April 25, 1933. I. HARTER 1,905,465

STEAM BOILER

Original Filed Oct. 29, 1921

Fig. 4

Fig. 3

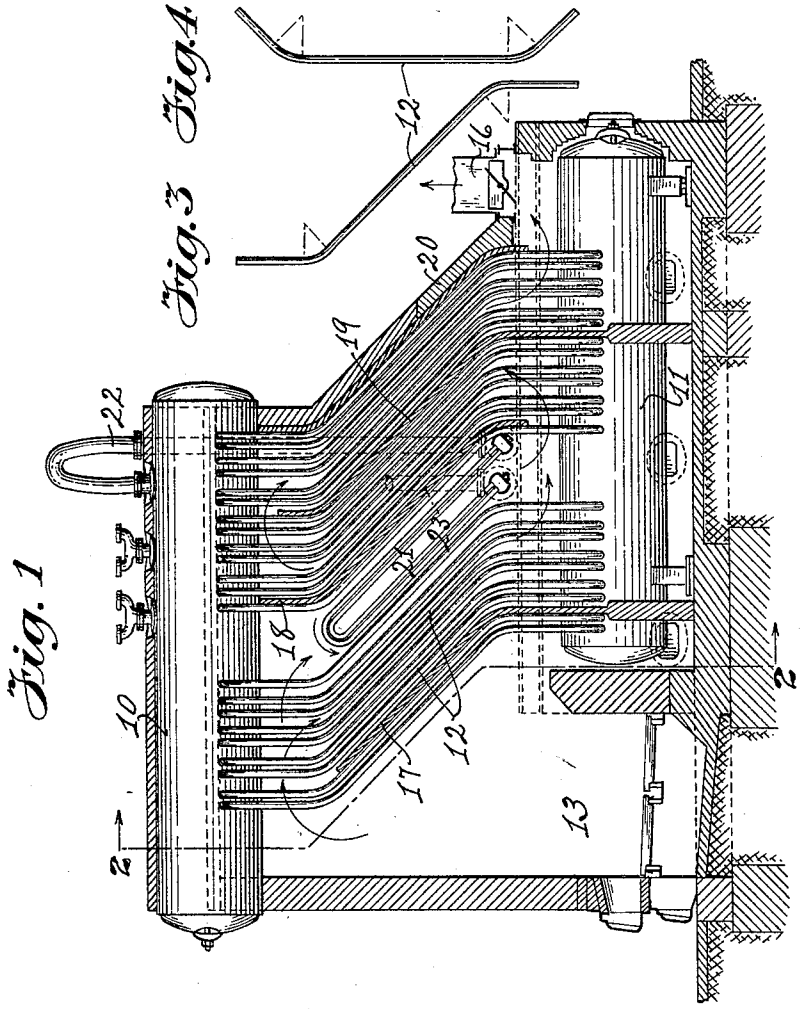


Fig. 1

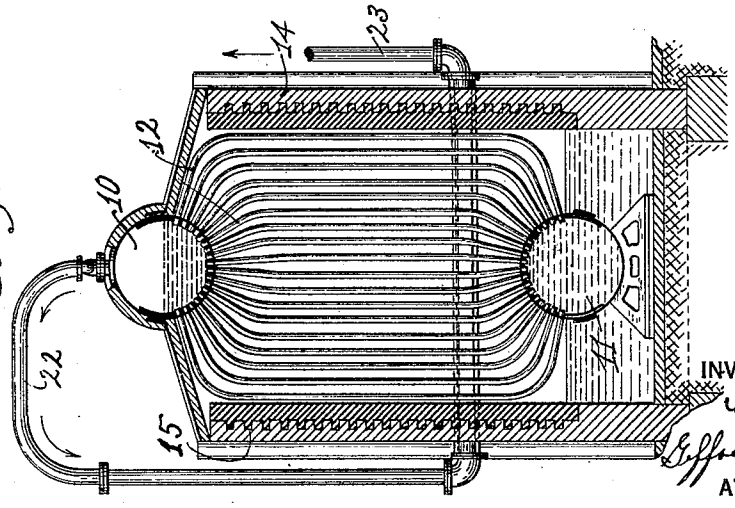


Fig. 2

INVENTOR
Isaac Harter
Gifford, Scull & Burgess
ATTORNEYS

Patented Apr. 25, 1933

1,905,465

UNITED STATES PATENT OFFICE

ISAAC HARTER, OF NEW YORK, N. Y., ASSIGNOR TO THE BABCOCK & WILCOX COMPANY, OF BAYONNE, NEW JERSEY, A CORPORATION OF NEW JERSEY

STEAM BOILER

Original application filed October 29, 1921, Serial No. 511,357. Divided and this application filed September 3, 1930. Serial No. 479,494.

