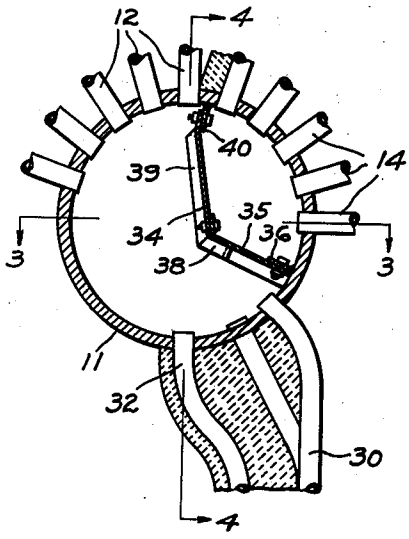
March 19, 1940. G. A. REHM 2,194,098

STEAM BOILER

Filed July 28, 1938

Fig. 2



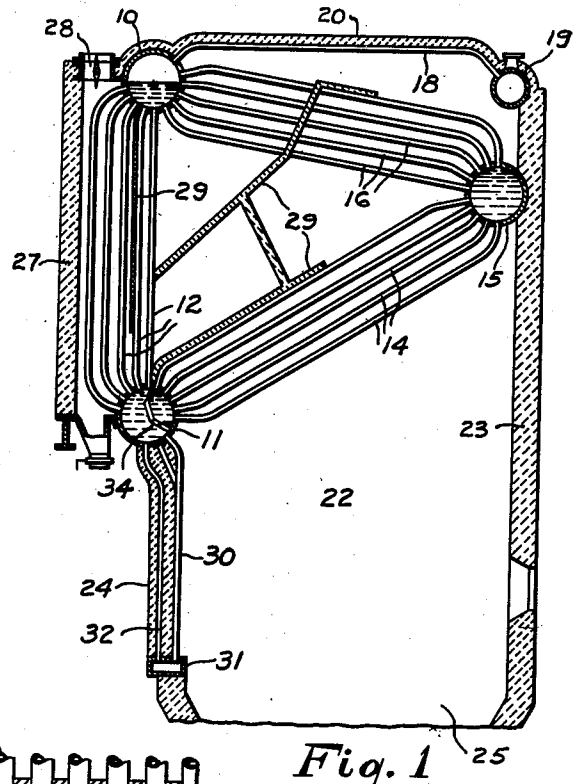


Fig. 1

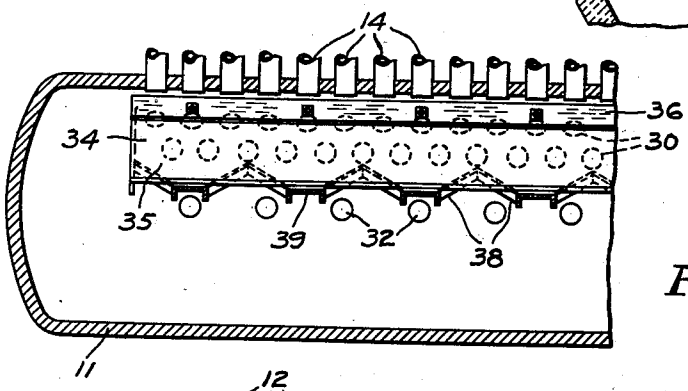


Fig. 3

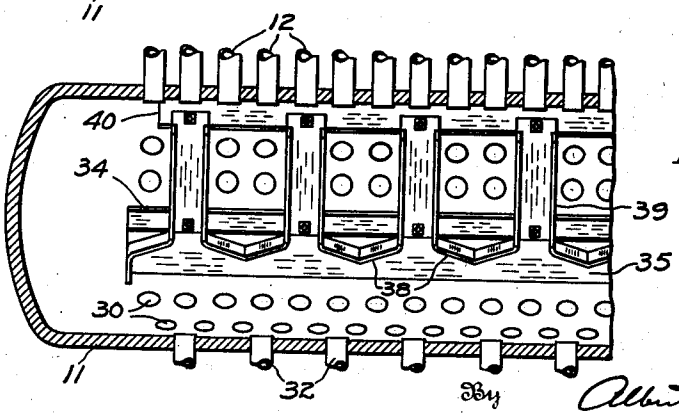


Fig. 4

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STEAM BOILER

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Application July 28, 1938, Serial No. 221,664

5 Claims. (Cl. 122—301)

This invention relates to steam boilers, and more particularly to boilers of the water tube type.

