

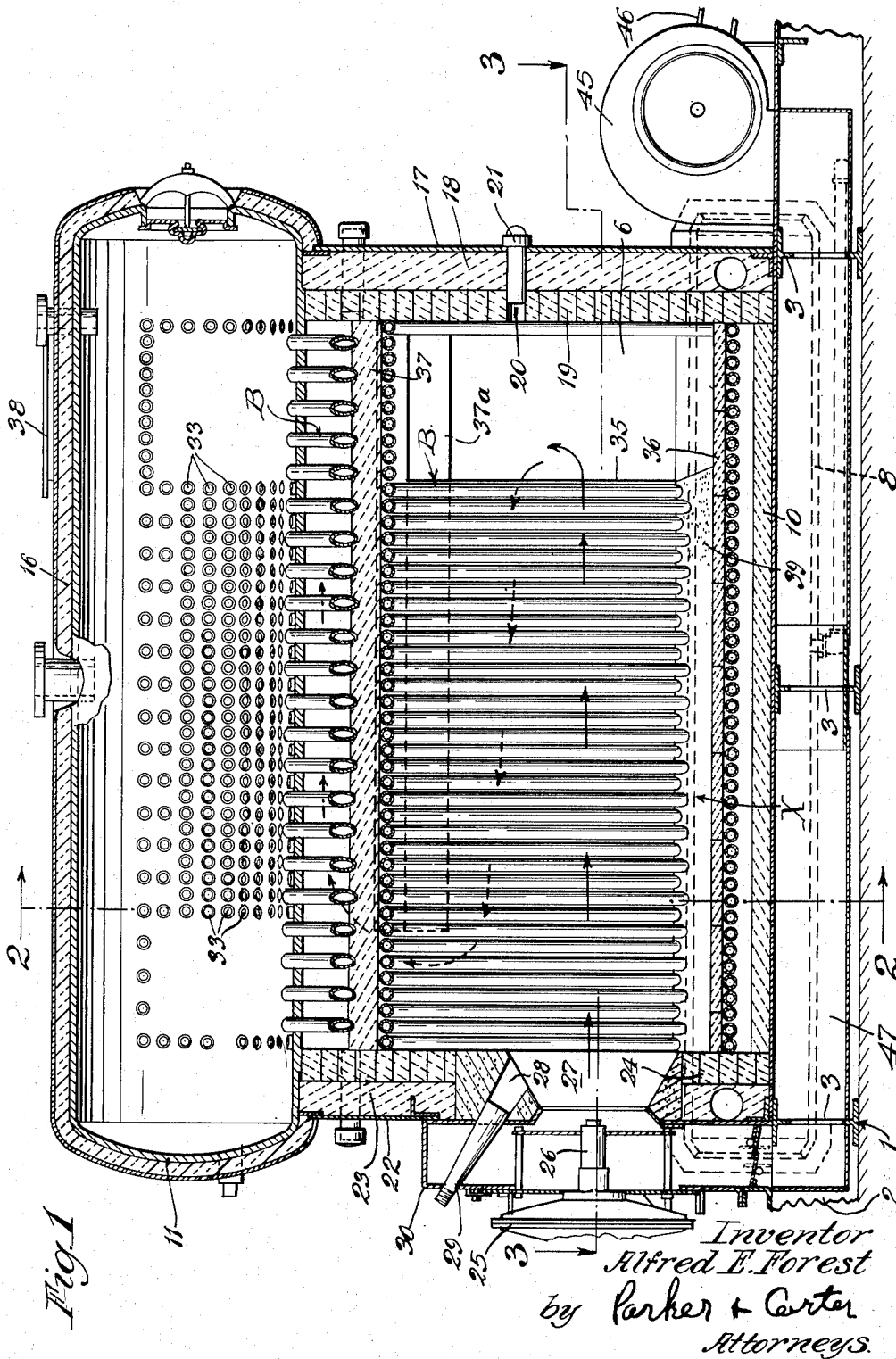
March 3, 1953

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WATER TUBE BOILER

2,630,103

Filed Aug. 21, 1948