This invention relates to water tube boilers, particularly of the type in which upper and lower horizontal drums are connected by water tubes, and in which the hot gases flow in a generally horizontal direction. This is a division of my application Serial No. 511,357, filed October 29, 1921.

My invention will be understood by reference to the accompanying drawing, in which Fig. 1 is a side elevation, partly in section, of an illustrative form of boiler embodying my invention; Fig. 2 is a section on the line 2—2 of Fig. 1, and Figs 3 and 4 are two views of one of the tubes shown in Fig. 1.

In the drawing, reference character 10 indicates an upper steam and water drum, and 11 a lower water drum, which drums are horizontal and one above the other, with the upper drum 10 projecting beyond the end of the lower drum 11. Rows of inclined water tubes 12 connect these drums in a manner to be described more specifically hereinafter, and beneath the row of tubes at the left of Fig. 1 is located a furnace chamber 13 having any suitable means for burning any desired kind of fuel.

Side walls 14, 15 provide a flue from the furnace chamber 13 to conduct the gases therefrom toward the right of Fig. 1, such gases ultimately passing out of the gas outlet 16.

Within the flue formed by these side walls are arranged the tubes 12 in rows extending across the flue, such arrangement being best shown in Fig. 2. Preferably, these tubes are divided in groups by baffles, the baffle 17, which is the one nearest the furnace chamber 13, being located, in the illustrative form, behind two rows of the tubes 12 and extending from the lower drum 11 up toward the upper drum 10, with a sufficient space between that drum and the top of the baffle to provide a gas passage. Similarly, a baffle 18 extends downward from the upper drum 10, and another baffle 19 extends up from the lower drum 11. The rear of the setting is closed by the rear wall 20.

Some of the rows of tubes are spaced apart, as best shown in Fig. 1, to provide a superheater chamber which, preferably, is located between the baffles 17 and 18, and in this superheater chamber is located at U-tube superheater 21, to the inlet header of which the steam from the drum 10 is conducted by the pipe 22 and from which the steam is taken through the outlet pipe 23.

It will be seen that in the form of boiler just described, the entire space between the front and rearmost rows of tubes is filled with rows of tubes which are parallel the greater portion of their length and through which the gases pass substantially parallel with the greater portion of each tube, the gases passing from the chamber 13 over the baffle 17, under the baffle 18 and over the baffle 19 to the gas exit 16. By having the tubes inclined over the furnace chamber 13, such tubes form a roof for the furnace, and, at the same time, by making the gas passage at the upper end of the baffle 17, a combustion chamber is provided in which the gases will be mixed and burned before entering the tubes. The two rows of tubes in front of the baffle 17 will protect the latter from the direct heat of the furnace and will also absorb the radiant heat of the fire.

The tubes 12 are expanded into the drums 10 and 11 in the usual manner, and it is desirable that the tubes shall enter each drum radially. This is accomplished by an arrangement of tubes which will appear as shown in Fig. 2 when viewed from the end of the boiler.

In order that the tubes may enter the drums radially and that, at the same time, the greater portions of such tubes may be inclined as shown in Fig. 1, I may bend each tube 12 in two planes, as shown in Figs. 3 and 4. When such a course is followed, all of the tubes will be bent in one plane so as to take the form shown in Fig. 3. At the end of each tube, however, there will be other bends in the plane at right-angles to the first plane, which bends will differ for each tube according to its position across the boiler. The bends which will be given one of the tubes are shown in Fig. 4. In this form, therefore, each tube will have four bends.

The boiler which I have illustrated is ef-

ficient and, at the same time, economical to construct. By having the tubes inclined over the furnace chamber, the radiant heat is absorbed and, at the same time, the difficulties arising from the maintenance of refractory roofs and arches are avoided. While, for some purposes, the gases might be carried straight back horizontally to the gas outlet, I find that, by providing baffles so as to compel the gases to flow up and down along the main portions of the tubes as the gases flow horizontally, there will be a more efficient passage of the heat from the gases to the tubes. By arranging all of the tubes in parallel rows, it will be obvious that all tubes in like situations will be duplicates. That is to say, all of the outermost tubes, for instance, in each row on one side will be alike except where the rows are staggered, in which case, the outermost tubes in each alternate row will be duplicates. Moreover, by placing all of the tubes in parallel rows, all of the boiler space may be filled with tubes so as to give a compact and efficient arrangement. If a superheater is used, then a space for it may be readily provided by omitting certain of the rows of tubes at a point where it is desired to place the superheater, and where high superheat is desired, such space may be provided in the first pass of the boiler, so that the superheater tubes will be contacted by the hot gases after these gases have passed over a few water tubes only. Moreover, the upper and lower drums will be similar so far as the arrangement of the tube holes therein are concerned, which is an important consideration in the cost of manufacture.