One common form of water tube boiler comprises a transverse lower water drum from which a bank of steam generating tubes extends upwardly across the path of flow of the furnace gases, and in many instances water wall tubes have been connected at their upper ends to this drum. These water wall tubes discharge large quantities of steam into the drum, and in some cases the rapid circulation of water through the drum has carried much of this steam into the steam generating tubes to mingle with the steam which is produced therein, causing such a congestion in these tubes as to block the circulation through them. Consequently the tubes have become overheated and damaged so seriously as to require replacement. These facts have been recognized and it has been proposed heretofore to install connecting tubes inside the drum between the upper ends of the water wall tubes and the lower ends of certain of the steam generating tubes which are swept by gases of comparatively low temperature. These connecting tubes are difficult to install or remove, they form a serious restriction to the circulation of water through the drum, and they prevent access to the ends of the steam generating tubes and water wall tubes.

It is accordingly one object of the invention to provide an improved means for conducting steam from water wall tubes through the lower drum of a boiler without unduly restricting the circulation of water through the drum.

It is a further object of the invention to provide an improved steam conducting means which can be readily installed in the lower drum of a boiler and easily removed therefrom, and which will not prevent access to the tubes connected to the drum.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts sets forth in the specification and covered by the claims appended hereto.

Referring to the drawing illustrating one embodiment of the invention, and in which like reference numerals indicate like parts,

Fig. 1 is a longitudinal section through a steam boiler;

Fig. 2 is an enlarged sectional view of the lower water drum and associated parts;

Fig. 3 is a section on the line 3—3 of Fig. 2; and

Fig. 4 is a section on the line 4—4 of Fig. 2.

The embodiment illustrated comprises a transverse upper steam-and-water drum 10 and a transverse lower water drum 11 located beneath the drum 10 and connected thereto by a bank of upright water tubes 12. A bank of water tubes 14 extends upwardly and forwardly from the front portion of the drum 11 to an upper water drum 15 which is connected to the steam-and-water drum 10 by a bank of upwardly and rearwardly sloping water tubes 16. A row of tubes 18 extends forwardly from the drum 10 to a steam drum 19 located above the water drum 15. These tubes 18 support the roof 20 of the boiler. Beneath the tube bank 14 there is provided a combustion chamber 22 having a front wall 23, a rear wall 24 and side walls 25. A wall 27 is provided in the rear of the tube bank 12, with a gas outlet 28 between the upper portion of this wall and the steam-and-water drum 10. Suitable baffles 29 are installed to direct the hot gases from the combustion chamber 22 into contact successively with the tube banks 14, 16 and 12, and thence to the outlet 28 in a well-known manner.

A row of upright water wall tubes 30 is associated with the rear wall 24 to support this wall and protect it from the heat of the combustion chamber. The upper ends of these tubes are connected to the lower front portion of the water drum 11, beneath the tubes 14, and in order to maintain adequate ligaments in the drum the ends of the tubes 30 may be staggered as shown in Figs. 3 and 4. The lower ends of the water wall tubes 30 are connected to a horizontal header 31 to which water is supplied from the drum 11 through a row of downcomer tubes 32 located in the rear of the tubes 30.

It will now be apparent that with the construction as so far described there will be a rapid circulation of water from the drum 10 downwardly through the tubes 12, thence forwardly through the drum 11 and the tubes 14 to the drum 15, and thence rearwardly through the tubes 16 to the drum 10. The steam which is generated in the tubes 14 and 16 will be carried along with the water and released in the drum 10, whence it will flow through the tubes 18 to the drum 19 and from this drum to a place of use. Large quantities of steam will be generated in the water wall tubes 30 and discharged upwardly into the drum 11, and the rapid forward circulation of water through this drum may sweep this steam into the water tubes 14 to mingle with the steam which is being generated in these latter tubes. This may cause so much congestion in the tubes 14 as to

prevent adequate circulation therethrough, and the tubes may be seriously overheated. This is particularly true of the tubes in the lowermost row, which are subjected to intense radiant heat.

In order to avoid this difficulty I provide an improved baffling means 34 in the interior of the drum 11 to direct the steam away from the lower rows of tubes 14 and into tubes which are remote from the water wall tubes in a direction circumferential of the drum. This steam is preferably directed into certain of the tubes 12, thus causing these tubes to serve as upcomers which conduct the steam upwardly to the upper drum 10. For this purpose I mount within the drum 11 a plate 35 which slopes upwardly and rearwardly above the upper ends of the water wall tubes 30. The front or lower edge of this plate is located between the tubes 30 and the lowermost of the tubes 14. For convenience in installing and removing this plate, its front edge portion may be bolted to a strip 36 which is welded to the interior of the drum wall. The bottom surface of the plate 35 is provided with depending ribs 38 which converge in pairs in the rearward direction. Steam flows upwardly from the tubes 30 to the plate 35 and is thereby compelled to flow rearwardly, the ribs 38 serving to concentrate this steam into several separate streams. These streams are directed upwardly into certain of the tubes 12 which lead directly to the drum 10, and for this purpose I preferably utilize a series of conduits in the form of channel members 39 which are spaced apart from each other in a direction longitudinal of the drum. These channel members are open toward the rear, and they slope upwardly and rearwardly at a steep angle from the rear edge of the plate 35. Their lower ends may be bolted to the plate, and their upper ends may be bolted to a strip 40 which is welded to the interior of the drum wall between the tubes 12 and 14. It will be noted from Fig. 4 that the upper end of each channel member 39 is located directly beneath one of the tubes 12, and that the lower end of each channel member is located between two of the converging ribs 38.