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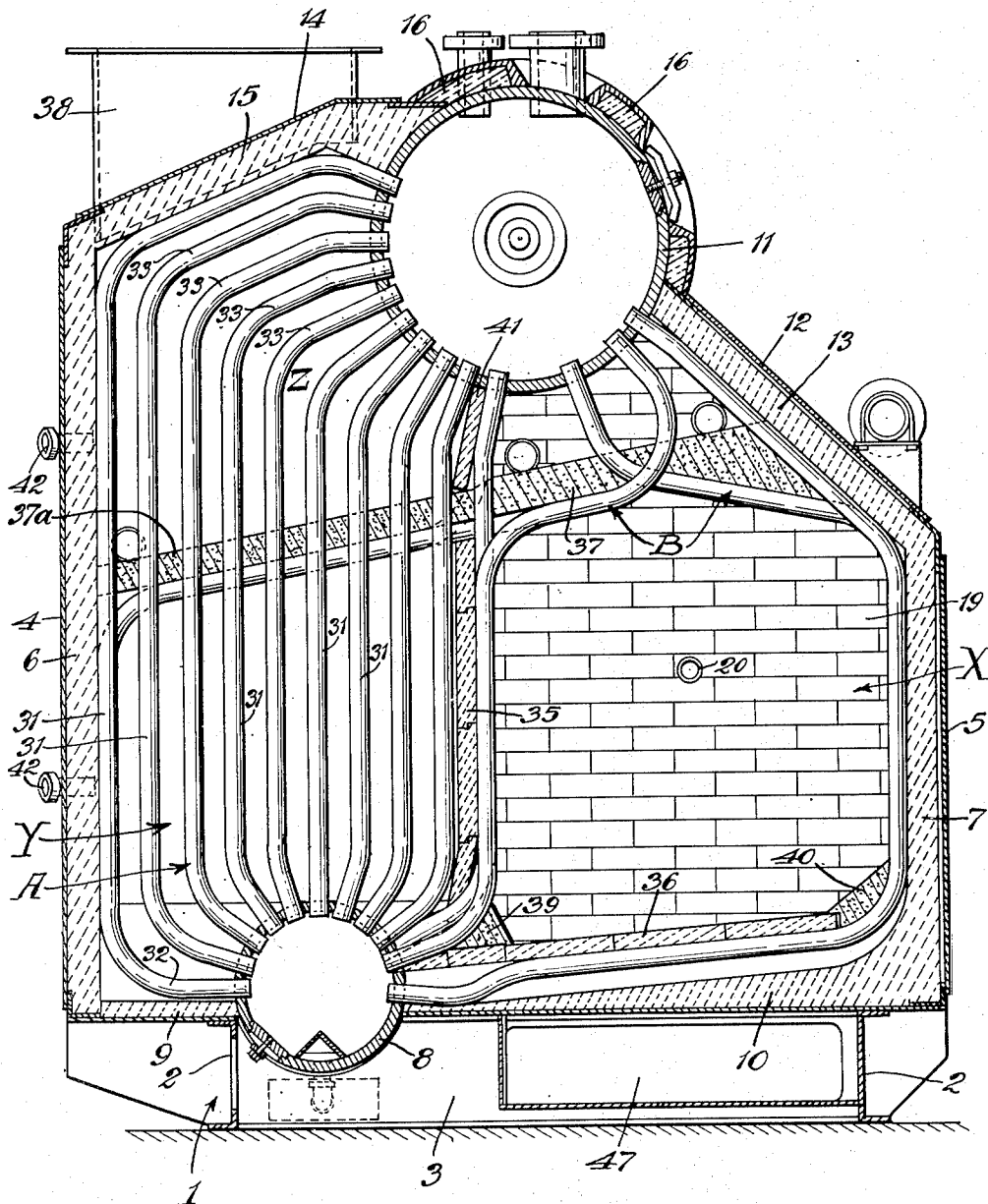
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*Fig. 2*