While I have described the drums 10 and 11 as cylindrical, it will be understood that drums of other cross-sections may be used, if desired. In such case, however, the portion of the drum sheet entered by the tubes will be curved and the bends which I have described will therefore also apply to such constructions. In the appended claims, when I describe the drums as cylindrical, it will be understood that I include in that term any drum in which the part entered by the tubes is a part of a cylinder. It will also be understood that, while I have shown the upper and lower drums as of the same length, the upper drum may be extended, if desired, until the end of the upper drum farthest from the furnace is over the corresponding end of the lower drum. Such an arrangement would give a vertical rear wall instead of the inclined rear wall which I have illustrated, and will also give added steam and water space, so that the steam could be taken from a point in the drum beneath which there are no water tubes.

I claim:

1. In a water tube boiler, an upper and a lower cylindrical drum, with their axes horizontal and parallel, a furnace, a flue arranged to conduct the hot gases from the furnace between and longitudinally of the drums, a plurality of water tubes in the path of the gases and connecting the upper and lower drums and being connected to said drums in circumferential rows, the tubes being arranged in rows extending across the flue, with the greater portion of each of the tubes in the several rows in parallel planes perpendicular to the plane of the axes of the drums and inclined toward the furnace end of the flue, the distance between the outer tubes in each row being greater than the diameter of one of said drums, the axis of each end of each tube being normal to that portion of the shell of the drum which the end enters and each tube having more than two bends.

2. In a water tube boiler, an upper and a lower cylindrical drum, with their axes horizontal and parallel, a furnace, a flue arranged to conduct the hot gases from the furnace between and longitudinally of the drums, a plurality of water tubes in the path of the gases and connecting the upper and lower drums and being connected to said drums in circumferential rows, the tubes being arranged in rows extending across the flue, with the greater portion of each of the tubes in each row in a plane perpendicular to the plane of the axes of the drums and inclined toward the furnace end of the flue, the planes of the several rows being parallel, the axis of each end of each tube being normal to that portion of the shell of the drum which the end enters and each tube having more than two bends, and the ends of each tube being disposed substantially radially with respect to said drums.

3. In a water tube boiler, an upper and a lower cylindrical drum, with their axes horizontal and parallel, a furnace, a flue arranged to conduct the hot gases from the furnace between and longitudinally of the drums, a plurality of water tubes in the path of the gases and connecting the upper end lower drums and being connected to said drums in circumferential rows, the tubes being arranged in rows extending across the flue, with the greater portion of each of the tubes in each row in a plane perpendicular to the plane of the axes of the drums and inclined toward the furnace end of the flue, the planes of the several rows being parallel, the axis of each end of each tube being normal to that portion of the shell of the drum which the end enters and each tube having more than two bends, the ends of each tube being disposed substantially radially with respect to said drums.

4. In a water tube steam boiler, a boiler setting, a steam offtake drum disposed centrally of the setting and at its top, a lower drum disposed beneath the offtake drum and

located with its axis substantially parallel to the axis of the offtake drum, means for supporting the lower drum in position with its forward end offset backwardly relative to the forward end of the upper drum so as to afford room for a furnace, steam generating tubes having parallel inclined portions within the setting, parallel and straight lower end portions of the tubes arranged in circumferential rows at right angles to the axis of the lower drum and in longitudinal rows parallel to the axis of the lower drum, upper straight and parallel tube portions arranged in circumferential rows at right angles to the axis of the upper drum and in longitudinal rows parallel with the axis of the upper drum, all of the tubes in any one longitudinal row being duplicates and all of said tubes constituting a bank of tubes inclined towards a position over the furnace and forming a bank of a width materially greater than the diameter of either drum.

5. In a water tube steam boiler, a boiler setting, an upper stream and water drum disposed in the setting, a lower drum disposed beneath the upper drum and located with its axis substantially parallel to the axis of the upper drum, means for supporting the lower drum in position with its forward end offset backwardly relative to the forward end of the upper drum so as to afford room for a furnace, steam generating tubes connecting the drums and having parallel inclined portions within the setting, lower end portions of the tubes arranged in circumferential rows arranged transversely relative to the axis of the lower drum and in longitudinal rows parallel to the axis of the lower drum, upper end portions of the tubes arranged in circumferential rows transversely of the axis of the upper drum and in longitudinal rows parallel with the axis of the upper drum, the longitudinal rows having duplicate tubes and the tubes forming a bank of tubes inclined towards a position over the furnace and having a width materially greater than the diameter of either drum.

ISAAC HARTER.