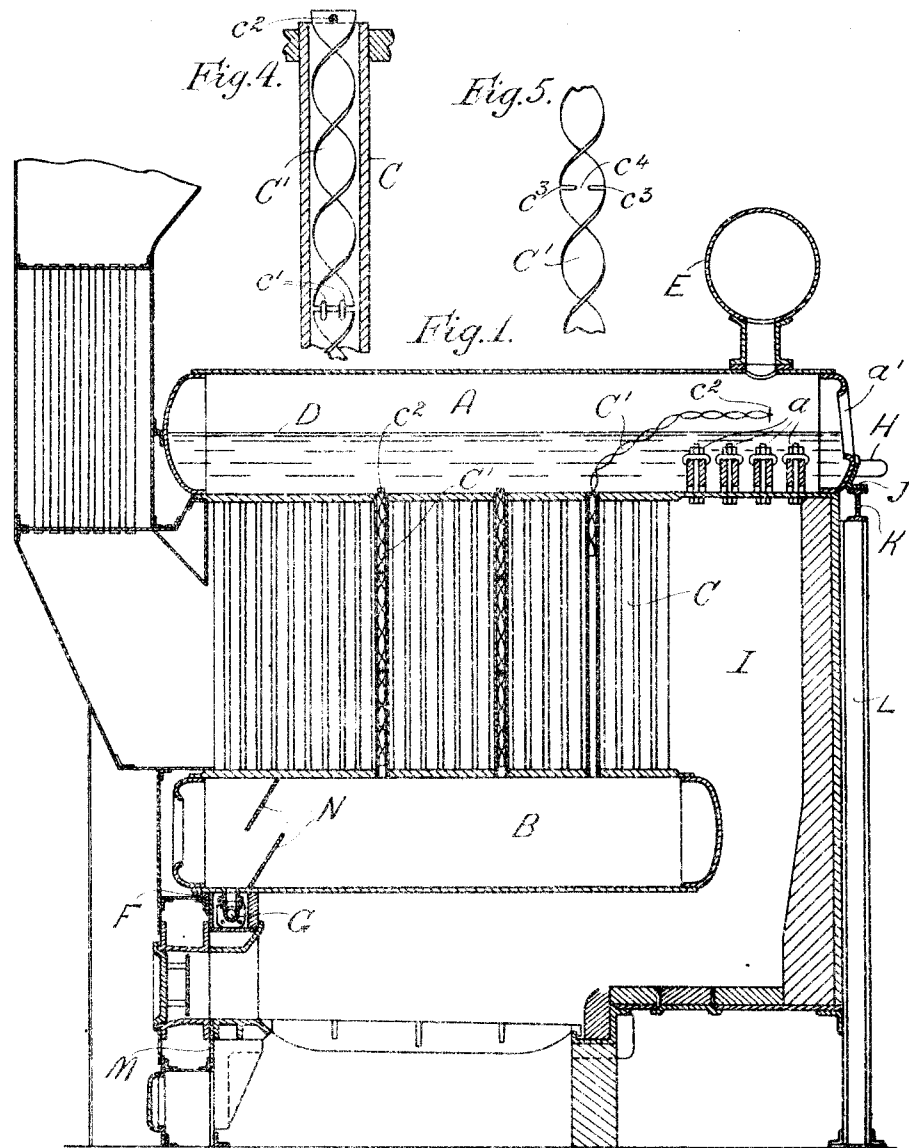


J. HOWDEN.
 WATER TUBE STEAM BOILER.
 APPLICATION FILED NOV. 27, 1909.

1,066,111.

Patented July 1, 1913.
 2 SHEETS—SHEET 1.



WITNESSES:
W. H. Derrigan
John H. Howden

INVENTOR
 JAMES HOWDEN,
 by *Frank DeLune*
 Attorney

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Fig. 2.

