

W. S. HUDSON.  
Crown-Sheets for Steam-Boilers.

No. 198,743.

Patented Jan. 1, 1878.

Fig: 1.

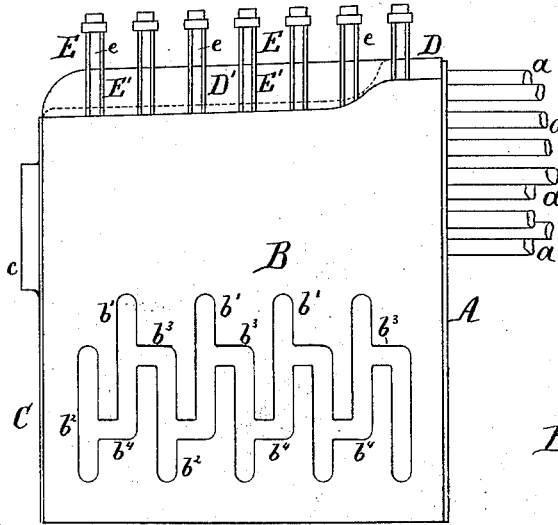


Fig: 3.

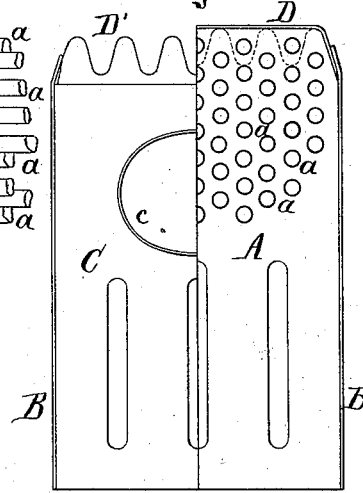


Fig: 2.

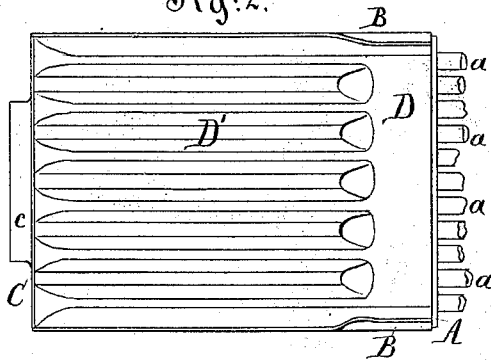


Fig: 5.

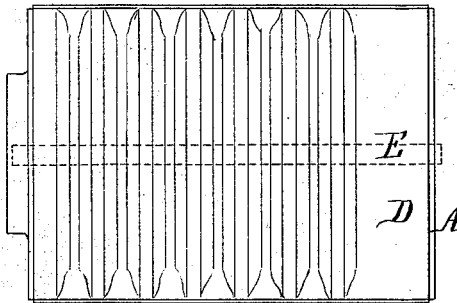
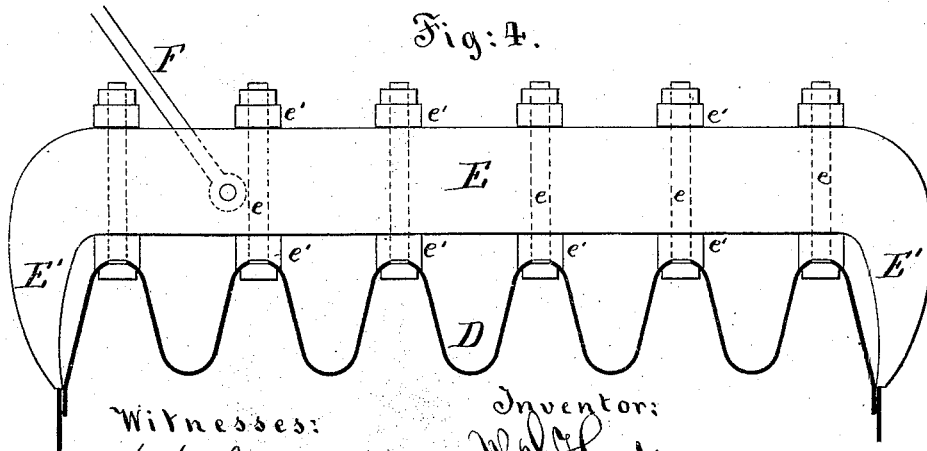


Fig: 4.



Witnesses:  
A. H. Glutner,  
H. A. Johnston.

Inventor:  
W. S. Hudson.  
By his attorney, J. B. Stetson,  
New York.

# UNITED STATES PATENT OFFICE.

WILLIAM S. HUDSON, OF PATERSON, NEW JERSEY.

## IMPROVEMENT IN CROWN-SHEETS FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. **198,743**, dated January 1, 1878; application filed August 14, 1877.

*To all whom it may concern:*

Be it known that I, WILLIAM S. HUDSON, of Paterson, Passaic county, in the State of New Jersey, have invented certain new and useful Improvements relating to Steam-Boilers, of which the following is a specification:

The improvement pertains to the crown-sheet and the parts immediately adjacent. It is intended more particularly for locomotives, but may be useful in all boilers having an internal fire-box surrounded by water.

I construct the fire-box in a generally rectangular form, with the tube-sheet of the usual height, and with the adjacent part of the crown-sheet plain, and at the usual level. The remainder of the crown-sheet is corrugated, and is lowered to an extent a little more than equal to the height of the corrugations. The depressions or channels formed by the corrugations are open-ended. They stand below and not above the level of the upper edge of the tube-sheet.

Previous efforts in this line have been made. One such had the corrugations extended above the top of the tube-sheet. With such construction the water must be carried higher than usual, to insure that the corrugations, which are higher than the upper tubes, are covered.

