Oct. 20, 1964 W. W. PALM 3,153,429

FIRE TUBE BOILER

Original Filed Aug. 8, 1958 2 Sheets-Sheet 1

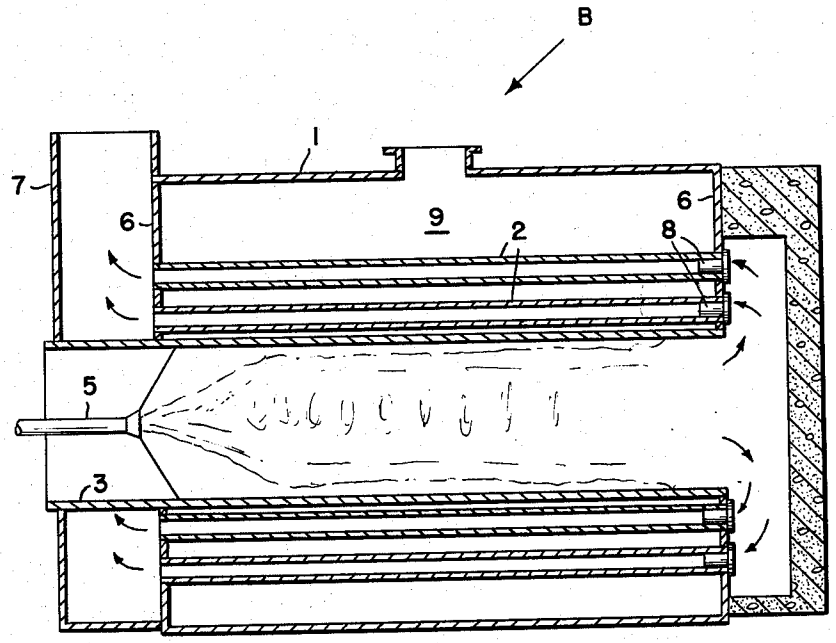


FIG. I.

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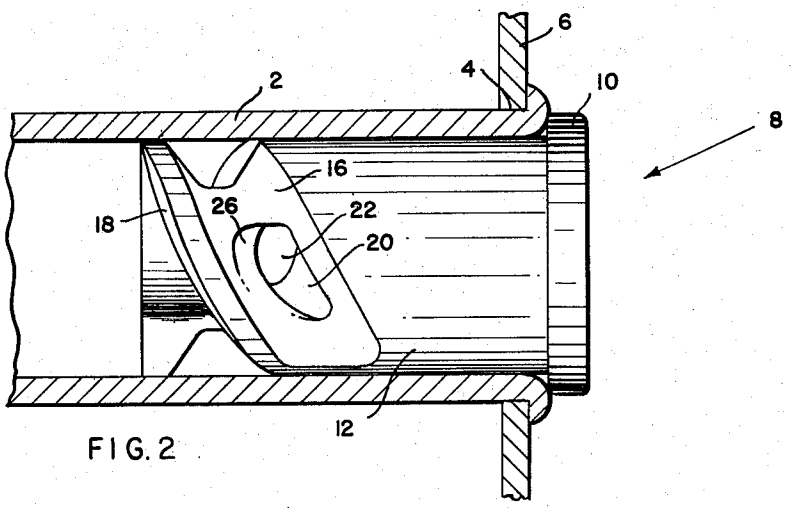


FIG. 2

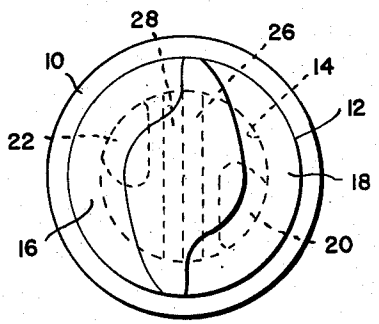


FIG. 3

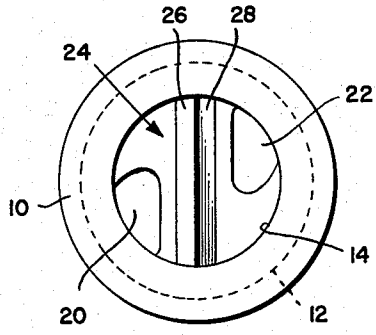


FIG. 4

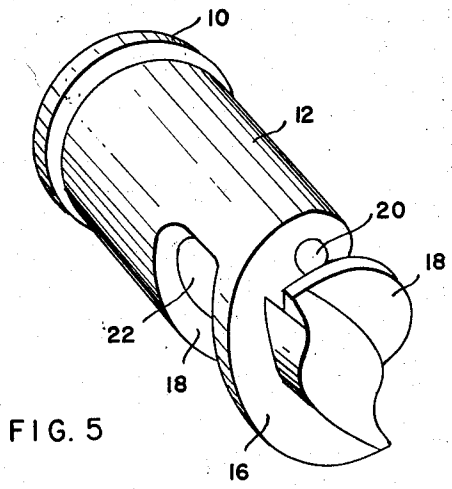


FIG. 5

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FIRE TUBE BOILER

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Continuation of abandoned application Ser. No. 753,975, Aug. 8, 1958. This application Jan. 12, 1962, Ser. No. 168,002

4 Claims. (Cl. 138—38)

This invention relates to a nozzle which is adapted to be used in a boiler return tube. The nozzle of this invention may be used, for example, in a return tube of a scotch marine type fire tube boiler of the forced draft type. It is of particular utility with forced draft type boilers providing a pressure drop through the nozzle of at least one inch of water.

This application is a continuation of my copending application Serial No. 753,975, filed August 8, 1958, now abandoned.

