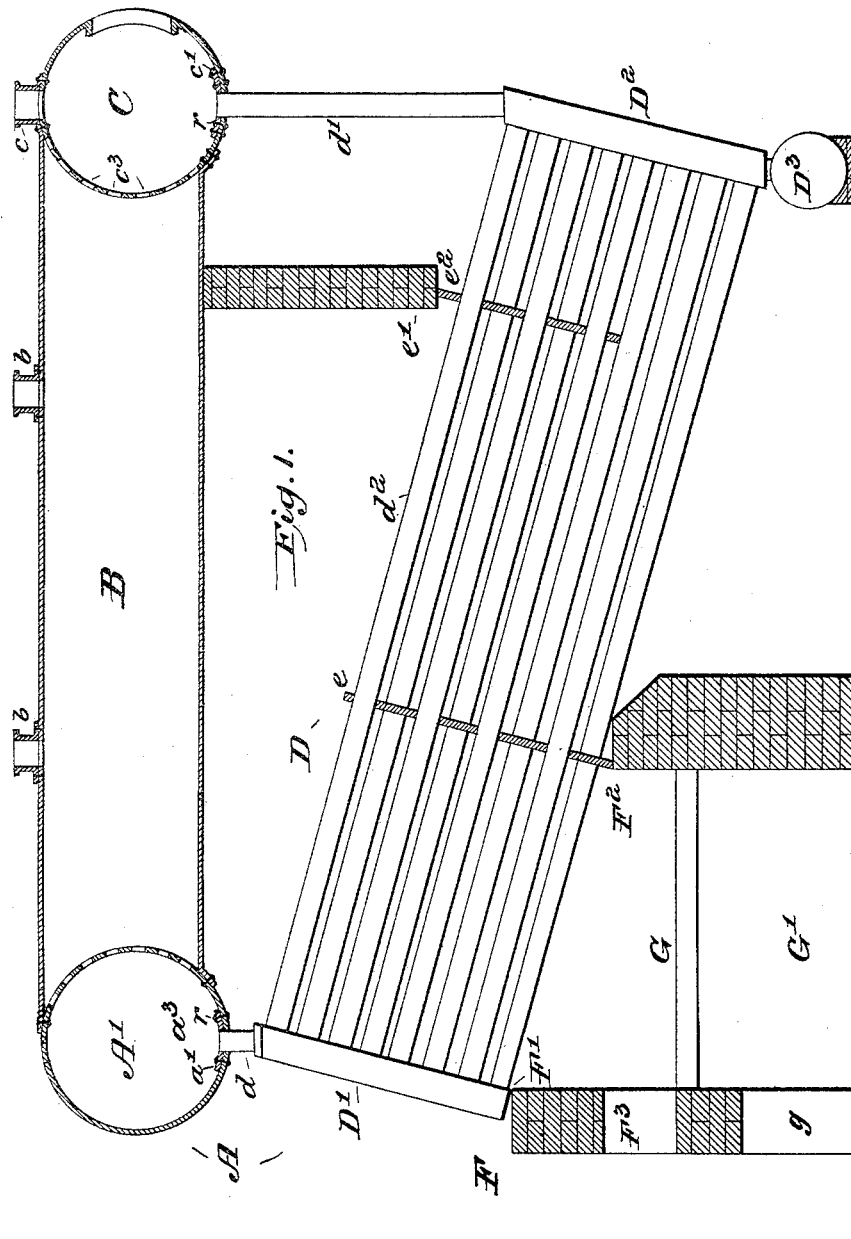


W. M. MACKAY.
STEAM BOILER.

No. 453,701.

Patented June 9, 1891.



Witnesses:

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William M. Mackay
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(No Model.)