My invention allows the tube-sheet to be carried up to the ordinary level with the full number and size of tubes ordinarily employed without requiring the water to be carried any higher than with the usual plain crown-sheet.

Stay-bars formed to afford the proper bearings may support my corrugated crown-sheet, the stay-bolts therefrom taking hold of the crown-sheet at the highest points in the several corrugations, and the stay-bars being formed with sufficient turned-down ends to obtain a firm bearing on the vertical walls at the sides or ends of the furnace.

The following is a description of what I consider the best means of carrying out the invention.

The accompanying drawings form a part of this specification.

Figure 1 is a side elevation. Fig. 2 is a plan view. Fig. 3 is an end elevation, the right side being an elevation of the front end, and the left side an elevation of the rear end.

Fig. 4 is a cross-section, on a larger scale, through the crown-sheet and the parts immediately adjacent. Fig. 5 shows a modification, which will be described farther on.

The drawings represent the novel parts, with so much of the ordinary parts as appears necessary to indicate the relations thereto.

Similar letters of reference indicate corresponding parts in all the figures.

All the parts not shown may be of the ordinary construction.

Referring to Figs. 1 to 3, A is the tube-sheet, of the ordinary form, and performing in all respects its ordinary functions; and *a a*, the ordinary tubes therein. B B are the side sheets, and C the rear sheet—that in which the hole *c* is provided for the door, as usual.

The forward part of the crown-sheet (marked D) is plain. The main portion D' of the crown-sheet is corrugated, the corrugations extending below and not above the plain portion D. This part is so much lower that the highest points in the corrugations are about level with the plain part D.

It is important that the corrugations or depressions be carried out low at the rear, to allow free circulation when the water is low.

The crown-sheet is wrought in the required form by hand or by machinery.

The corrugations increase the amount and efficiency of the heating-surface. The absence of any pockets or recesses below the edges and the free circulation of the water prevent the accumulation of solid material. Preserving the full ordinary dimensions of the tube-sheet allows the full ordinary height and arrangement of tubes.

The plain or uncorrugated portion D at the forward edge of the crown-sheet, kept up at the ordinary level, as shown, affords access below for expanding and calking the ends of the tubes, and affords nearly the ordinary full capacity to the furnace. The lower level of the hinder and main portion D' of the crown-sheet holds the corrugations at such a level that the tops of the ridges thereof will be covered whenever the tubes are covered. My crown-sheet will be less likely to fail from want of water than the ordinary plain crown-sheet.

The side plates B can be plain, as usual, near

the top; but I produce corrugations at and near the line immediately above the grate, which is liable to be most intensely heated in burning coal.

The corrugations are represented by  $b^1$   $b^2$   $b^3$   $b^4$ . The corrugations  $b^1$  and  $b^2$  are ranged up and down, but joggled or out of level with each other, as shown. The corrugations  $b^3$  and  $b^4$  are horizontal, and unite the others, as shown. The set  $b^3$  are higher than the set  $b^4$ . The whole affords ample liberty for expansion and contraction with changes of temperature.

E E designate stay-bars, with their ends bent downward to a more than ordinary extent, as shown at E'. They rest upon the edges of the vertical side sheets B, and support the crown-sheet by taking hold thereof at points along the ridges of the corrugations. This is effected by means of stay-bolts  $e$ , passing through short thimbles  $e'$ , all in the ordinary manner, except that the stay-bolts  $e$  must always take hold of the highest parts or ridges of the corrugations.

Fig. 5 is a plan view, showing a modification, in which the stay-bars E, instead of extending across the fire-box, extend forward and backward, the place of one stay-bar being shown by a dotted line, and the others being understood to be parallel thereto. With this arrangement one end only of each stay-bar need be bent down to an unusual extent, the other end resting on the flat part D. In this figure the corrugations also extend in a different direction, standing across instead of lengthwise of the fire-box; but I do not consider this condition absolutely material. The corrugations may extend either way so long as the water-spaces between the ridges are open at one or both ends to allow a free circulation when the water is low.

The form shown in Fig. 5 allows the water to enter the corrugations from both sides.

The stay-bars in either case afford a strong support to the crown-sheet additional to the

stiffness imparted by the corrugations. A less number of stay-bars may be used than is usual. If the stay-bars extend in the same direction as the corrugations there should be one stay-bar over each ridge; but I prefer that they extend across the ridges, as shown. The stays which extend above to the arching top of the boiler (not shown) can be better spread or made to radiate if the stay-bars extend crosswise of the boiler. One such stay in an oblique position is indicated at F in Fig. 4.

The corrugated portion D' of my crown-sheet being, as shown, below the level of the top of the tube-sheet A, it results that my locomotive carries a greater body of water over the furnace than usual, which I esteem an important advantage.

Many modifications may be made by any good mechanic. Thus the number and depth of the corrugations may be greater or less than shown, and the length of the several corrugations and the thickness of the material may be varied. The side walls may be extended farther upward, and bent inward to correspond to the inclined condition of the edge of the crown-sheet. In such case the line of rivets is higher, and the bent-down ends of the stay-bars are correspondingly shortened.

I claim as my invention—

1. The crown-sheet described, having the corrugated main body D' lower than the front D, as and for the purposes herein specified.

2. The partially-corrugated crown-sheet D D', formed as shown, in combination with stay-bolts  $e$  and stay-bars E E', supporting the upper portions of the several corrugations and resting on firm supports, as and for the purposes shown and described.

In testimony whereof I have hereunto set my hand this 23d day of July, 1877, in the presence of two subscribing witnesses.

WM. S. HUDSON.

Witnesses:

CHAS. C. STETSON,  
THOMAS D. STETSON.