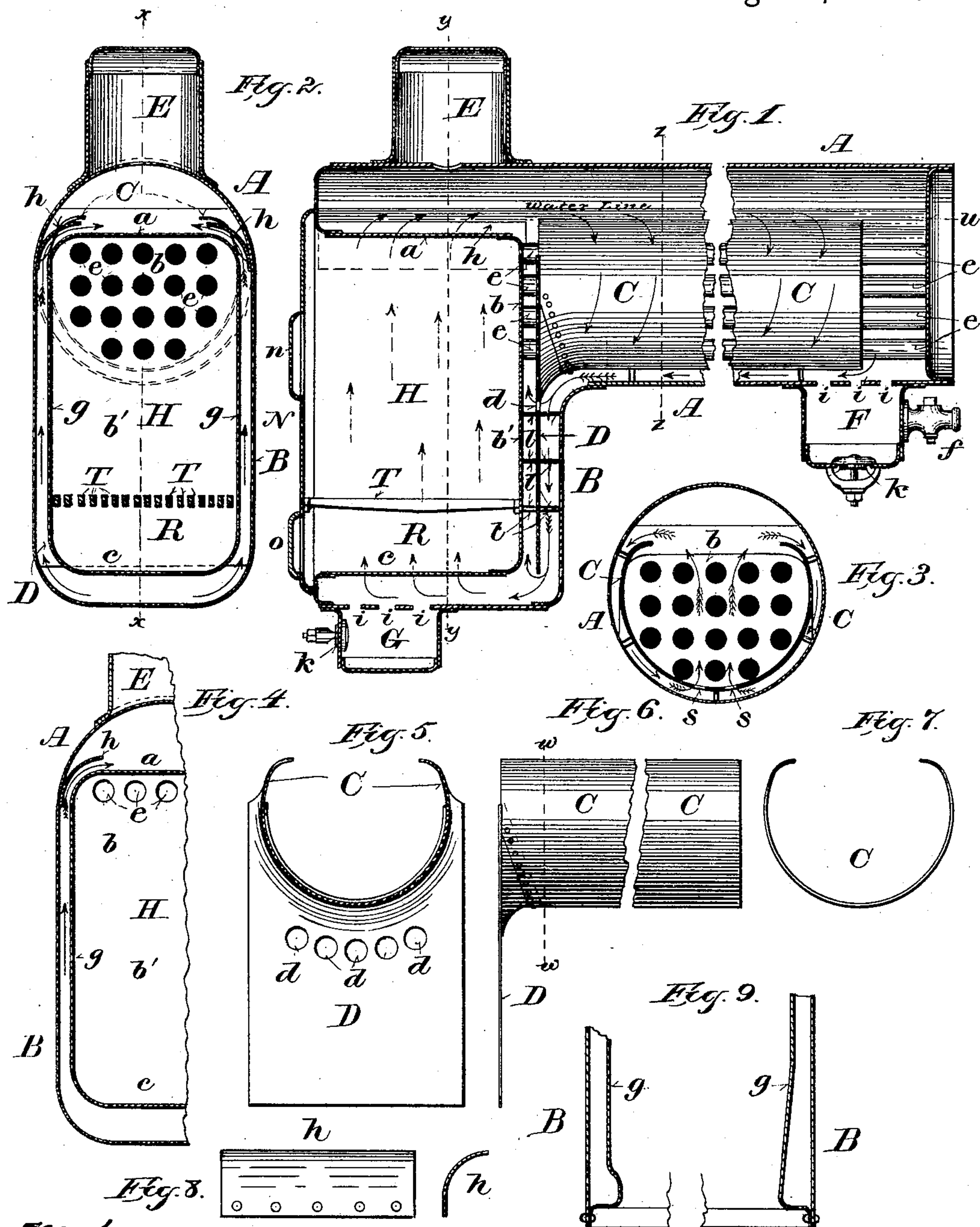


(No Model.)

A. CUNNINGHAM.
STEAM BOILER.

No. 434,656.

Patented Aug. 19, 1890.



Witnesses:

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UNITED STATES PATENT OFFICE.

ALBERT CUNNINGHAM, OF MILWAUKEE, WISCONSIN.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 434,656, dated August 19, 1890.

