(No Model.)

G. R. WILSON.

STEAM BOILER.

No. 379,749. Patented Mar. 20, 1888.

Fig. 1.

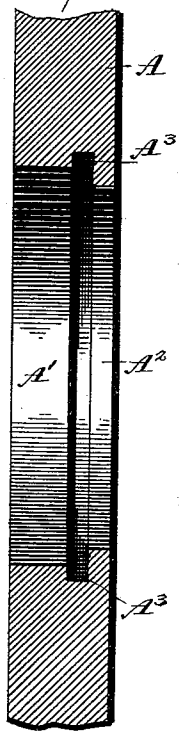


Fig. 2.

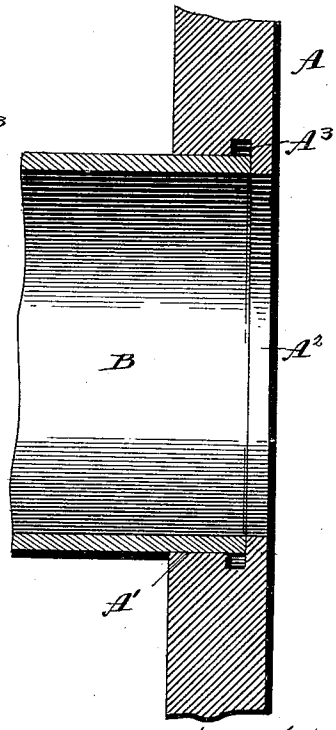


Fig. 3.

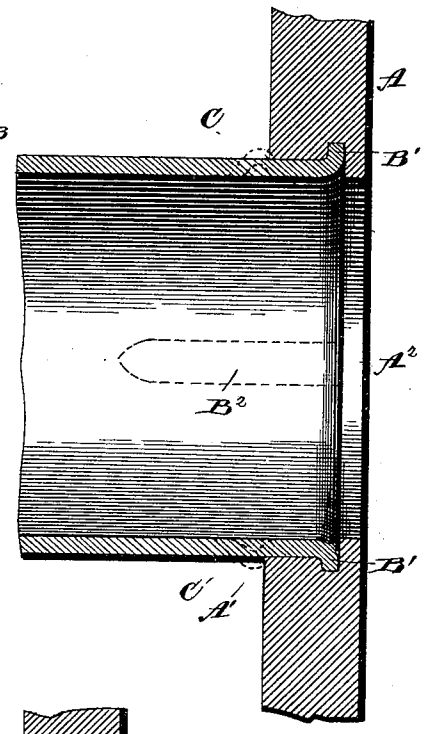
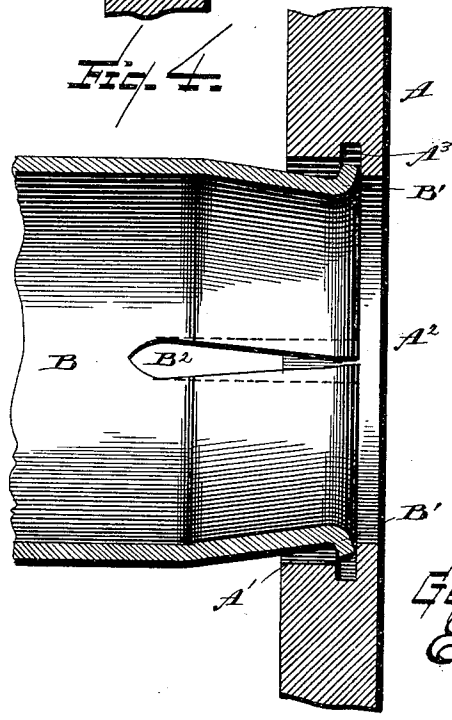


Fig. 4.



Witnesses:
L. C. Hills.
W. S. Durall.

Inventor.
Geo. R. Wilson.
E. B. Stocking.
Attorney

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

GEORGE R. WILSON, OF WASHINGTON, DISTRICT OF COLUMBIA.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 379,749, dated March 20, 1888.

Application filed November 17, 1887. Serial No. 255,424. (No model.)

To all whom it may concern:

Be it known that I, GEORGE R. WILSON, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention has relation to steam-boilers, and refers more particularly to a certain manner of connecting the flues or tubes with the tube-sheet of such boilers.

It is well known that in all constructions wherein the tube or flue passes completely through the tube-sheet the end of the tube is exposed to the excessive heat of the products of combustion passing therethrough, so that in time said end of the tube becomes burned or otherwise injured and weakened, and (with or without the effects of expansion and contraction of the tube) the joint between it and the tube-sheet becomes defective and unsafe, insomuch that the tube must be replaced by a new one.