3 Sheets—Sheet 2.

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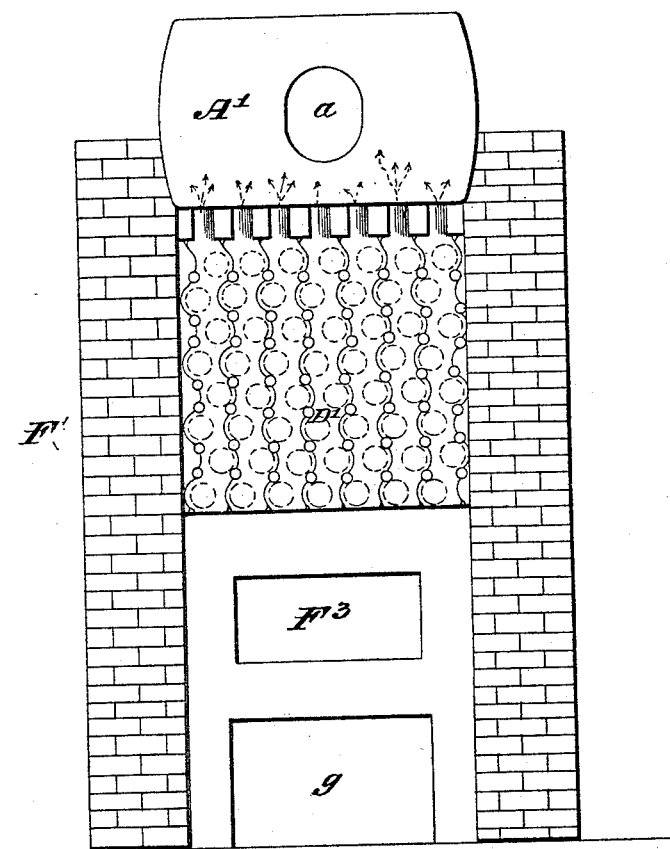


Fig. 2.

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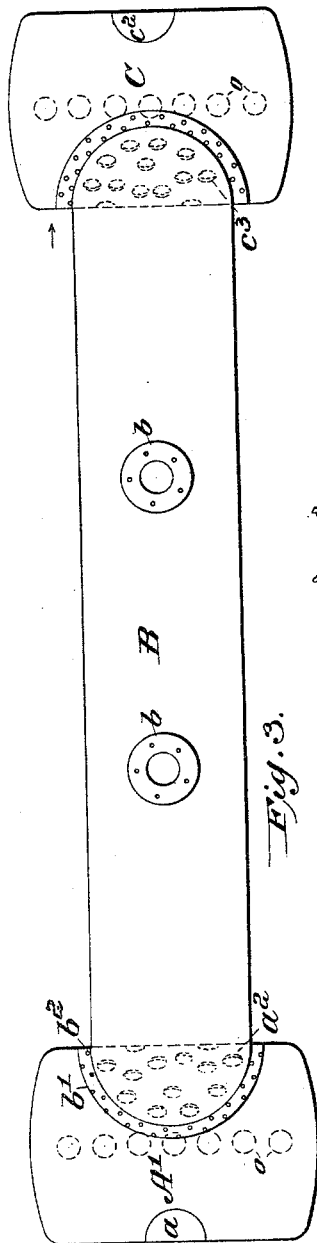


Fig. 3.

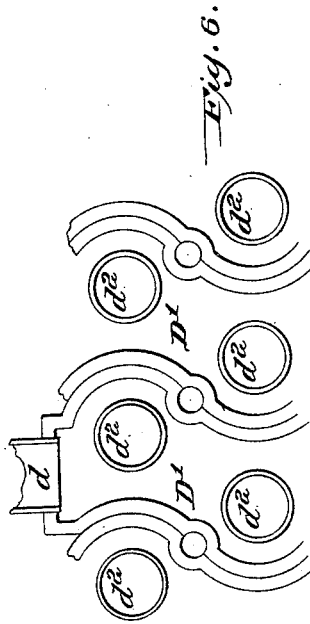


Fig. 6.

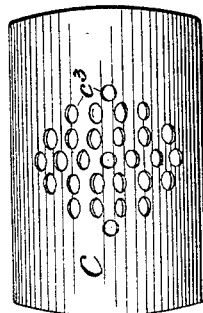


Fig. 4.

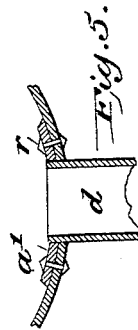


Fig. 5.

