W. R. WOOD.

WATER TUBE BOILER.

APPLICATION FILED DEC. 26, 1918.

1,300,087.

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Fig. 2.

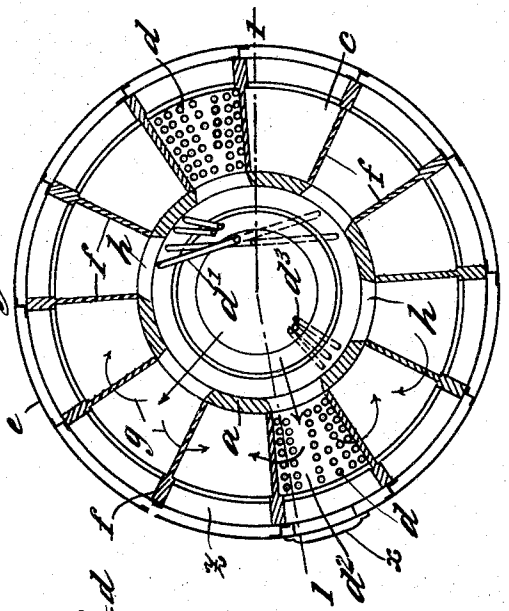
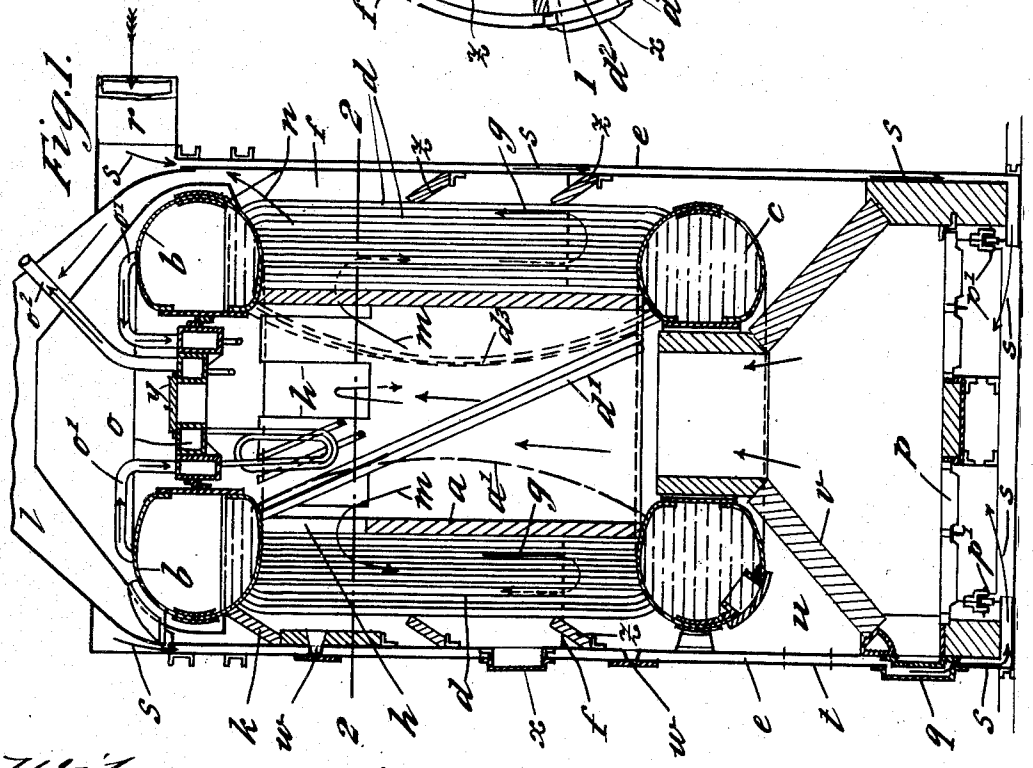


Fig. 1.



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WATER-TUBE BOILER.

1,300,087. Specification of Letters Patent. Patented Apr. 8, 1919.

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To all whom it may concern:

Be it known that I, WILFRED ROTHERY WOOD, a citizen of the United States of America, resident in London, England, have invented certain new and useful Improvements in Water-Tube Boilers, of which the following is a specification.

This invention relates to a vertical water-tube boiler of the kind having the tubes in compartments formed by vertical baffles radiating from a central flue or cylindrical baffle to a casing coaxial with the flue, the combustion gases passing down and up the compartments in succession to the boiler flue.

The essential feature of this invention is a combination of the known boiler having vertical water tubes connected at the top and bottom ends with annular shaped drums, with the said arrangement of the tubes in compartments, the cylindrical baffle having at its upper part peripheral openings the combined length of which in a horizontal plane amounts to at least one-third of the length of the periphery in a horizontal plane, so that the gases enter some of the compartments and, having descended them, ascend others on their way to the boiler flue.

