No. 676,162. Patented June 11, 1901.

D. R. TODD.

WATER TUBE STEAM BOILER.

(Application filed Dec. 4, 1900.)

(No Model.) 2 Sheets—Sheet 1.

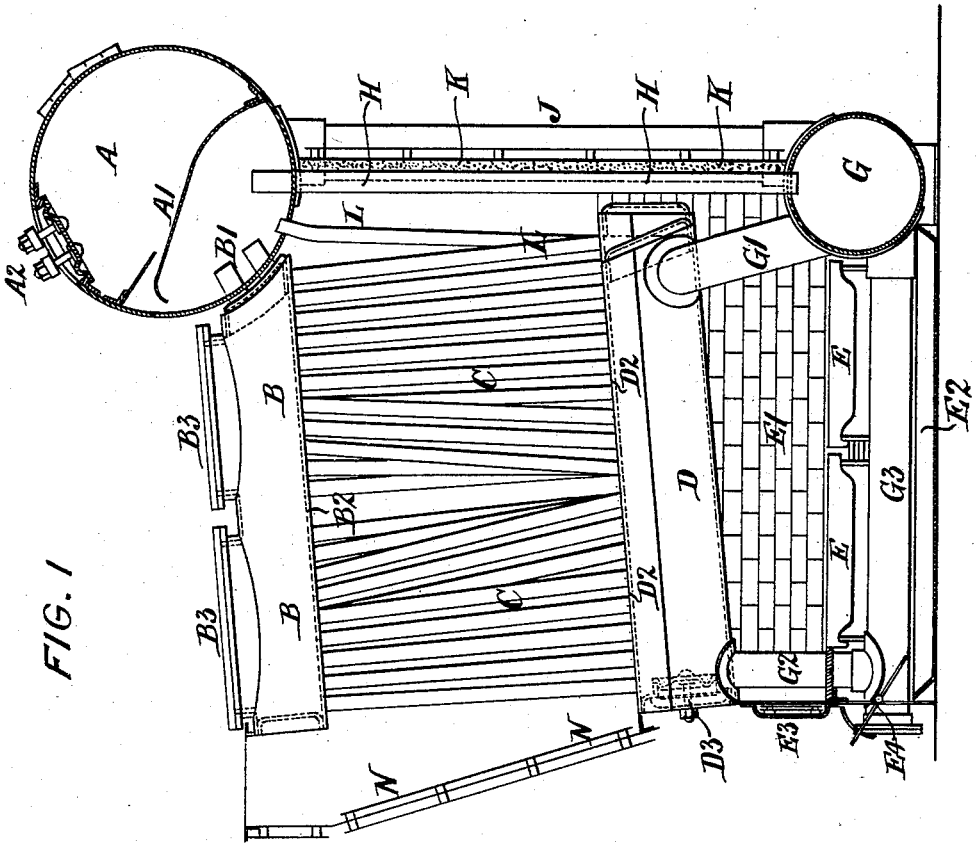

FIG. 1

WITNESSES:
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S. C. Connor

INVENTOR
DAVID ROSS TODD
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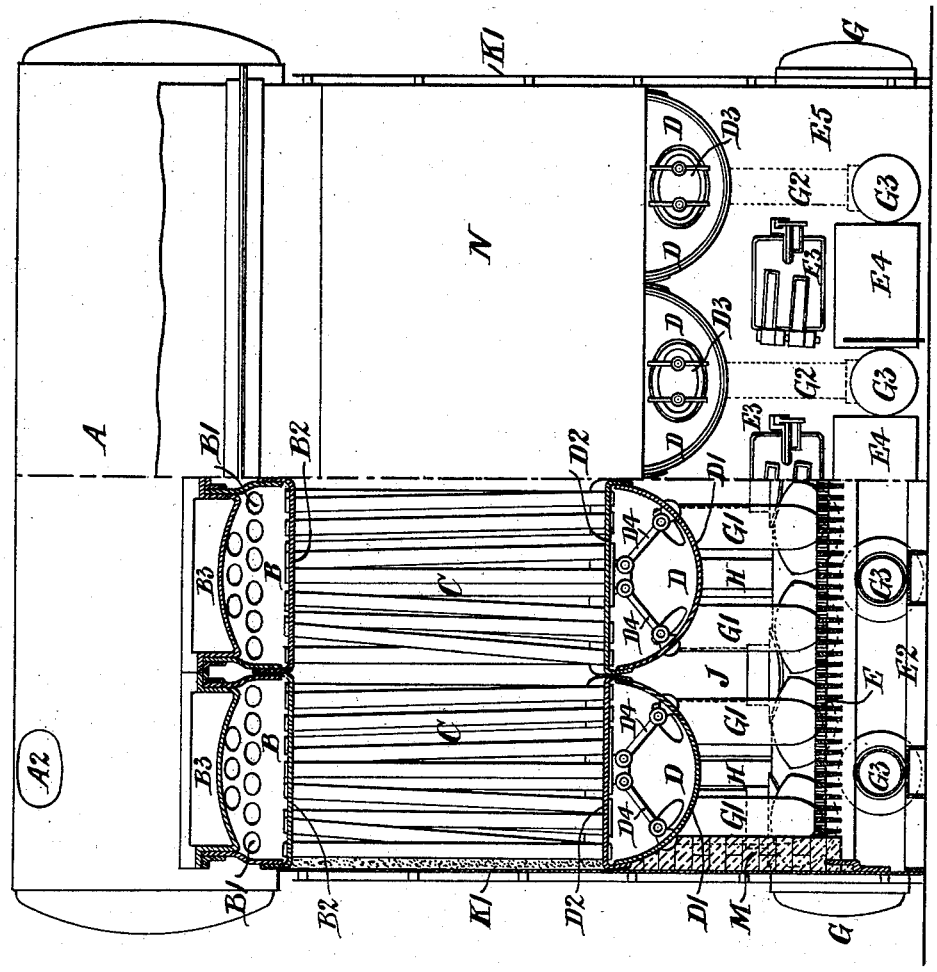
FIG. 2