Application filed July 9, 1885. Serial No. 171,106. (No model.)

To all whom it may concern:

Be it known that I, ALBERT CUNNINGHAM, of Milwaukee, in the county of Milwaukee and State of Wisconsin, 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 invention, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying-drawings, and to the letters of reference marked thereon, which form a part of this specification.

The objects of my invention are, first, to prevent the overheating of the walls of the fire-box, and, second, to increase the steaming capacity of steam-generating boilers.

It consists, essentially, of a system of circulating-plates separating the boiler into distinct channels for the opposing currents, whereby the water is kept in rapid circulation and the cooler portions thereof returned against the walls of the fire-box and flues to be reheated.

In the accompanying drawings like letters refer to the same parts in the several figures.

Figure 1 is a longitudinal vertical section on the line *x x*, Fig. 2, of a boiler to which my improvements, shown partly in section and partly in elevation, are applied. Fig. 2 is a transverse section of the same on the line *y y*, Fig. 1. Fig. 3 is a like section on the line *z z*. Fig. 4 is a sectional detail of a portion of the leg of the boiler, showing one of the deflecting-plates adjacent to the crown-sheet of the fire-box. Fig. 5 is a detached view or front elevation of the diaphragm dividing the water-space in front of the fire-box, showing the circulating-sheet in section on line *w w*, Fig. 6. Fig. 6 is a detached view or side elevation of said diaphragm and the curved circulating-sheet in the horizontal limb of the boiler. Fig. 7 is an end elevation of the curved circulating-sheet shown in Fig. 6. Fig. 8 shows a side and end elevation of one of the deflecting-plates, and Fig. 9 modified forms of an open-bottom fire-box adapted for use with my improvements.

Although designed particularly for use, and shown for the purpose of illustration, with a boiler of the locomotive or portable engine type, my improvements are applicable, with

suitable modifications, to other kinds of boilers.

A represents the barrel of the boiler, provided in the usual manner with smoke-flues *e e*, steam-dome E, and mud-trap F.

B is the rectangular leg of the boiler, inclosing the fire-box H and provided with a mud-trap G, as shown in Fig. 1.

a represents the crown-sheet of the fire-box; *b*, the flue-sheet; *b'*, the front sheet or waist; *g g*, the side sheets, and *c* the bottom sheet, said waist *b'*, bottom *c*, and side sheets *g g* inclosing between them and the walls of leg B water spaces or channels.

T T are the grate-bars dividing the fire-box proper H from the ash-pit R.

N is a cast-iron door-plate closing the fire-box H and ash-pit R at the rear and provided with doors *n* and *o*, communicating, respectively, with said fire-box and ash-pit.

To facilitate the circulation of the water in the boiler and the return of the cooler portions to the walls of the fire-box H, I inclose the flues *e e* at the bottom and sides by a metallic plate or sheet C, preferably curved to conform to the contour of the barrel A, and terminating a short distance from the smoke-box flue-sheet *u*, as shown in Figs. 1 and 3, and supported by rivets or stay-bolts a short distance therefrom, leaving a space between said sheet and barrel to receive and conduct the outward and downward currents. It is attached at its rear edge to a vertical plate or diaphragm D, which, supported between and a short distance from the front wall of the leg B and the waist *b* of the fire-box by stay-bolts *l l*, terminates at or near the bottom of said fire-box or ash-pit R, and fills or nearly fills the space between the side walls of leg B. The upper edges of the plate C are curved inwardly, as shown in Figs. 3 and 7, so as to come below the surface of the water and to readily catch the outward and downward currents.

The diaphragm D, just below its junction with the circulating-sheet C, has a number of perforations *d d*, as shown in Figs. 1 and 5, to permit portions of the return-currents to pass through the same directly against the flue-sheet *b*.

To the walls of the boiler A, adjacent to the top of fire-box H, I attach the deflecting-

plates *h h*, as shown in Figs. 2 and 4, curved to conform more or less to the rounded corners of said fire-box and to direct the upward currents between the said walls of leg B and side sheets *g g* of the fire-box upon the crown-sheet *a*.