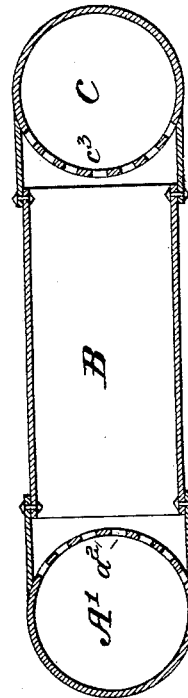


Fig. 7.

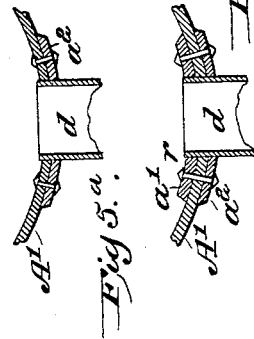


Fig. 5a.

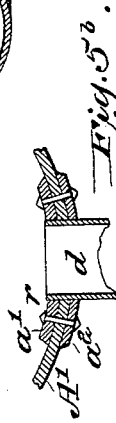


Fig. 5b.

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UNITED STATES PATENT OFFICE.

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STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 453,701, dated June 9, 1891.

Application filed January 6, 1891. Serial No. 376,900. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM M. MACKAY, a citizen of the United States, and a resident in the city of Newark, in the county of Essex, in the State of New Jersey, have invented a new and useful Steam-Boiler, of which the following is a correct description.

The invention has relation particularly to the class of boilers in which two vertically-arranged water-chambers are placed respectively at the front and rear portion of the furnace, the latter being in a lower plane than the former and are connected by a series of intermediate tubes and have thus come to be known as "water-tube boilers."

The object of the invention is to provide a water-tube boiler of simple construction of such strength that it shall be capable of withstanding a high degree of steam-pressure, in which the circulation shall be free and unobstructed without wave motion or "oscillation" of the water and without frequent abrupt changes in its direction, in which flat or plane interior surfaces shall be avoided, in which the use of intermediate connections or "headers" shall be unnecessary, and in which the heat derived from the fuel shall be effectively utilized.

With a view to the accomplishment of these objects the invention consists in the novel parts and combinations involved in the construction, which will now be particularly described, and which will be specifically indicated in the paragraphs which follow such description.

In the drawings which constitute a part of this specification, Figure 1 represents a vertical central longitudinal section of a boiler in which the essential features of my invention are embodied. Fig. 2 is a front elevation of the boiler as when "set" for use. Fig. 3 is a top plan of one of the compound drum-sections detached. Fig. 4 is a side elevation of one of the transverse or end sections of the compound drum as it appears before the parts are assembled and as looking in the direction of the arrow seen in Fig. 3. Fig. 5 is an enlarged detail vertical-section representing the means employed in attaching one of the re-enforce or compensating plates. Fig. 5^a represents a detail modification of the con-

struction shown in Fig. 5. Fig. 5^b represents a detail of a further modification of the construction seen in Fig. 5. Fig. 6 is an enlarged detail elevation of parts seen in Fig. 2. Fig. 7 represents in vertical longitudinal central section a modification of the construction of the intermediate section of the steam-drum.

My construction embraces front and rear transversely and horizontally arranged steam-drums A' and C, which extend across the boiler-chamber at a distance above the boiler-tubes, substantially as shown in the drawings. The drums A' and C are connected by means of an intermediate drum B, one or more, which is preferably of somewhat smaller diameter than the transverse drums and is arranged at a right angle therewith, as shown, the top of the three sections being in the same plane while at the bottom thereof the intermediate section is in a slightly higher plane than the two end sections. To effect the connection of the parts the intermediate section is at its ends curvilinearly recessed from top to bottom in an arc which corresponds to the curvature of the transverse sections and is provided with a flange, as b', for rivet connections b², as seen in Fig. 3. Instead of this connection the parts may be welded or otherwise suitably united in any approved manner.