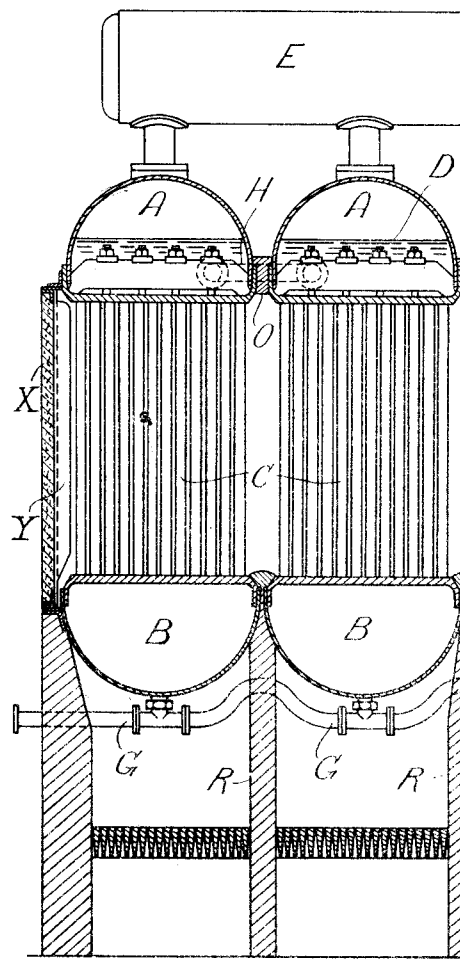
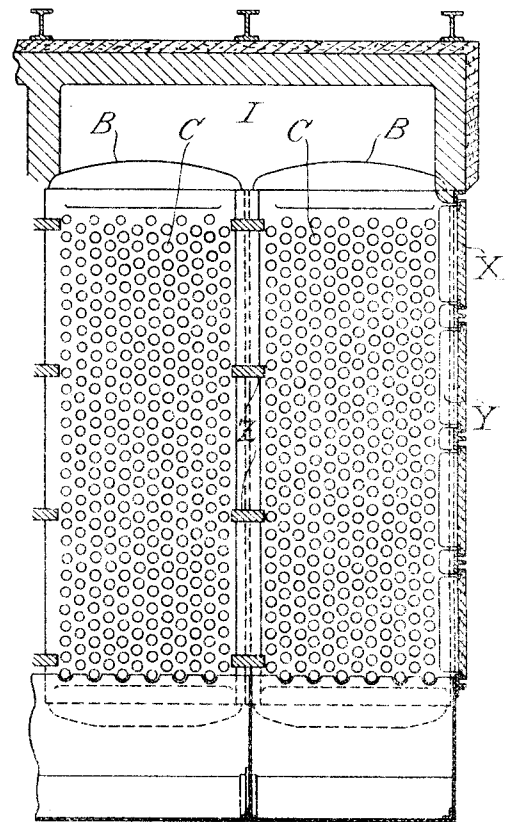


Fig. 3.



WITNESSES

W. H. Derrigan,
John N. Ho Sing

INVENTOR,
 JAMES HOWDEN,
 by *Wm. D. Russell*
 Attorney.

UNITED STATES PATENT OFFICE.

JAMES HOWDEN, OF GLASGOW, SCOTLAND.

WATER-TUBE STEAM-BOILER.

1,066,111.

Specification of Letters Patent.

Patented July 1, 1913.

Application filed November 27, 1909. Serial No. 530,129.

To all whom it may concern:

Be it known that I, JAMES HOWDEN, a subject of the King of the United Kingdom of Great Britain and Ireland, and residing at Glasgow, Scotland, have invented a certain new and useful Improvement in Water-Tube Steam-Boilers, of which the following is a specification.

This invention relates to an improved water tube steam boiler of the kind comprising top drums and bottom drums of semi-circular or approximately semi-circular cross-section connected by upright water tubes.

In the accompanying drawings Figure 1 is a longitudinal section of a boiler constructed in accordance with the invention. Fig. 2 is a half cross section and Fig. 3 is a half sectional plan of the boiler. Figs. 4 and 5 show detail views of alternative forms of circulating devices located within the vertical tubes.

As shown, the boiler comprises top drums A and bottom drums B semi-circular or approximately so in cross-section, with manhole doors at one end of each drum, through which access is obtained to the inside of the drums though the upper drums may when more convenient on account of the position of surroundings have a manhole on the top for access.

C C are vertical water tubes connecting the two drums, through which the steam evaporated in the lower drum and in the tubes themselves passes into the upper drum. The tubes are of equal length, straight, without bends, and thus-interchangeable.

The water line D of the boiler is in the top drums, the upper part of these drums being steam space. In boilers having several elements or principal parts, these steam spaces in the top drums are connected by preference to a common steam receiver E, from which the steam to be used is taken. The bottom drums B placed immediately above the furnaces are connected to each other by a common feed water pipe G. This pipe can also be used as a common blow-off by means of separate valves for each operation, the feed valve being closed when the blow-off valve is opened, and vice versa. The water in the upper drums also has a common connection by means of short pipes H preferably at the back of the drums. The top drums A are extended backward over the combustion chamber I, thus forming

part of the effective heating surface of the boiler, said top drums being provided with bridge stays a.

