May 15, 1928. 1,669,414

C. G. HAWLEY

LOCOMOTIVE BOILER

Filed May 13, 1922

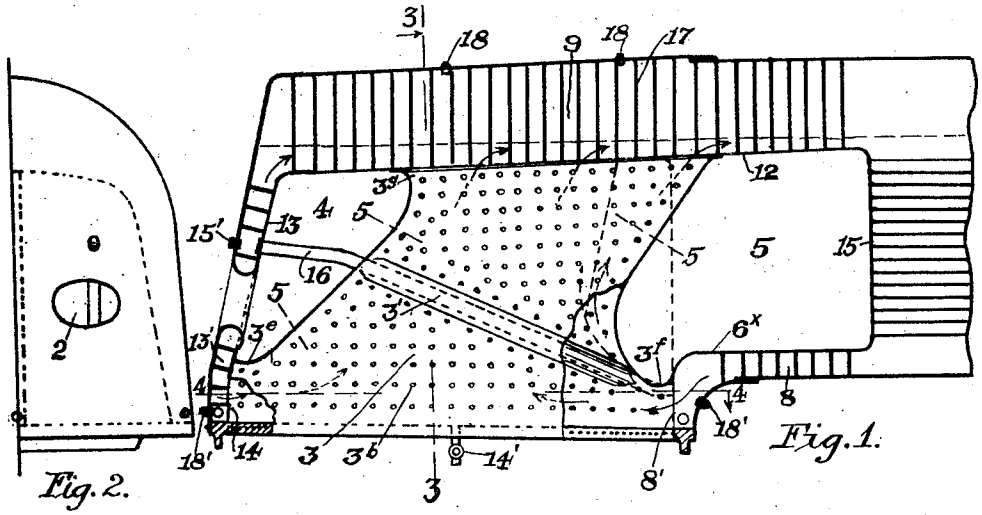

Fig. 1.

Fig. 2.

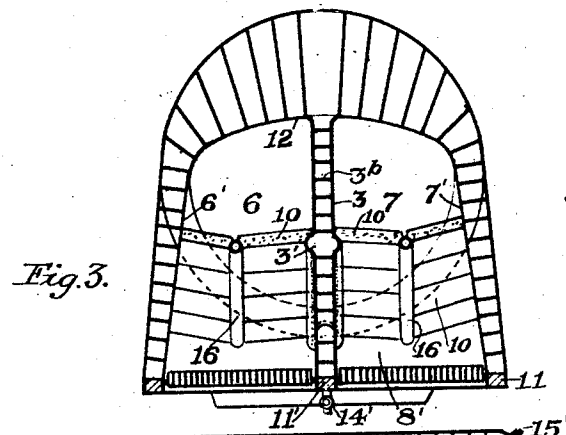

Fig. 3.

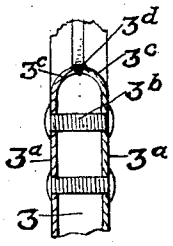

Fig. 5.

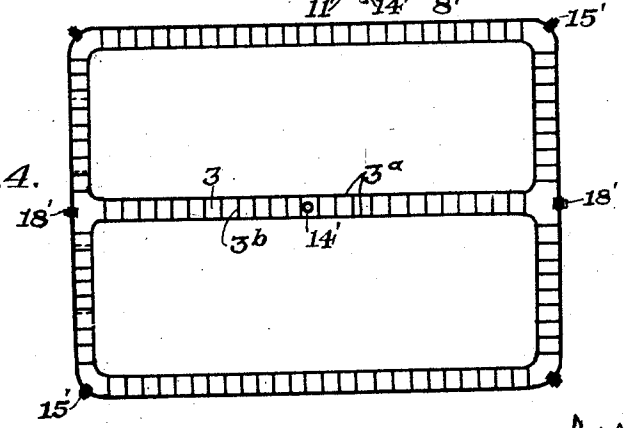

Fig. 4.

Inventor.

Patented May 15, 1928. 1,669,414

UNITED STATES PATENT OFFICE.

CHARLES GILBERT HAWLEY, OF CHICAGO, ILLINOIS, ASSIGNOR TO LOCOMOTIVE FIREBOX COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE.

LOCOMOTIVE BOILER.

Application filed May 13, 1922. Serial No. 560,653.

My invention relates to improvements in locomotive boilers and has particular reference to the fireboxes thereof. The invention is adapted to fireboxes of both the plain flue sheet type and the combustion chamber type, although I have shown only the latter in the drawings accompanying this specification. In said drawings Fig. 1 is a vertical longitudinal section of a locomotive boiler and its internal firebox; Fig. 2 is a partial rear end elevation thereof; Fig. 3 is a vertical cross section substantially on the line 3—3 of Fig. 1; Fig. 4 is a horizontal section on the line 4—4 of Fig. 1; and, Fig. 5 is a sectional detail, enlarged, upon any one of the line 5—5 of Fig. 1.