It will now be apparent that in the operation of the boiler there will be a rapid circulation of water downwardly from the lower drum 11 through the downcomer tubes 32 to the header 31 and thence upwardly through the water wall tubes 30. These tubes 30 will discharge large quantities of steam into the drum, and this steam will rise through the water until it encounters the plate 35 and thence will travel upwardly and rearwardly along the lower surface of the plate. During this rearward travel the steam will be directed by the inclined ribs 38 into several concentrated streams which are spaced apart in a direction longitudinal of the drum, and these streams will flow upwardly through the channels 39 into the tubes 12 thereabove which lead directly to the steam-and-water drum 10. Because of the comparatively wide spacing between the channels 39 there is ample area for the normal circulation of water forwardly through the drum 11 to the lower ends of the water tubes 14, and the baffle construction will prevent this water circulation from carrying any of the steam into these tubes. The baffles are simple and inexpensive to manufacture and they allow ready access to the tubes for cleaning purposes.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A steam boiler comprising a horizontal water drum, downcomer water tubes connected at their lower ends to the drum, upcomer water tubes connected at their lower ends to the drum, a row of water wall tubes connected at their upper ends to the drum and arranged to discharge steam into the drum, and baffle means spaced above the upper ends of the water wall tubes and arranged to concentrate the steam discharged by the water wall tubes into streams spaced apart longitudinally of the drum and to direct said streams into certain of the upcomer tubes, the downcomer tubes serving to deliver water to the drum which flows between the said concentrated streams of steam and thus to upcomer tubes on the other side of said streams.

2. A steam boiler comprising a horizontal water drum, downcomer water tubes connected at their lower ends to the drum, upcomer water tubes connected at their lower ends to the drum, a row of water wall tubes connected at their upper ends to the drum and arranged to discharge steam into the drum, baffle means spaced above the upper ends of the water wall tubes and arranged to concentrate the steam discharged by the water wall tubes into streams spaced apart longitudinally of the drum, and spaced conduits to direct said streams upwardly into certain of the upcomer tubes, the downcomer tubes serving to deliver water to the drum which flows between the said conduits and thus to upcomer tubes on the other side of said conduits.

3. A steam boiler comprising a horizontal water drum, downcomer water tubes connected at their lower ends to the drum, upcomer water tubes connected at their lower ends to the drum, a row of water wall tubes connected at their upper ends to the drum and arranged to discharge steam into the drum, baffle means spaced above the upper ends of the water wall tubes to deflect the steam discharged by the water wall tubes and including depending ribs which converge in pairs in the direction of flow to concentrate the steam into streams which are spaced apart longitudinally of the drum, and spaced conduits to direct said streams upwardly into certain of the upcomer tubes, the downcomer tubes serving to deliver water to the drum which flows between the said conduits and thus to upcomer tubes on the other side of said conduits.

4. A steam boiler comprising a horizontal water drum, a plurality of rows of water tubes connected to the upper portion of the drum and extending upwardly therefrom, means to direct hot gases into contact with the water tubes, a row of water wall tubes connected to the front side of the drum below the water tubes and arranged to discharge steam into the drum, baffle means spaced above the upper ends of the water wall tubes to deflect the steam rearwardly and including depending ribs which converge in pairs in the rearward direction to concentrate the steam into streams which are spaced apart longitudinally of the drum, and upwardly extending conduits arranged to direct said streams into certain of the water tubes which are remote from the water wall tubes in a direction circumferential of the drum.

5. A steam boiler comprising a horizontal water drum, a plurality of rows of water tubes connected to the upper portion of the drum and extending upwardly therefrom, means to direct hot gases into contact with the water tubes, a row of water wall tubes connected to the front side of the drum below the water tubes and arranged to discharge steam into the drum, an upwardly and rearwardly sloping plate spaced above the

upper ends of the water wall tubes to deflect the steam rearwardly, ribs depending from the plate and converging in pairs in the rearward direction to concentrate the steam into streams which are spaced apart longitudinally of the drum, and channel shaped members open toward the rear and sloping upwardly and rearwardly to direct said streams into certain of the water tubes which are remote from the water wall tubes in a direction circumferential of the drum.

GUSTAV A. REHM.