It is known to employ vanes or the like in boiler return tubes. The heretofore known vane arrangements, however, have tended to direct the primary flow of gases along the axis of the return tube and have failed to provide a spiral vortex flow which will persist through the length of the tube. The deficiencies of the prior art structures are particularly marked when it is attempted to employ them with forced draft systems providing a substantial pressure drop through the vanes.

The nozzle in accordance with this invention successfully provides a spiral vortex flow which will persist through the length of a typical boiler return tube where a forced draft is employed producing a pressure drop of at least one inch of water through the nozzle.

These and other objects of this invention will become apparent on reading the following description in conjunction with the drawings in which:

FIGURE 1 is a schematic illustration representing a vertical front to back section through a typical two pass return fire tube boiler equipped with nozzles according to the invention;

FIGURE 2 is a side elevation of a nozzle in accordance with this invention;

FIGURE 3 is a rear end elevation of the nozzle of FIGURE 2;

FIGURE 4 is a front end elevation of the nozzle of FIGURE 2; and

FIGURE 5 is a rear perspective view of the nozzle of FIGURE 2.

Referring to FIGURE 1, there is shown schematically a typical oil-fired scotch marine type horizontal return tube boiler, generally designated B, having the usual shell 1, furnace 3, burner 5, tube sheet walls 6, return tubes 2, uptake 7, and water and steam space 9. As will be understood by those skilled in the boiler art, the burning gases pass from the furnace 3 and through return tubes 2 to the uptake 7; the water in space 9 being heated by heat transfer through the furnace wall, tube sheet walls 6 and return tubes 2.

FIGURE 2 shows the inlet end of a typical boiler return tube 2, which is partially broken away, mounted in an opening 4 in a boiler wall 6.

A nozzle 8 in accordance with this invention is inserted in the entrance of return tube 2 and is provided with a flange 10 to provide protection for the terminal end of the return tube 2 and to limit the inward movement of the nozzle 8 into the return tube.

Nozzle 8 will be formed of a highly heat resistant material such as a refractory material, for example, silicon carbide, fire clay brick ($SiO_2Al_2O_3$) or aluminum

oxide or a metal such as a chrome-nickel alloy steel, chrome-steel alloy or titanium.

Nozzle 8 has a body portion 12 provided with a bore 14. The diameter of bore 14 will be over 50% of the outside diameter of body 12 which, in turn, will make it over 50% of the inside diameter of the return tube.

Body 12 is also provided with a pair of helical grooves 16 and 18. An opening 20 leads from bore 14 to groove 16. An opening 22 leads from bore 14 to groove 18.

Contrary to the conventional vane structures for boiler return tubes, the nozzle 8 has a closed center and is provided with a wall 24 to divide the gas flow sending approximately half of the flow through the passage defined by opening 20 and groove 16, and the other half through the passage defined by opening 22 and groove 18. Wall 24 is provided with sloping faces 26 and 28, face 26 sloping from the center outwardly towards opening 22 and face 28 sloping outwardly from the center towards opening 20.

It has been found that gases passing through bore 14, divided by wall 24 and passing, in part, through openings 20 and 22 and then respectively through helical grooves 16 and 18, are introduced into the boiler return tube as a spiral vortex which will adhere closely to the inner surface of the boiler return tube and persist throughout the length of the boiler return tube. The superior results achieved in forced draft type boilers apparently can be partially attributed to the employment of two sets of helical grooves so as to introduce only two helical streams into the boiler return tube and due to the fact that the gases are only introduced adjacent the periphery of the nozzle with no gases being introduced at the center of the nozzle.

It is not desired to be limited except as set forth in the following claims.

What is claimed is:

1. In a boiler of the type having return tubes, the combination with a return tube of a nozzle formed of highly heat resistant material, said nozzle having a body inserted within the entrance end of said return tube and an annular flange at the inlet end of the nozzle enclosing the entrance end of the return tube to limit the movement of the nozzle into and to protect the end of the return tube, the body having a bore extending inwardly from the inlet end of the nozzle, having a pair of helical grooves extending about the body at the discharge end of the nozzle, having an opening connecting said bore with each of said grooves and a central wall at the inner end of said bore between said openings to direct gases passing through the bore towards said openings.

2. In a fire tube boiler of the type having return tubes, the combination with a return tube of a nozzle within the inlet end of said tube, said nozzle being formed of highly heat resistant material and comprising a generally cylindrical body having an outside diameter such that the body closely engages the inner wall of said tube, a bore extending inwardly from the end of the body adjacent said inlet end of the boiler tube, a plurality of helical grooves extending around said body at the other end thereof, openings individually connecting each of said grooves with said bore, the depth of said grooves being substantially constant along their length, whereby gases are discharged from said nozzle through said grooves in a spiral path adjacent the inner wall of said tube, and a wall formed in said body at the end of said bore and between said openings to direct gases toward the openings.

3. The combination according to claim 2 wherein said wall has faces sloping outwardly from the central diametrically extending portion thereof and the entrance end of said passages are forwardly of the dividing wall.

4. In a fire tube boiler of the type having return tubes,

the combination with a return tube of a nozzle inserted within the entrance of said return tube, said nozzle comprising a body formed of a highly heat resistant material, said body having an internal bore extending inwardly from said entrance end in the direction of the flow of gases through said return tube, and a pair of external grooves extending about the body at the discharge end thereof, and openings connecting said bore with the passages defined by said grooves, said helical grooves discharging said gases in two streams at diametrically opposed portions of the nozzle in spiral paths concentrated along the inner surface of said return tube, said body comprising a wall extending diametrically across said bore at the end thereof and between said openings to divide the gases so that approximately equal amounts flow into each of said openings.

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