As herein shown, the firebox embodying my invention has two fire doors 2 (see Fig. 2). It may have only a single fire door, though not so advantageously, this invention being peculiarly adapted to fireboxes of the wide type usually having two doors. The firebox is divided by a vertical middle water-wall 3, which I utilize as a means of increasing the heating area of the firebox and especially in promoting a vigorous fore-and-aft circulation of the boiler water throughout the boiler.

The general object of my invention is to obtain a more effectual combustion of the fuel in the firebox; to obtain a more efficient transmission of heat between the radiant products of combustion and the boiler water; and especially to improve the circulation of water within the boiler; to the end that the capacity and efficiency of the boiler shall be improved and the durability of both firebox and boiler increased.

It is a simple matter to determine to put a middle water wall or partition in a locomotive boiler firebox, but as often as it has been tried it has been abandoned, usually because of faulty operation and always because of the practical impossibility of maintaining the partition against disruption by the contrary effects of its expansion and contraction. In every case it has been noticeable that widely different temperatures obtain in the two halves or parts of the divided firebox, leaving one side of the water wall to expand and contract so differently from the other side, as quickly to bring about a destruction of the sheets and connecting stay-bolts.

Primarily, my invention overcomes the former difficulties by constructing the partition or water wall 3 in a form which best adapts it to the free circulation of the water and a free disposal of the generated steam and especially in such manner as not to invade or actually divide the firebox considered as a whole. In brief, I provide the wall with openings 4 and 5 of such size and position as to allow a free interchange of gases and heat between the two parts 6 and 7 of the firebox. This last I find necessary in order that substantially uniform and equal temperatures may be maintained in the two sides 6 and 7 of the firebox, notwithstanding variations in the rates of combustion therein or the varying in-rush of cold air through the fuel doors.

In every form of my invention there will be found a middle water-circulating-and-steaming wall or partition which is in communication with the water in the lower part 8 of the boiler and which at the top is in free communication with the top 9 of the boiler; and importantly this partition occupies only a portion of the middle of the firebox, leaving the large communicating openings 4 and 5 between the two sides 6 and 7 of the latter. By this last precaution, although the two sides of the firebox have separate grates and fires of different intensities, there is always a sufficient intermingling of gases to keep the sides of the water wall so nearly at the same temperature as to avoid destructive differences of expansion and contraction. Further details of my invention comprehend special forms for the partition (see bulging parts 3′) whereby it is adapted for employment with fire brick arches or baffle walls 10 intended to improve combustion. The bulging portions 3′ which I adopt for the support of the arch brick also serve as absorbers of expansion differences between the stayed sides of the water wall.

Further referring to the drawings, attention is called to the mud-ring or foundation-ring, 11, of the firebox. This, as well shown in Figs. 3 and 4, is provided with the middle bar or section 11′, which serves as the foundation for the water-steaming-and-circulating wall 3. From the mud-ring bar 11′, the wall rises directly to, and opens upward through the crown sheet 12 of the firebox.

The other sheets or parts of the firebox are the side sheets 6′ and 7′, the throat sheet 8′ and the back sheet 13. The same and

those composing the wall 3 are generally formed from firebox plates of the same thickness. Steel is the material usually employed; and sometimes copper.

The wall 3 is generally composed of the two spaced apart sheets 3^a, 3^a, cut to some such pattern as here indicated (to provide the openings 4 and 5) and joined by closely spaced stay-bolts 3^b. As shown in Fig. 5 the edges 3^c of the sheets are flanged together and joined by an autogenous weld or seam 3^d. The rear bottom end 3^e of the wall presents a vertically elongated slot-like opening 14 which is in direct communication with the rear water-leg 13′ of the firebox, the component sheets and mud-ring being united by riveted and welded seams. A like condition obtains at the bottom front end of the wall 3, where the hollow portion 3^f is in open communication with the front water-leg or throat 8 of the boiler. The open top 3^g of the wall is longitudinally extensive, as compared with the intake openings 3^e and 3^f. At all of these openings 3^e, 3^f and 3^g, the component sheets of the wall may be flanged outwardly, as required by the best welding and stay-bolting practices.

Obviously the mud ring bar forms the bottom of the water wall and to dispose of any accumulation of sediment thereon I provide one or more blow-off cocks 14′, see Figs. 1 and 2. These supplement the other blow-off cocks and wash-out plugs 15′ with which the firebox is equipped.

