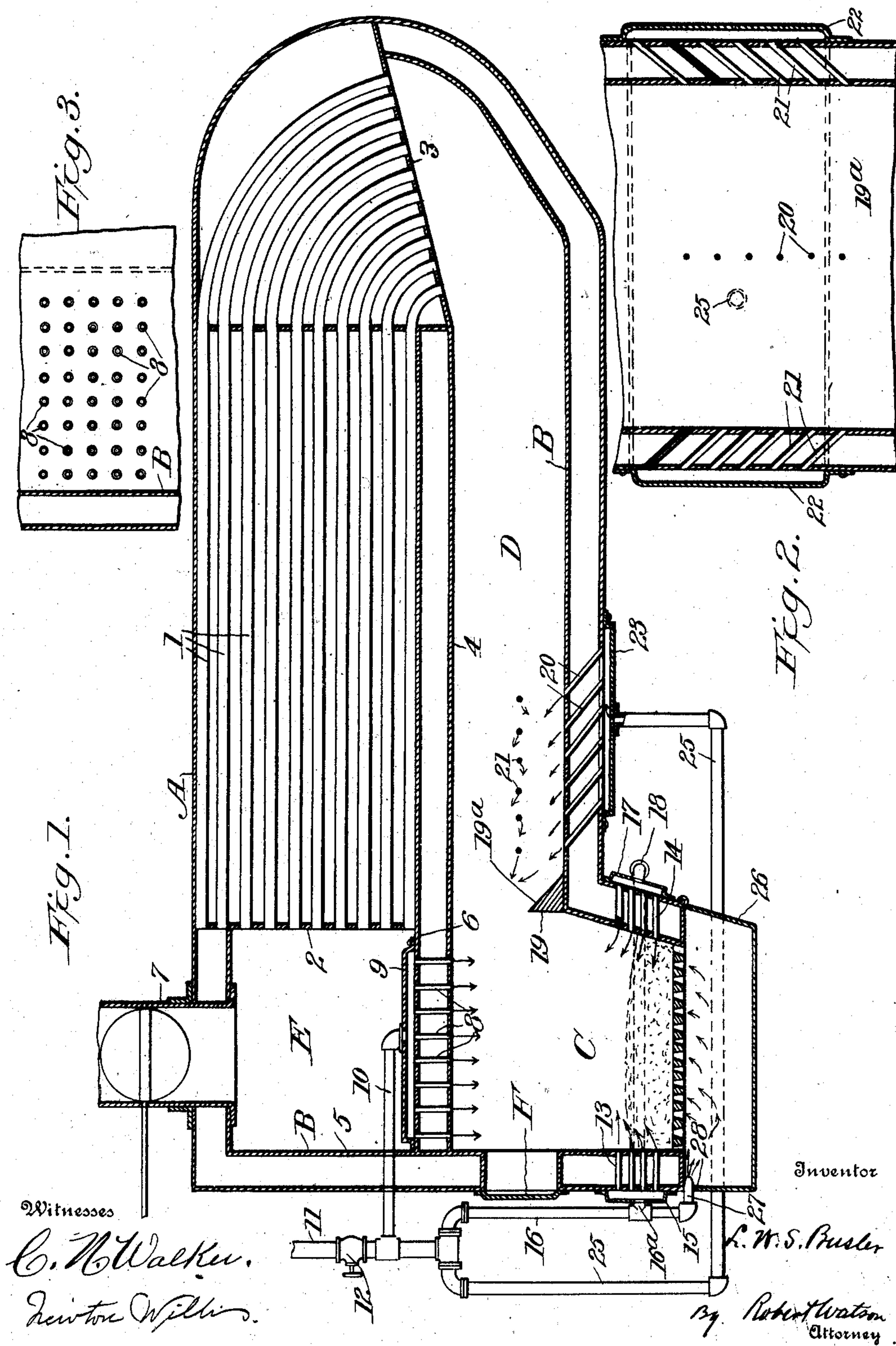


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PATENTED AUG. 27, 1907.

L. W. S. BUSLER.
STEAM BOILER.

APPLICATION FILED APR. 6, 1907.



UNITED STATES PATENT OFFICE.

LEVI W. S. BUSLER, OF SUNBURY, PENNSYLVANIA.

STEAM-BOILER.