The invention is for the purpose of relieving the boiler from strains due to unequal heating and of working the boiler with less draft than the known construction requires. The boiler is smaller in over-all dimensions than boilers of this annular type having no tube compartments.

The boiler furnace is of substantially the same diameter as the annular drums, but the combustion gases are caused by a conical roof or arch to the furnace, to flow through the central opening of the lower annular drum. The arch protects this drum from the direct heat of the furnace and provides an annular space between itself and the drum, which space is open to the compartments formed by the radial baffles and constitutes a collecting chamber into which the dust carried by the descending and ascending combustion gases settles and whence it can readily be removed through a door in the casing of the boiler.

The superheater is placed within and closes the central opening of the upper annular drum, a position of particular advantage, since its heating tubes depend into the combustion chamber or space, and the receiving compartment of the superheater can be connected at more than one point with the steam space of the drum. This insures a uniform flow of steam through the superheater (particularly if the steam is taken from the delivery compartment of the superheater at more than one point) and excessive loss of pressure is avoided. Preferably, the superheater is of annular shape, its central opening being closed by a cover which can be removed for obtaining access to the combustion chamber.

Since the depending tubes of the superheater are apt to be over-heated, it is preferable that some of the water tubes should be arranged within the combustion chamber so that some of the heat may be removed from the gases before they leave the tubes of the superheater. This object is the better attained by so arranging such inner tubes that they form a constriction in the combustion chamber.

To diminish further the floor space required by the boiler the furnace has a rotary grade of known kind, whereby the stoking can be effected from one point and constant access to the boiler at any other point is not required.

Any of the usual means for feeding the drums may be employed.

In the accompanying drawings Figure 1 is a vertical section on line 1—1 of Fig. 2, of a boiler constructed according to the invention, and Fig. 2 is a horizontal section on line 2—2 of Fig. 1.

The combustion chamber is formed by the cylindrical baffle *a* at the ends of which are the annular water drums *b*, *c* respectively. The water tubes *d* which connect the drums are arranged on the peripheries of imaginary cylinders coaxial with cylinder *a* between the latter and the double-walled boiler casing *e*. These rows of tubes are grouped by vertical radial partitions *f*, which extend to the upper drum but terminate at a short distance above the lower drum to permit passage of combustion gases from one of the compartments formed by the partitions to the next, as indicated by arrows *g* in Fig. 1.

The upper end of cylinder *a* is cut away between alternate partitions *f* to form openings *h* and between these partitions the passage around the drum *b* to the chimney flue *l* is blocked by baffles *k*. Thus, the combustion gases pass from the space within the cylinder *a* into alternate compartments between partitions *f*, down these com-

partments as indicated by arrows *m*, beneath the partitions, up the intermediate compartments and through the passages left open to the chimney flue *l*, as indicated by arrows *n*.

The annular superheater *o* set in the annulus of drum *b* is of tubular type, its tubes extending into cylinder *a*. Its receiving chamber is connected by pipes *o'* with the steam space of drum *b*, and its delivery chamber has more than one steam offtake o^2. To protect the superheater tubes from being over-heated the two inner rows of water tubes are within the cylinder *a* and are so arranged as to produce a constriction in the combustion chamber substantially following the dot and dash line *a'* in Fig. 1. In this manner some of the heat of the combustion gases is taken up by the water before the gases pass among the superheater tubes.

One method of producing such a throat or constriction in the combustion chamber consists in giving the row or rows of straight tubes *d'* within the cylinder *a* the kind of arrangement which would be produced if they were set on the periphery of an imaginary cylinder between the water drums and one of the latter were rotated relatively to the other. Another method consists in curving the tubes within the cylinder *a* as indicated in dotted lines at d^3 in Figs. 1 and 2.

The circular grate *p* carrying rollers *p'* running on a circular track, and also carrying a circular rack (not shown), may be rotated by a pinion (not shown) engaging the rack and turned by hand as may be required to bring the clinkers to the stoking door *q*, where fresh fuel may be substituted for them.

Air enters the upper part of the casing *e* at *r* and is drawn between the walls of the casing to beneath the grate as indicated by arrows *s* and is thus preheated before it burns the fuel.

The conical roof or arch *v* of the furnace is adapted to direct the combustion gases into the central combustion chamber and to protect the lower annular drum from direct heat; it also forms with the casing a space *u* below this drum from which dust may be removed through a door *t*.

The casing may also be provided with a number of doors such as *w* for cleaning the outer surfaces of the tubes *d*, and a door *x* for access to these tubes for removing them.

Access to the tubes *d'* may be had by removing the cover *y* of the annular superheater *o*, and in order that these tubes (when they are of larger diameter than tubes *d*) may be removed, there is left in the compartment containing the door *x* a gap d^2 between adjacent radial rows of tubes *d*. This gap is opposite door *x* so that the tube *d'*, having been raised through the superheater, can be pushed through the gap d^2 and out of the door *x*.