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UNITED STATES PATENT OFFICE.

DAVID ROSS TODD, OF MANCHESTER, ENGLAND.

WATER-TUBE STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 676,162, dated June 11, 1901.

Application filed December 4, 1900. Serial No. 38,681. (No model.)

To all whom it may concern:

Be it known that I, DAVID ROSS TODD, a subject of the Queen of Great Britain and Ireland, and a resident of Manchester, in the county of Lancaster, England, (whose postal address is 39 and 40 Arcade Chambers, St. Mary's Gate, Manchester, England,) have invented certain Improvements in Water-Tube Steam-Boilers, (for which I have applied for British Patent No. 13,164, dated July 21, 1900,) of which the following is a specification.

This invention has for its object to provide a water-tube steam-boiler of simple form and construction and which is of high efficiency in every respect.

The improved boiler is formed with straight tubes, provision being made for their easy examination and repair, and the parts are arranged so that the water will circulate regularly and continuously in one direction.

In the accompanying drawings, Figure 1 is a longitudinal section, and Fig. 2 a front elevation, partly in section, of the improved water-tube steam-boiler.

According to the invention the boiler consists of a steam-drum A, which is set transversely and is provided with an internal dash-plate device A′ and a man-door A^2. The drum A is connected to top elements or headers B by means of nipples or short tubes B′, the tubes being fixed by expanding their ends into the drum and the headers, or, if preferred, connections may be employed which are fixed by rivets. The top headers B, of which there are four in the example of boiler shown, are set longitudinally, being inclined downward from back to front. The under sides of the headers B are flat, so as to form suitable tube-plates B^2 for the reception of the upper ends of the generating-tubes C, which are straight, the tube ends being expanded into the tube-plates in the usual manner. Man-doors B^3 are arranged on the headers B, so as to provide for the convenient examination and withdrawal of the tubes C. The lower elements or headers D are set similarly to the top headers B, each lower header being placed over the grate-bars E of the furnace E′, so as to be immediately under its corresponding top header. The lower headers D are formed with semicircular bottoms D′ and flat tops or tube-plates D^2, the lower ends of the generating-tubes C being expanded into the tube-plates. The lower headers D have their front ends fitted with man-doors D^3, and are internally stayed, preferably, by means of link-stays D^4, as shown, the upper headers B being similarly stayed, if desired. A cylindrical vessel or mud-drum G is arranged across the back of the furnace E, the top of the drum extending a little above the grate-bars E. The mud-drum G is connected to the back end of each lower header D by two short pipes or tubes G′, having flanged ends, which are riveted to the drum and header, or instead of employing two large pipes three or more smaller pipes or tubes may be employed, the tubes being preferably fixed by expanding their ends into the drum and header-plates. The front end of the lower headers D are connected by similar pipes or tubes G^2 to pipes G^3, which pass longitudinally through the ash-pit E^2 and are connected at the back to the mud-drum G. In some cases, however, these front and intermediat econnecting-pipes G^2 G^3 may be dispensed with. The steam-drum A communicates direct with the mud-drum G by a series of straight vertical uptake tubes H and downcomer-pipes J, the tubes conveniently serving as a wall for supporting the rear casing or lagging plates K of the boiler. The tubes H are fixed by expanding their ends into both drum-plates, and the pipes J are fixed by riveting their flanged ends to the drums A G, or the pipes may be fixed to saddle-pieces, which are fixed to the drums. Instead of employing a single row of large downcomer-pipes, as shown, two or more rows of smaller pipes may be employed, the rear casing or lagging plates being arranged against the pipes forming the back row. Between the vertical tubes H, connecting the steam and mud drums A G, and the back rows of generating-tubes C, connecting the top and bottom headers, a space L of considerable size is formed, which serves as a combustion-chamber, in which the unburned gases rising from the grate are consumed before passing among the generating-tubes. The furnace E′ is inclosed at the sides by brickwork M, and the generating-tubes C are inclosed at both sides of the boiler by casing or lagging plates K′, which are lined with