Attention is called to the fact that by preference the closed rear end of the wall starts upward from a point below the fuel door in the back head 13. Similarly the closed front end of the wall starts upward from a point on the throat or flue sheet 8′ below the floor 6^x of the firebox combustion chamber, or in the case of a plain firebox, at a point below the boiler flues.

In every case the upper rear and front ends of the wall stand far away from the back sheet 13 and the flue sheet 15, respectively. In addition to providing the large openings 4 and 5, the described form of wall leaves ample space for free access to all parts of the adjacent firebox sheets, stay-bolts and flues.

It will be noted that the described wall construction is such as to avoid all danger of pocketing steam within the hollow wall; is such as to provide a very wide free opening for the discharge of steam and water from the top of the wall; and, is such as to admit of wash-out access to every interior surface of the wall. All these are matters of great importance with relation to the problem of maintaining the structure. Secondarily, in this regard attention is called to the upward and rearward slanting position of the expansion absorption bulges 3′ in the sides of the wall. As will be observed, these are substantially perpendicular to the stress lines set up by the relatively diagonal expansion and contraction movements in a wall which extends upward and forward from the back of the firebox, as does this.

The bulges 3′ incidentally parallel the arch tubes 16, which may well be added to assist in supporting the arch brick 10.

An intense fire being maintained on both grates shown, the boiler water is rapidly heated and evaporated upon all heating surfaces of the firebox, and especially within the dividing wall 3, which is heated on both sides. Obviously the highly heated water in the wall 3, lightened by the presence of many steam bubbles, is rapidly displaced by the cooler water from the bottom of the boiler. Thus an extremely rapid and positive circulation of water is set up throughout the boiler with great benefit to the heating efficiency of all its heating surfaces, firebox and flues included.

Incidentally, the safety of the firebox is insured by the thermic action of the wall. In event the water in the boiler is allowed to fall so low as to uncover the crown sheet, the greater part of the latter is nevertheless fully bathed with the water which at such times fountains from the wall and spreads over the crown sheet. But for this the crown sheet would become hot and being violently blown down away from the hundreds of crown bolts 17, a disastrous boiler explosion would occur.

The parts marked 18 are wash-out plugs positioned in the firebox shell above the top opening of the wall 3; for an obvious purpose similar wash-out plugs 18′ are provided in the front and back of the firebox shell.

In closing, I desire that it be understood that my invention is not limited to one such longitudinal water wall in a firebox. My invention comprehends and it is entirely feasible to use two such walls in any wide firebox, and the three longitudinal grates characteristic of two walls can easily be fired through two fuel doors. In the following claims the term—middle bar of the mud ring—is to be construed accordingly, for it may mean a single bar or one of two such middle bars in a single firebox.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. A locomotive boiler and fire box embodying therein, a crown sheet, side sheets and front and rear sheets, an upright flat tubular water wall extending longitudinally of the fire box between said side sheets and connected at its ends with the bottom portions only of the front and rear water legs of the boiler and opening at its top through the crown sheet, said water wall, substantially dividing the fire box into a plurality of fire chambers connected together only at

the ends of the water wall above its points of connection with said front and rear water legs, whereby temperature conditions in said fire chambers are substantially equalized.

2. A locomotive boiler and fire box embodying therein, a crown sheet, side sheets and front and rear sheets, an upright flat tubular water wall extending longitudinally of the fire box between said side sheets and connected at its ends with the front and rear water legs of the boiler and opening at its top through the crown sheet, said water wall having bulged portions inclined upwardly and rearwardly from said front water leg and substantially dividing the fire box into a plurality of fire chambers connected together only at the ends of the water wall above its points of connection with said front and rear water legs whereby temperature conditions in said fire chambers are substantially equalized.

3. A locomotive boiler and fire box embodying therein, a crown sheet, side sheets and front and rear sheets, an upright flat tubular water wall extending longitudinally of the fire box between said side sheets and connected at its ends with the front and rear water legs of the boiler and opening at its top through the crown sheet, said water wall having bulged portions inclined upwardly and rearwardly from said front water leg and substantially dividing the fire box into a plurality of fire chambers connected together only at the ends of the water wall above its points of connection with said front and rear water legs whereby temperature conditions in said fire chambers are substantially equalized, water tubes connecting the said front and rear water legs and having portions in parallel relation with said bulged portion of said water wall and fire brick supported upon said bulged portion of the water wall and said water tubes.

In testimony whereof, I have hereunto set my hand this 6th day of May, 1922.

CHARLES GILBERT HAWLEY.