No. 864,358.

Specification of Letters Patent.

Patented Aug. 27, 1907.

Application filed April 6, 1907. Serial No. 366,860.

To all whom it may concern:

Be it known that I, LEVI W. S. BUSLER, a citizen of the United States, residing at Sunbury, in the county of Northumberland and State of Pennsylvania, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

The purpose of my invention is to provide improved means for promoting the combustion of gases from fuel in the furnaces of steam boilers, and the invention comprises an arrangement of air feeding devices adapted to supply air to the gases which are given off when fresh fuel is thrown into the furnace, and to hold the gases in check until they are ignited and consumed. The air feeding tubes are arranged so that they are always surrounded by water and therefore not liable to burn out, and their arrangement is such as not to obstruct the fire box or the flue leading therefrom.

In the accompanying drawing which illustrates my invention, Figure 1 is a longitudinal central section through the boiler; Fig. 2 is a section through the flue leading from the fire box, taken on the line 2—2 of Fig. 1, and Fig. 3 is a bottom plan view of a portion of the top of the fire box or crown sheet.

Referring to the drawing, A indicates the outer shell of the boiler, in the upper portion of which a nest of fire tubes 1 is arranged between the tube sheets 2 and 3. The boiler has an inner shell B extending in front of the tube sheet 2 and downwardly around the fire box C and also around the flue D which leads from the fire box to the tube sheet 3. A partition 4 extends from the tube sheet 3 to the vertical wall 5 of the inner shell and this partition forms the top of the fire box and flue and the bottom of that portion of the boiler containing the fire tubes. The tube sheet 2 is placed at some distance back of the vertical wall 5, about in line with the rear end of the fire box, forming a smoke box E between the inner shell of the boiler and said tube sheet. The smoke box is closed at the bottom by a partition 6, which extends between the tube sheet 2 and the vertical wall 5, and said partition is arranged at a suitable distance above the partition 4 in order to provide a water space between said partitions. A stack 7 leads upwardly from the smoke box as shown. A series of air tubes 8 evenly spaced apart throughout the area of the partition 6, extend downwardly through the partitions 6 and 4, and through the intervening water space, and a casing 9, within the fire box, extends over the upper ends of the air tubes. A pipe 10 leads from the casing 9 to an air supply pipe 11, which is connected to a suitable blower (not shown) and provided with a valve 12. By opening the valve 12 jets of air, under pressure will be caused to flow through the air tubes 8, over the entire area of the fire box, directly toward the fuel on the grate *g*.

Air tubes 13 and 14 extend horizontally through the front and rear walls or water legs of the fire box, respec-

tively, these tubes being evenly spaced apart and located so that some of the tubes will be partly beneath the fuel on the grate *g*, while the uppermost tubes will be slightly above the fuel. A casing 15 extends over the outer ends of the tubes 13, and this casing is connected by a pipe 16 to the main air supply pipe 11. Similarly a casing 17 extends over the outer ends of the tubes 14 and this casing is connected by a pipe 18 to the pipe 16 and thence to the pipe 11, so that when the valve 12 is opened jets of air will be projected horizontally through the air tubes 13 and 14 into the fuel a short distance below and a short distance above its surface. A bridge 19 is arranged above the rear water leg of the fire box, the rear side 19^a of said bridge being inclined, as shown, and at the rear of the bridge are arranged three series of air tubes 20, 21 and 22, which extend diagonally through the outer and inner shells of the boiler and through the intervening water space. The tubes 20 are arranged at the bottom of the flue and the tubes 21 and 22 are arranged at the sides of the flue. A casing 23 extends beneath the outer shell of the boiler and incloses the outer ends of the three series of tubes. A pipe 25 connects the casing with the air supply pipe 11. The air tubes 20, 21 and 22 are arranged so as to deliver jets of air into the flue in a direction to oppose the flow of gas from the fire box through the flue. An ash pan 26, hinged to the fire box, extends beneath the grate *g*, and a pipe 27 connected to the pipe 16 extends through an opening 28 in the ash pan so as to deliver air under pressure beneath the grate *g*.