In some cases it may be advantageous to utilize material by constructing the intermediate section from several plates, and in two or more sub-sections instead of in a single part. This may be readily accomplished, the cylindrical section being riveted to the short end sections in an ordinary manner, the whole when united being secured to the transversely-arranged drums in the manner already described.

That portion of the shell of the transverse drum-sections A' and C which is encircled and covered by the intermediate drum-section at their point of connection is provided with openings, as a² and c², which, while in number and capacity sufficient to permit a free circulation of the contents of the several sections, are not so numerous or so large or so near to each other as to impair the strength of the sections in which they are provided.

At suitable intervals pipe connections or nozzles, as b and c , are provided in those portions of the drum-sections from which steam is ordinarily taken. Also man-holes, as a and c^3 , are formed in the outer exterior portion of the two transverse drum-sections to permit access to the interior for "expanding" the ends of the vertical water-tubes or for other desired purposes.

In the lower portion of each of the transverse drum-sections openings o are provided in number corresponding to the number of the water-tubes, as d and d' , which rise from the vertical tube-headers D' and D^2 of the boiler D , and the communication being effected without the intervention of headers or of saddles at the base of the drum-sections, the passage of water and steam upward through the tubes d into the drum-section A' , and the passage of water downward from the section C into and through the tubes d' to the rear vertical header D^2 is free, continuous, and in uniform volume and unvarying velocity, no oscillation or to-and-fro movement of the water within the intermediate section being produced, and foaming and consequent dampening of the steam being therefore wholly avoided.

In order to compensate in the front and rear transverse sections for the loss of strength and rigidity consequent on the formation of the tube-openings o therein, each opening is provided with a compensating, re-enforce, or auxiliary plate, as a' or c' , such plate being of flattened annular form curved to conform to the interior curvature of the section, and provided with a central preferably upwardly-flaring opening, which substantially corresponds in area with the opening o in the body of the drum-section, and provided also with perforations, as p , to receive rivets r , by which the plate is firmly joined to the section, the described construction being represented most clearly in Fig. 5 of the drawings. In some instances it may be desirable to provide this auxiliary or compensating plate upon the exterior instead of upon the interior of the shell of the steam-drum, as in Fig. 5^a, in which such exterior re-enforce or auxiliary plate is designated by the letter a^2 . A still stronger construction is represented in Fig. 5^b, in which both an interior and an exterior plate are employed.

The "front" F of the boiler and furnace A may be of any approved construction, being provided with seat or bearing F' for the front tube-header D' , fuel-supply opening F^3 coincident with the fuel-space above the grate-bars G , and with clearing-opening g , which affords access to the ash-pit G' .

From the upper extremity of the bridge-wall F^2 a diaphragm e , of a width corresponding to the vertical extent of the sections of water-tubes and having perforations corresponding to the number and diameter of such tubes, extends upwardly, as shown. Within an arched support e' , near the rear extremity

of the boiler, is arranged a similarly-perforated diaphragm e^2 , which preferably extends downwardly from the support to a point substantially in a plane with the upper extremity of the bridge-wall, and which acts, in conjunction with the diaphragm or deflecting-plate e , to cause the volatile products of combustion to pass in vertical planes substantially thrice across the tube-sections before being permitted in their passage to the uptake to envelop the series of tubes d' .

It will be understood that the inclined water-tubes d^2 are in themselves of ordinary construction; that their connection with the headers D' and D^2 is effected by ordinary means, and that the construction and arrangement of the sediment-chamber D^3 do not differ materially from those which are commonly employed.

The transverse drum-sections may be of such length as to adapt them to receive such number of the water-tube sections as are deemed necessary to constitute a boiler of the required power, and the intermediate drum-section will be of a longitudinal extent proportioned to the length of the water-tubes employed in the boiler.

It will be observed that under the described construction a settling and separating space or chamber, as a^3 , is produced at the point where the volume of steam and water is discharged from the boiler into the front section of the compound steam-drum.