To keep the descending and ascending gases as much as possible among the tubes *d*, baffles *z* are mounted between the radial baffles *f*.

The particular cross section of the annular drums here shown, namely a circular cross section with that side flattened which forms the interior of the annulus, is adapted to facilitate their construction without sacrificing their strength.

Having thus described the nature of the said invention and the best means I know of carrying the same into practical effect, I claim:

1. A boiler comprising, in combination, upper and lower annular water drums, upright water tubes connecting said drums, a boiler casing inclosing said tubes and having an outlet, a cylindrical baffle constituting a substantially central combustion chamber, and substantially radial and vertical partitions subdividing the space between said baffle and the boiler casing into compartments each containing a portion of said water tubes, said cylindrical baffle having at its upper end peripheral openings communicating with certain of said compartments, the remaining compartments being in communication with said outlet, the combined length of said openings in a horizontal plane being equal to at least one third of the length of the periphery of said baffle in a horizontal plane, and said partitions being arranged to permit passage of gases beneath them between adjacent compartments.

2. A boiler comprising, in combination, upper and lower annular water drums, upright water tubes connecting said drums, a boiler casing inclosing said tubes and having an outlet, a cylindrical baffle constituting a substantially central combustion chamber, and substantially radial and vertical partitions subdividing the space between said baffle and the boiler casing into compartments each containing a portion of said water tubes, said cylindrical baffle having at its upper end peripheral openings communicating with alternate compartments, the remaining compartments being in communication with said outlet, the combined length of said openings in a horizontal plane being equal to at least one third of the length of the periphery of said baffle in a horizontal plane, and said partitions being arranged to permit passage of gases beneath them between adjacent compartments.

3. A boiler comprising, in combination, upper and lower annular water drums, upright water tubes connecting said drums, a boiler casing inclosing said tubes and having an outlet, a cylindrical baffle constituting a

substantially central combustion chamber, a superheater of the tubular type set within the annulus of the upper drum with its tubes extending into said cylindrical baffle, and substantially radial and vertical partitions subdividing the space between said baffle and the boiler casing into compartments each containing a portion of said water tubes, said cylindrical baffle having at its upper end peripheral openings communicating with certain of said compartments, the remaining compartments being in communication with said outlet, the combined length of said openings in a horizontal plane being equal to at least one third of the length of the periphery of said baffle in a horizontal plane, and said partitions being arranged to permit passage of gases beneath them between adjacent compartments.

4. A boiler comprising, in combination, upper and lower annular water drums, upright water tubes connecting said drums, a boiler casing inclosing said tubes and having an outlet, a cylindrical baffle constituting a substantially central combustion chamber, a superheater of the tubular type set within the annulus of the upper drum with its tubes extending into said cylindrical baffle, certain of said water tubes being arranged within said baffle to diminish the temperature of the combustion gases before they reach said superheater tubes, and substantially radial and vertical partitions subdividing the space between said baffle and the boiler casing into compartments each containing a portion of said water tubes, said cylindrical baffle having at its upper end peripheral openings communicating with certain of said compartments, the remaining compartments being in communication with said outlet, the combined length of said openings in a horizontal plane being equal to at least one third of the length of the periphery of said baffle in a horizontal plane, and said partitions being arranged to permit passage of gases beneath them between adjacent compartments.

5. A boiler comprising, in combination, upper and lower annular water drums, upright water tubes connecting said drums, a boiler casing inclosing said tubes and having an outlet, a cylindrical baffle constituting a substantially central combustion chamber, a superheater of the tubular type set within the annulus of the upper drum with its tubes extending into said cylindrical baffle, a plurality of connecting pipes between the receiving space of said superheater and the steam space of said upper drum, and substantially radial and vertical partitions subdividing the space between said baffle and the boiler casing into compartments each containing a portion of said water tubes, said cylindrical baffle having at its upper end peripheral openings communicating with certain of said compartments, the remaining compartments being in communication with said outlet, the combined length of said openings in a horizontal plane being equal to at least one third of the length of the periphery of said baffle in a horizontal plane, and said partitions being arranged to permit passage of gases beneath them between adjacent compartments.

6. A boiler comprising, in combination, upper and lower annular water drums, each of circular cross section with that side flattened which forms the interior of the annulus, upright water tubes connecting said drums, a boiler casing inclosing said tubes and having an outlet, a cylindrical baffle constituting a substantially central combustion chamber, and substantially radial and vertical partitions subdividing the space between said baffle and the boiler casing into compartments each containing a portion of said water tubes, said cylindrical baffle having at its upper end peripheral openings communicating with certain of said compartments, the remaining compartments being in communication with said outlet, the combined length of said openings in a horizontal plane being equal to at least one third of the length of the periphery of said baffle in a horizontal plane, and said partitions being arranged to permit passage of gases beneath them between adjacent compartments.

In testimony whereof I have signed my name to this specification.

WILFRED ROTHERY WOOD.