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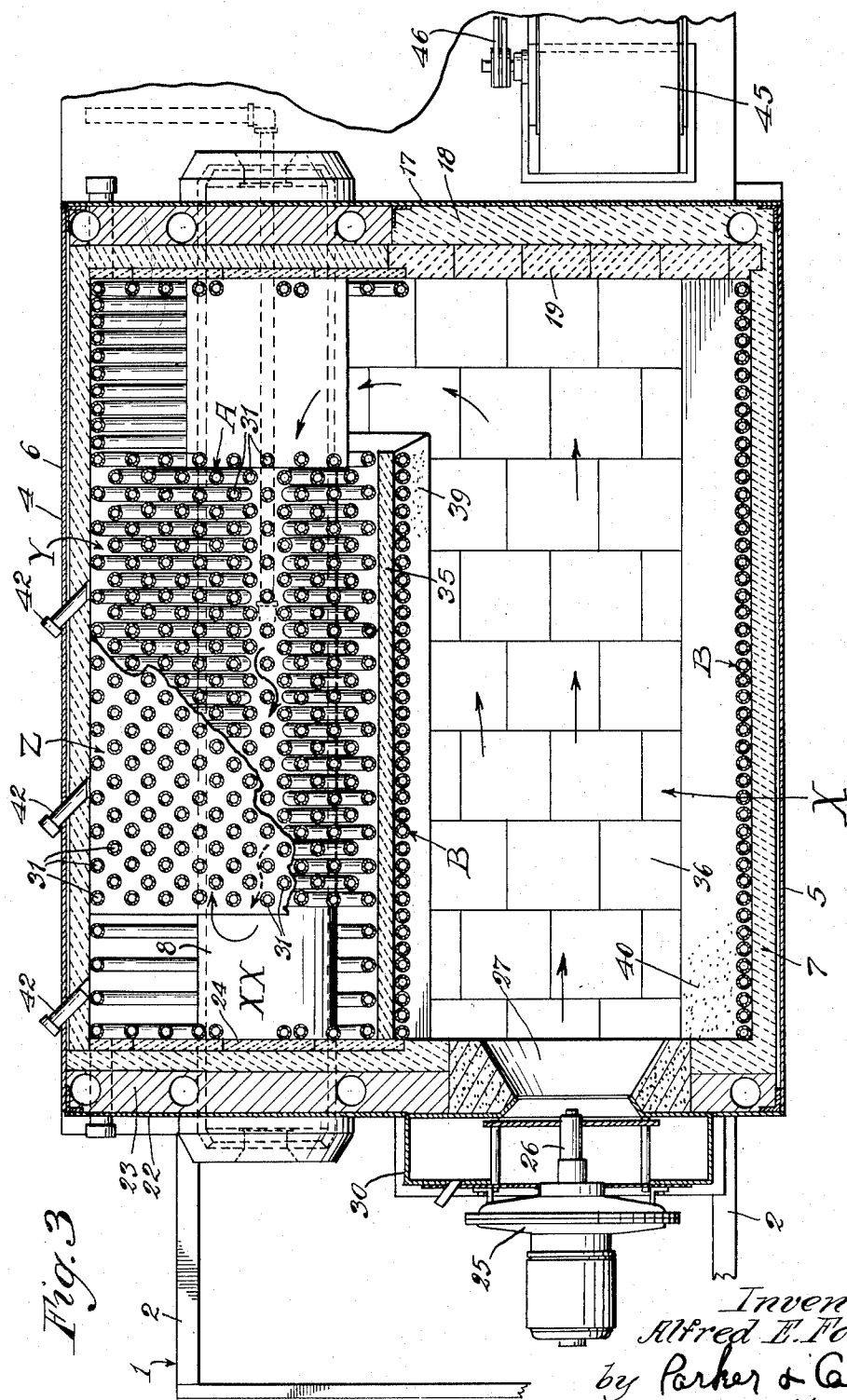
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## UNITED STATES PATENT OFFICE

2,630,103

## WATER TUBE BOILER

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8 Claims. (Cl. 122-138)

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My invention relates to a boiler, and has for one purpose to provide a boiler of the water tube type.

Another purpose is to provide a water tube boiler having an improved arrangement of steam generating tubes.

Another purpose is to provide a boiler having an improved arrangement of heat exchange passages by which the heated products of combustion are put in heat exchange relation with the steam generating tubes.

Another purpose is to provide a simple and efficient furnace wall structure.

Another purpose is to provide a furnace particularly adapted for use with burners in which a horizontal flame is projected along a longitudinally extending combustion chamber.

Other purposes will appear from time to time in the course of the specification and claims.

I illustrate the invention more or less diagrammatically in the accompanying drawings wherein:

Figure 1 is a vertical longitudinal section;

Figure 2 is a vertical transverse section on the line 2-2 of Figure 1; and

Figure 3 is a horizontal section on the line 3-3 of Figure 1.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to the drawings, I generally indicate a bottom supporting structure which may include longitudinally extending channels 2 and suitable cross beams or supports 3. It will be understood that the details of the supporting structure may be widely varied. Extending upwardly from the base thus formed are side walls which I indicate as including outer shell members 4, 5, within which are any suitable liners 6, 7 of any suitable heat resistant material or refractory.

Supported on or extending longitudinally along the base 1 is the lower drum 8. Extending from the drum 8 to the side liner 6 is a bottom liner 9. Extending from the drum 8 to the side liner 7 is a bottom liner 10 which underlies the below described combustion space. 11 is an upper or steam drum. It is connected to the upper end of the side wall members 5, 7 by the outer shell 12 and the liner 13, which are inclined, as shown in Figure 2, and which partially overlie the below described combustion space. It will be noted that, in a broad sense, the drums 8 and 11 constitute part of the outer wall of the general boiler structure. The drum 11 is connected to the side wall members 4, 6

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by the outer shell 14 and the liner 15. Any suitable outer jacket or insulation 16 may surround the otherwise exposed part of the steam drum 11.