The back ends of the drums have projecting angle pieces J or the like, with vertical flanges fixed to the ends of the drums, the lower flange resting on a common horizontal iron or steel beam K resting on and fixed to iron columns or standards L preferably resting and fixed on a common iron foundation plate. The horizontal upper beam K and those vertical standards are preferably of H-section.

The lower drums B are supported on the front end by a strong vertical plate M stiffened by angle bars F on which these several drums rest. This plate is carried down to a strong angle at the bottom across the whole front of the boiler. The plate M has suitable openings for the furnace and ashpit doors. Cast-iron air boxes are placed inside the furnace door openings, carrying a protection of brickwork above for the common feed and blow-off pipe, the front carrying plate being also protected from the action of the fire.

Inside the lower drums at the front are diaphragm plates N which cause the front tubes to act as "downcomers," and also insure the collection of any sediment, so that such sediment does not reach the bottom of the drum above the fire but is deposited in the front ends of the drums and blown out through the blow-off valve.

In this form of boiler a large proportion of the evaporation is effected by the lower drums, so that much less is required to be done by the tubes than in the usual forms of water tube boilers, where all or nearly all the evaporation takes place in the tubes themselves greatly lessening their durability and efficiency by their being subject to the direct heat of the furnace. This feature reduces greatly the injurious action of the heat of the flame on the tubes and consequently renders them much more durable, and when the boiler is properly worked, the tubes last for many years without requiring renewal.

The method of removing and replacing the tubes with the boiler in position is as follows: The tubes are cut in the usual manner from the interior of the drums by a tube cutter, and a ferrule filling up an enlarged hole in one of the drums, say the lower one, is also cut out at the same time. Should the

tube to be removed be in the interior of the stack of tubes; the tubes nearest to the outside in the row are also removed in a like manner and drawn up through the space O or taken out at the side doors if they are in the side elements and nearer to these doors. By this method of removing and replacing the tubes, all the costly and objectionable doors on the top of the drums A which are used in other forms of water tube boilers of this kind may be entirely dispensed with.

On the outer sides of the boiler it is preferred to have doors X which can be opened and shut easily for examining the tubes, such doors comprising sheet iron cases containing a non-conducting substance and being also protected by linings Y of non-conducting material.

The passage of the hot gases through the spaces between the several elements is impeded by means of partitions Z as shown in Fig. 3. The boiler is also arranged so that the tubes can be cleaned and scraped by steel scrapers put in edgewise from the front and turned on the flat and then passed up and down the outside surfaces of the tubes. These scrapers can be actuated from the front smoke-box and combustion chamber when the boiler is cold. The boiler comprises four elements or principal parts but can be made of more elements if required, with a common furnace, or it may be made with a separate furnace for each element, with division walls R between the furnaces, as shown in the drawings.

As shown, the water tubes C are fitted with spiral circulating strips C', which, as regards their contour may be of the usual form, each of said strips being composed of two or more lengths or sections jointed together as by wire lacing c' passed through small holes punched in the end parts of the

sections so that the sections may be folded on each other or so inclined in relation to each other that the spiral circulating strip may be passed into the top drum A of the boiler through the usual man-hole opening a' and unfolded as it is entered into any one of the water tubes C as indicated at Fig. 1 so as to form a continuous spiral.

The strip C' when fitted in the water tube C may be suspended by a cross pin c² or in any other usual way.

As shown in Fig. 5, the sections or lengths of the strip C' are formed by cutting cross slits c² in a long strip so as to leave a connecting web portion c⁴ which, while retaining the strip in a single piece, permits the sections to be readily folded on or inclined in relation to each other.

Having now described my invention what I claim and desire to secure by Letters Patent of the United States is:—

In a water tube steam boiler, in combination, a top drum and a bottom drum, the said bottom drum overlying the furnace grate, the front part of said bottom drum being protected from the furnace gases, upright rows of straight water tubes connecting the top and bottom drums, the front rows of tubes serving as downcomers, and rearwardly inclined baffle plates disposed in the bottom drum in the vicinity of the downcomers, said baffle plates being adapted to prevent passage of steam from the rear part of the drum into the front part of the drum, and so to the downcomers.

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

JAMES HOWDEN.

Witnesses:

JNO. ARMSTRONG, Sr.,
JOHN McCLEARY, Jr.