suitable non-conducting material. A smoke-box N is fixed to the front of the boiler, and fire and ash doors E^3 E^4 are suitably arranged on the furnace-fronts E^5.

The action of the boiler is as follows: The steam and heated water which is generated in the lower parts of the bottom elements or headers D rises through the vertical generating-tubes C, across the surfaces of which a current of hot gases is passing and escapes into the steam-drum A, the inclination given to the headers B D allowing all the steam generated in the headers and tubes to escape freely into the steam-drum. The vertical straight tubes H connecting the steam-drum A with the mud-drum G also serve as uptakes for the steam and water current. The descending current passes down from the steam-drum A to the mud-drum G, through the large downcomer-pipes J, the water supply to the bottom headers D being maintained by means of the short uptakes G' G^2 and intermediate pipes G^3, which connect the mud-drum with the bottom headers. The semicircular bottom headers D are placed in most advantageous position over the grate-bars E, and being thus exposed to the radiant heat of the furnace most valuable heating-surface is thereby provided immediately over the furnace, which adds greatly to the steaming capacity of the boiler. Wear and tear of the generating-tubes C is also considerably reduced by arranging them as shown, as they are not exposed as ordinarily to the radiant heat of the furnace. The flames and hot gases from the furnace traverse the whole length of the bottom elements or headers D and passing up between the short uptake-pipes G' at the back of the furnace become thoroughly mixed, entering afterward into the combustion-chamber L, where they are finally consumed, the combustion-chamber considerably reducing smoke troubles and increasing the efficiency of the boiler. The burned gases then return to the front end of the boiler, passing across the vertical generating-tubes C, and being thereafter discharged into the smoke-box or uptake N at the front of the boiler.

What I claim is—

1. In water-tube steam-boilers, in combination, top elements or headers connected by short pipes or tubes to a steam-drum arranged across the back ends of the headers, the headers being formed with flat bottom plates and man-doors and connected by vertical or nearly vertical generating-tubes to bottom elements or headers arranged over the furnace and formed with flat top plates and man-doors, the top and bottom headers being inclined downward from back to front the back and front ends of the bottom headers being connected by pipes or tubes to a mud-drum arranged across the back of the furnace and connected by vertical uptake and downcomer pipes or tubes to the steam-drum, a combustion space or chamber being formed between the generating-tubes and the tubes connecting the steam and mud drums, substantially as and for the purposes herein set forth.

2. In water-tube steam-boilers, in combination top elements or headers connected to a steam-drum, the headers being formed with flat bottom tube-plates and upper man-doors and connected by generating-tubes to bottom headers having flat top tube-plates, both top and bottom headers being inclined, the back ends of the bottom headers being connected by pipes or tubes to a mud-drum at the back of the furnace, the mud-drum being connected by uptake and downcomer pipes to the steam-drum, a combustion space or chamber being formed between the back rows of the generating-tubes and the tubes connecting the steam-drum with the mud-drum substantially as and for the purposes herein set forth.

3. In water-tube steam-boilers in combination, top elements or headers connected to a steam-drum the headers being inclined and formed with flat bottom tube-plates and man-doors, and connected by generating-tubes to inclined bottom headers formed with flat top tube-plates, the bottom headers being connected by pipes or tubes to a mud-drum arranged at the back of the furnace and connected by pipes or tubes to the steam-drum substantially as and for the purposes herein set forth.

4. In a water-tube steam-boiler, bottom elements or headers, arranged lengthwise of the grate of the furnace and above and over the grate, upper elements or headers parallel with the lower headers and generating-tubes connecting the upper and lower headers, in combination with a steam-drum communicating with the upper header and with the lower header, as and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

DAVID ROSS TODD.

Witnesses:

EUSTACE THOMAS,

JOHN WILLIAM THOMAS.