As will be clear from Figure 1, I employ a rear end wall including the outer shell 17, the liner 18, and the inner refractory liner 19 which closes the end of the combustion space. 20 is an inspection aperture suitably closed by the removable plug 21. The front end of the boiler is closed by the front end wall having the outer shell 22, the liner 23, and the refractory 24. 25 generally indicates a liquid fuel burner, the details of which do not, of themselves, form part of the present invention. It may include a nozzle element 26, from which flame is directed through the flared aperture 27. 28 is an inspection aperture from which extends the outwardly tapered inspection tube 29. 30 indicates any suitable outer housing which surrounds the nozzle 26 and the inlet space to the combustion chamber.

The two drums are shown as connected by a plurality of tubes which are arranged in two groups, generally identified as A and B. The tubes A are arranged in a bank, most of which have intermediate vertical lengths 31. These vertical lengths are connected by angles or bends 32 with the lower or mud drum 8, connected by angles or bends 33 with the upper or steam drum 11. A generally vertical, longitudinally extending, intermediate partition 35 extends upwardly from the false bottom 36 of the combustion space, generally indicated as X. An intermediate, transversely extending partition 37 has a right-hand portion, referring to the position of the parts as shown in Figure 2, which closes the top of the combustion space X, and the left-hand portion 37a which separates the steam generating space into a lower passage Y and an upper passage Z, the two passages being connected at their front ends by a space XX, which is substantially free from the tubes A. It will be understood, as shown in Figure 3, that the combustion space X extends to the rear wall element 19, the products of combustion moving in the direction of the arrows of Figure 3. They then pass to the left, referring to Figure 3, in the direction of the arrows, passing around the rear end of the vertical longitudinal partition 35. The gases then pass forwardly along the lower passage Y and about the tubes A. At the front of the boiler the gases move upwardly through the passage XX and return rearwardly along the upper passage Z, still in communication with the upper portions of

the tubes A. The gases may then escape from any suitable flue outlet, more or less diagrammatically shown at 38.

The tubes B are so arranged, as will be clear from Figures 2 and 3, to surround the combustion space X. Some of the tubes B pass below the false bottom 36, which may consist of readily replaceable bricks or slabs of suitable refractory material. Any suitable bodies of refractory cement may be employed where needed, as at 39 and 40. The upper passage Z may be completed by an intermediate partition 41 extending between the wall 37 and the lower portion of the upper or steam drum 11. Access passages or ducts 42 may be provided for the passages Y and Z, as shown in Figures 2 and 3.

Any suitable forced draft system may be employed. I illustrate, for example, a blower housing 45 of the snail shell type, which may carry any suitable fan driven by the belt 46, from any suitable motor not herein shown. The output of the fan may flow through any suitable passage 47 formed in or extending through the base, and upwardly into the above described burner-surrounding or delivery housing 30.

The interior details of the drums do not form part of the present invention and are not herein described. The present invention is directed primarily to the arrangement of the tubes in relation to the path or passages along which the heated products of combustion pass.

It will be realized that, whereas, I have described and illustrated a practical and operative device, nevertheless many changes may be made in the size, shape, number and disposition of parts without departing from the spirit of my invention. I therefore wish my description and drawings to be taken as in a broad sense illustrative or diagrammatic, rather than as limiting me to my precise showing.

The use and operation of the invention are as follows:

I illustrate a simple, compact and efficient structure in which an upper or steam drum and a lower or mud drum are connected to water tubes which are divided into two bodies, one of which surrounds a longitudinally extending combustion space and the other of which extends through two parallel, horizontally longitudinal heat exchange passages or chambers. It will be noted that the upper drum is substantially offset from the lower. One advantage of this arrangement is that adequate space is given for the upper passage Z, which is open from the top of the boiler structure down to the intermediate partition 37a. The combustion chamber X is surrounded by oppositely bent groups of the tubes B. These tubes are surrounded and backed by liners 7, 10, 35 of suitable material. However, I find it advantageous to overlay the bottom of the combustion space by the readily replaceable false bottom or liner 36 which actually overlies and covers that part of the tubes B which extend directly beneath the bottom of the combustion chamber X. I may also flex some of the tubes A across the bottom of the transverse partition 37a, as shown in Figure 1.