To direct a portion of the cooler returning current against the flues *e e*, I may make an opening or openings *s s*, as shown in Fig. 3, in the bottom of the circulating-sheet C.

The mud-trap F, attached to the under side of barrel A near the front end, communicates therewith through suitable openings *i i*, made in the shell, and is provided with a blow-off cock *f* and a hand-hole and plate *k* for the purpose of removing the dirt and sediment caught therein. The trap G, applied to the bottom of leg B, communicates in like manner with the water-bottom through openings *i i* and is provided with a hand-hole and plate *k* or other suitable means for removing mud therefrom.

When my improvements are applied to boilers having open-bottom fire-boxes or those which have no water-space underneath the fire-box, I prefer to give the side sheets *g g* an inward curve at or near the bottom, as shown in Fig. 9, so as to leave a larger water-space about the bottom of said fire-box and to facilitate the distribution of water to the sides and back of the same.

The details of my invention may be variously modified without departure from the principles embodied therein.

The operation of my device may be described as follows: The water about the walls of the fire-box being heated and partially converted into steam, rises, gives off its steam, and forms an upward and outward current into and through the barrel A about and above the flues *e e*, which tend to maintain and accelerate the upward and outward currents. As the outwardly-diverging currents approach the walls of said barrel A, they are caught by the inwardly-turned edges of the circulating-sheet C, descend between said sheet C and barrel A, as shown by the arrows in Figs. 1 and 3, and are directed back along the cooler exterior portion of the boiler to the diaphragm D, by which they are deflected downward into the water-bottom, and are thence distributed to the sides and front of the fire-box. The water rising at the sides of the fire-box is directed at the top by the deflecting-plates *h h* over and upon the hot crown-sheet *a*, whence it escapes in front into the barrel A, as shown by the arrows in Figs. 1 and 2. A portion of the cooler return-current, finding its way through the openings *d d* in diaphragm D and openings *s s* in plate C against the flue-sheet *b* and the flues *e e*, supplies the place of the rapidly-vaporizing water in those parts of the boiler, prevents the over-

heating of said flues and flue-sheets, and further contributes to the steaming capacity of said boiler.

I claim—

1. In a steam-boiler, the combination, with barrel A, one or more flues *e*, leg B, and fire-box H, of the curved sheet C, interposed between said flue or flues and said barrel with which it forms a channel opening at the sides of the boiler below the water-line, and the diaphragm D, dividing the water-space in front of said fire-box, substantially as and for the purposes set forth.

2. In a steam-boiler, the combination, with barrel A, flue or flues *e*, fire-box H, and leg B, of the sheet C, curved to conform to the curvature of said barrel, between which and said flue or flues it is interposed with its upper edges below the water-line, and diaphragm D, forming with said sheet C a channel for conducting the descending currents from the sides of the barrel to the lower part of the leg, substantially as and for the purposes set forth.

3. In a steam-boiler, the combination, with barrel A, one or more flues *e*, leg B, and fire-box H, of the sheet C, interposed between said barrel and flue or flues upwardly curved and terminating at each side below the water-line, diaphragm D, dividing the water-space in front of said fire-box, and the deflecting-plates inclined inwardly from the walls of said boiler adjacent to the crown-sheet of said fire-box, substantially as and for the purposes set forth.

4. In a steam-boiler, the combination, with barrel A, one or more flues *e*, leg B, and fire-box H, of the sheet C, curved upwardly at each side and interposed between said barrel and flue or flues with its upper edges below the water-line, diaphragm D, dividing the water-space in front of said fire-box, and the mud-trap G, applied to the bottom of said leg, substantially as and for the purposes set forth.

5. In a steam-boiler, the combination, with barrel A, one or more flues *e*, leg B, and fire-box H, of the sheet C, curved upwardly at each side and interposed between said barrel and flue or flues with its upper edges below the water-line, diaphragm D, dividing the water-space in leg B in front of said fire-box, and one or more perforations *d d* in said diaphragm, substantially as and for the purposes set forth.

In testimony that I claim the foregoing as my own I affix my signature in the presence of two witnesses.

ALBERT CUNNINGHAM.

Witnesses:

CHAS. L. GOSS,
M. E. BENSON.