The communication-openings between the front transverse drum-section and the intermediate drum-section and between the intermediate drum-section and the rear transverse drum-section are in their aggregate area greater than the total area of the connections from and to the water-tube sections, and this preponderance of passage-way prevents friction and foaming and enables dry steam to be drawn from the drum-sections without necessity for the employment of a separator. This construction, moreover, permits a free circulation of water through the water-space of the drum-sections, from the fact that it enters the drum from the water-tube sections into a chamber of large capacity, and passing thence through the intermediate drum-section enters the rear drum-section, the receiving-openings c^3 of which are of greater superficial area than the area of the outlet-tubes, into and through which without appreciable friction the currents pass to repeat the circuit.

The space between the upper extremity of the steam-drum and the lower extremity of the boiler-headers D' and D^2 being wholly free from obstruction from end to end, it is easily practicable to reach every portion of the interior of the headers and of the tubes d' and d^2 and to free them from injurious accumulations.

In practice the compound steam-drum will in an ordinary manner be suitably suspended from transverse girders, which at their ends

will be sustained upon vertical columns, which at their bases will rest upon a suitable solid foundation.

The invention having been thus described, what is claimed is—

1. In a steam-boiler, a compound steam-drum which embraces two transversely-placed drum-sections, the coincident inner vertically-curved faces of which are provided with perforations for the passage of steam and water, and an intermediate longitudinally-arranged connecting drum-section, which at each end is recessed or cut away in an arc which conforms to the curvature of and is rigidly secured to the body of the transverse drum-sections.

2. In a steam-boiler, a compound steam-drum which consists of two transversely-placed drum-sections, each of which has numerous perforations in its inner wall, and an intermediate longitudinally-arranged connecting drum-section, which is open at its ends and the body or shell of which is conformed to the outer surface of the transverse drum-sections and is securely attached thereto, substantially as and for the purposes set forth.

3. In a steam-boiler, a compound steam-drum which consists of two transversely-arranged interiorly-perforated drum-sections, and an intermediate longitudinally-extending connecting drum-section, which directly and closely engages the transversely-arranged perforated drum-sections, substantially as shown and described.

4. In a steam-boiler, the described horizontally-arranged three-chambered steam-drum, consisting, essentially, of the front and rear transversely-arranged drum-sections, which are provided in their coincident sides with openings for the passage of steam and water, and the intermediate connecting drum-section, the walls of which are at their ends recessed or cut away in a plane which conforms to the configuration of the transverse drum-sections, the three parts being united by suitable close joints, substantially as specified.

5. In a steam-boiler, a compound or three-part steam-drum which consists of front and rear drum-sections, which are arranged trans-

versely of the furnace and the boiler and provided with top, bottom, and side openings, as set forth, and the intermediate connecting drum-section extending longitudinally of the furnace, closely joined to the transverse drum-sections, and connecting therewith for operation through a series of openings formed in the inner side of the shell or body thereof, substantially as described and shown.

6. In a steam-boiler, a steam-drum which consists of conjoined transversely and longitudinally arranged sections, a tubular steam-boiler, and connecting-tubes which extend from the front and rear headers of the boiler to the lower extremity of the steam-drum, the spaces between the upper extremity of such steam-drum and the lower extremity of such front and rear headers being free and unobstructed from top to bottom thereof, in combination, for the purposes set forth.

7. In a steam-boiler, a three-chambered horizontally-arranged steam-drum, a tubular steam-boiler, and connecting-tubes which extend, respectively, from the front and from the rear headers of the boiler directly upward to and terminate at the lower extremity of the steam-drum, the space between the bottom of the headers and the top of the steam-drum being continuous and wholly unobstructed, and all the parts being combined for operation substantially as described.

8. In a steam-boiler, the described compound steam-drum, the inclined tubular steam-boiler having vertically-arranged end headers, and the vertically-arranged connecting-tubes, as *d* and *d'*, extending directly from such end headers to the bottom openings of the steam-drum, substantially as specified.

9. In a steam-boiler, a compound steam-drum which consists of two transversely-arranged perforated drum-sections, and an intermediate longitudinally-extending connecting drum-section, which is composed of two or more parts and which directly and closely engages the transversely-arranged drum-sections, substantially as shown and described.

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FRANK J. PAGE.