I claim:

1. In a boiler structure, walls and intermediate partitions defining a generally horizontally extending combustion chamber and two heat exchange passages lying generally one above the other, adjacent and generally parallel with the combustion chamber, the structure including a transversely extending partition intermediate

the top and the bottom of the boiler structure, one part of said partition separating said heat exchange passages, and another part of said partition forming a top liner wall for the combustion chamber, the combustion chamber having an end formed and adapted to admit a generally horizontally directed burner flame, the two heat exchange passages being connected to each other at opposite ends of the boiler structure, one of said passages being connected at one end to the inner end of the combustion chamber, and a flue outlet for the passage which is not connected to the combustion chamber, the flue outlet being located at the end of the passage opposite to its connection with the opposite passage, an upper and a lower drum, and tubes connecting said drums, some of said tubes extending generally vertically through said heat exchange passages and others surrounding said combustion chamber.

2. In a boiler structure, walls and intermediate partitions defining a generally horizontally extending combustion chamber and two heat exchange passages lying generally one above the other, adjacent and generally parallel with the combustion chamber, the combustion chamber having an end formed and adapted to admit a generally horizontally directed burner flame, the two heat exchange passages being connected to each other at opposite ends of the boiler structure, one of said passages being connected at one end to the inner end of the combustion chamber, a flue outlet for the passage which is not connected to the combustion chamber, the flue outlet being located at the end of the passage opposite to its connection with the opposite passage, an upper and a lower drum, and tubes connecting said drums, some of said tubes extending generally vertically through said heat exchange passages and others surrounding said combustion chamber, and a removable false bottom overlying the tube lengths which extend across the bottom portion of the combustion chamber.

3. The structure of claim 2 characterized in that the removable false bottom overlying the tube lengths which extend across the bottom portion of the combustion chamber is formed of heat insulating material and has a generally plane top surface.

4. In a boiler structure, walls and intermediate partitions defining a generally horizontally extending combustion chamber and two heat exchange passages lying generally one above the other, adjacent and generally parallel with the combustion chamber, the combustion chamber having an end formed and adapted to admit a generally horizontally directed burner flame, the two heat exchange passages being connected to each other at opposite ends of the boiler structure, one of said passages being connected at one end to the inner end of the combustion chamber, and a flue outlet for the passage which is not connected to the combustion chamber, the flue outlet being located at the end of the passage opposite to its connection with the opposite passage, an upper and a lower drum, and tubes connecting said drums, some of said tubes extending generally vertically through said heat exchange passages and others surrounding said combustion chamber, the combustion chamber being substantially equal in transverse section to each of the heat exchange passages in transverse cross section thereof.

5. In a boiler structure, walls and intermediate partitions defining a generally horizontally disposed combustion chamber, at least two heat ex-

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change passages disposed one above the other with relation to each other, said passages being adjacent and generally parallel to the combustion chamber, one of said passages residing in the same horizontal plane as the combustion chamber, said combustion chamber having an end formed and adapted to admit a generally horizontally directed burner flame, said heat exchange passages being connected to each other at opposite ends of the boiler structure, the said one of the passages being connected at one end to the inner end of the combustion chamber, and a flue outlet for a passage which is not connected to the combustion chamber, the flue outlet being located at the end of the passage opposite to its connection with another passage, an upper and a lower drum, and continuous tubes connecting said drums, some of said tubes extending continuously generally vertically through said heat exchange passages and others surrounding said combustion chamber.

6. In a boiler structure, walls defining an outer shell of heat insulating material, an upper drum and a lower drum included in said walls, a generally vertical, longitudinally extending intermediate wall defining, at one side thereof, a combustion chamber, said combustion chamber having an end formed and adapted to admit a generally horizontally directed burner flame, tubes extending continuously between said drums, some of said tubes extending generally vertically at opposite sides of said combustion chamber, and being exposed to and lining the interior of said combustion chamber, said boiler structure having two heat exchange passages parallel with and located at one side of said combustion cham-

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ber, one of said passages being located above the other, the lower of said passages being in communication with the inner end of the combustion chamber, the upper of said passages being connected to the lower passage at one end and to a flue outlet at the other, and additional tubes extending continuously between said drums and through said heat exchange passages.

7. The structure of claim 6 characterized by and including a transversely extending partition intermediate the top and bottom of the boiler structure, one part of said partition separating the two heat exchange passages, and another part of said partition forming an upper liner wall for the combustion chamber.

8. The structure of claim 6 characterized by and including a removable false bottom overlying the bottom portion of the combustion chamber, some of the tubes which line the combustion chamber extending across said bottom portion and beneath said false bottom.

ALFRED E. FOREST.

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