Among the objects of my invention are to provide a new form, manner, and construction of the tube-sheet, and of the means of the connection of the same with a tube or flue, the whole being of such a nature as to protect the ends of the tubes from being burned off by direct exposure to the fire or the products of combustion; to permit of the ready disconnection and removal of the tube from the tube-sheet for the purpose of replacing the worn or injured tubes with new ones, and this without the slightest injury to the tube-sheet, and to bring the ends of the tubes not only in a protected position, so far as regards the products of combustion, but also nearer to that side of the tube-sheet which comes in contact with the water in the boiler, whereby the ends of the tubes are less heated by the products of combustion, so that in attaining the above-mentioned objects I produce a boiler which is more serviceable, durable, and more economical than one constructed with the ends of the tubes exposed.

With these objects in view my invention consists of certain features of construction hereinafter described, and particularly pointed out in the claim.

Referring to the drawings, Figure 1 represents a portion of a tube-sheet constructed in accordance with my invention, it being a sectional view taken on a line passing through the opening formed in the tube-sheet for the reception of a tube. Fig. 2 is a like view of the tube-sheet, with a tube inserted therein but not permanently connected therewith. Fig. 3 is a like view of the sheet and tube, the latter being connected with the former and ready for use. Fig. 4 is a similar view representing one manner of disconnecting the worn tube from the sheet.

Like letters refer to like parts in all the figures.

A represents a portion of a tube-sheet in which I form an opening, A′, of a shape and size adapted to form a more or less close joint with the tube B, which is to be connected with the sheet. This opening does not extend completely through the sheet, but stops short of that side thereof which is to be exposed to the fire or products of combustion. At the latter side of the sheet, and preferably concentric with the opening A′ therein, I form another opening, A^2. It is of a diameter substantially agreeing with the inner diameter of the tube to be connected with the tube-sheet. At a desired point between the surfaces of the sheet that is between the water-surface and the fire-surface thereof, and in the larger opening, A′, in the sheet, I form an annular groove, A^3, so that there is within the larger opening a receptacle into which the end of a tube may be set, flanged, or calked.

As shown in Fig. 2, the tube B is first inserted into the opening A′. Then, by any suitable expanding, flanging, or calking instrument or tool, the end of the tube is set into the groove A^3, thereby forming a connecting and holding edge or flange, B′. If desired, the usual bent shoulder, C, as shown by dotted lines in Fig. 3, may be formed in the tube at the water side of the sheet. Now it will be noticed that as the opening A^2 is substantially equal in diameter to the inner diameter of the tube it is fully protected against destructive

effects of the products of combustion, and in accordance with the location of the annular groove A^3, (which may be more or less distant from the fire side of the tube-sheet,) the end of the tube is kept more or less cool by the water within the boiler.

When it is desired to remove a tube and to reset the same or replace it with a new one, a slot, B^2, may be cut therein, as shown by dotted lines in Fig. 2, when, by the use of any suitable tool or instrument, the edges of the slot may be brought toward each other sufficiently to withdraw the flange B′ from the groove A^3, when the tube may be easily disconnected and withdrawn from the tube-sheet. Herein lies an important part of my invention, in that the tubes are removed from the tube-sheet without disturbing the flange or portion bounding the opening A^2, so that the sheet remains uninjured and in perfect condition to receive a new tube.

I have illustrated in the drawings but a single opening in the tube sheet; but it is well known that the number of tubes and openings in the tube-sheets in steam-boilers may be greater or less, as desired. I deem, therefore, the illustration of a single opening as sufficient to give a clear understanding of my invention.

Heretofore tubes have been flanged or calked into an annular groove formed in the tube-sheet, in which annular groove there has been also inserted a wedge or other shaped ring, and in some instances a collar has been forced into the tube to retain the latter and the wedge-ring within the groove of the tube-sheet. It has been attempted to connect the tube with the tube-sheet by forming an annular V-groove in the tube-sheet and expanding the end of the tube, so that its end edges shall bear against the front wall of the V-groove. In the first above-mentioned construction the tube-sheet must necessarily be either weakened by the width of the grooves formed therein to receive the flange of the tube and the wedge-ring, or said tube-sheet must necessarily be of excessive thickness, so that in either event the cost of manufacture is materially increased. The provision of a collar reduces the conductive capacity of the tube to a material degree. The V-groove construction does not give any practical permanent protection to the end of the tube so far as the destructive action of the products of combustion thereof is concerned. By my construction said protection is complete, the cost of manufacture is reduced to a minimum, and there is no wedging ring or collar required.

What I claim is—

The combination, with a tube-sheet having within the tube-opening thereof an annular straight-walled groove of a width substantially agreeing with the thickness of the tube to be connected therewith, said tube-opening being at the water side of the tube sheet of a diameter substantially agreeing with the outer diameter of the tube, and being at the fire side of the tube-sheet of a diameter substantially agreeing with the inner diameter of the tube, of a tube flanged and set into the annular groove of the said sheet, substantially as specified.

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

GEORGE R. WILSON.

Witnesses:

APPLETON P. CLARK,

W. S. DUVALL.