In operation when fresh fuel is thrown into the furnace through the doorway F and the door has been closed, the valve 12 is opened, thus admitting air through all of the air tubes, as indicated by the arrows. The air passing through the tubes becomes intimately mixed with the smoke and gases arising from the fuel and forces the gases downward around the fuel on the grate. The air flowing through the tubes 20, 21 and 22 prevents the gases from flowing through the flue D, and the air flowing through the tubes 13 and 14 mixes with the gases within and immediately above the fuel. The air from the pipe 27 passes through the grate and upward through the fuel. The entire arrangement is such that a large amount of air is supplied in such a manner as to become intimately mixed with the smoke and gases, thereby supplying the necessary oxygen for combustion of the same, and the mixed air and gases are held in check and circulated in contact with the flames from the fuel, so that combustion of the smoke and gases which would otherwise pass out through the stack, takes place in the furnace chamber and flue. After a short interval of time, when the newly added fuel has become heated and conditions become normal, the valve 12 is closed and the air supply shut off; or it may be left partly open to supply any desired amount of air.

As all of the air tubes extend through the double walls of the furnace and are protected by water, there is little danger of the tubes burning out, and the tubes do not in any way obstruct the fire box or flue. Air tubes arranged above the fire box are peculiarly liable to injury from excessive heat, and my arrangement of tubes between the smoke box and the fire box is particularly advantageous because the tubes are surrounded by water and therefore less liable to injury from heat than they would be if arranged directly within the fire box.

It will, of course, be understood that my improvements are applicable to boilers of other forms than that shown in the drawing. One purpose of the closed ash pan is to prevent the smoke and gases from being driven down through the fuel and out past the grate by the air pressure from above. The ash pan closes the fire box below the grate and the pressure in the ash pan is maintained by the air admitted through the pipe 27.

By the use of my invention a large saving in fuel is effected. When fresh coal is thrown onto a hot fire a large amount of the gas in the coal is immediately evolved, and, in the ordinary boiler the gas thus freed passes out through the stack unconsumed. By my invention these gases are consumed within the furnace, and less fuel is therefore required to maintain the steam pressure in the boiler.

What I claim is,—

1. In a steam boiler, a fire box, and a flue each having double walls with intervening water spaces, and a crown sheet extending over said fire box and flue, a plurality of air tubes extending horizontally through the walls of the fire box, a plurality of air tubes extending diagonally through the walls of the flue towards the throat between the fire box and flue, a plurality of air tubes extending through the crown sheet over the fire box and through a water space in the boiler, and means for conducting air to said tubes.

2. In a steam boiler, a fire box, a smoke box arranged above the fire box and separated from the crown sheet

thereof by a water space, a plurality of air tubes extending through the crown sheet of the fire box and through the bottom of the smoke box, and means for conducting air to said air tubes.

3. In a steam boiler, a fire box, a smoke box arranged above the fire box and separated from the crown sheet thereof by a water space, a plurality of air tubes extending through the crown sheet of the fire box and through the bottom of the smoke box, a casing in the fire box extending over said tubes and an air pipe leading from the interior of said casing.

4. In a steam boiler, a fire box and a flue extending horizontally therefrom, said fire box and flue both having double walls with intervening water spaces, a crown sheet extending over said fire box and flue, a smoke box above said fire box and separated from the crown sheet by a water space, fire tubes above the crown sheet extending from the flue to the smoke box, a plurality of air tubes extending vertically through the crown sheet and the bottom of the smoke box, a plurality of air tubes extending diagonally through the walls of the flue at the rear of the fire box and directed toward the throat between the fire box and flue, a plurality of air tubes extending through the walls of the furnace, and pipes or conduits arranged to conduct air to said tubes.

5. In a steam boiler, a fire box and a flue extending horizontally therefrom, said fire box and flue both having double walls with intervening water spaces, a crown sheet extending over said fire box and flue, a smoke box above said fire box and separated from the crown sheet by a water space, fire tubes above the crown sheet extending from the flue to the smoke box, a plurality of air tubes extending vertically through the crown sheet and the bottom of the smoke box, a plurality of air tubes extending diagonally through the walls of the flue at the rear of the fire box and directed toward the throat between the fire box and flue, a plurality of air tubes extending through the walls of the furnace, casings extending over the outer ends of said tubes, and air pipes arranged to conduct air to the interiors of said casings.

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

LEVI W. S. BUSLER.

Witnesses:

ROBERT WATSON,
NEWTON P. WILLIS.