

April 18, 1933.

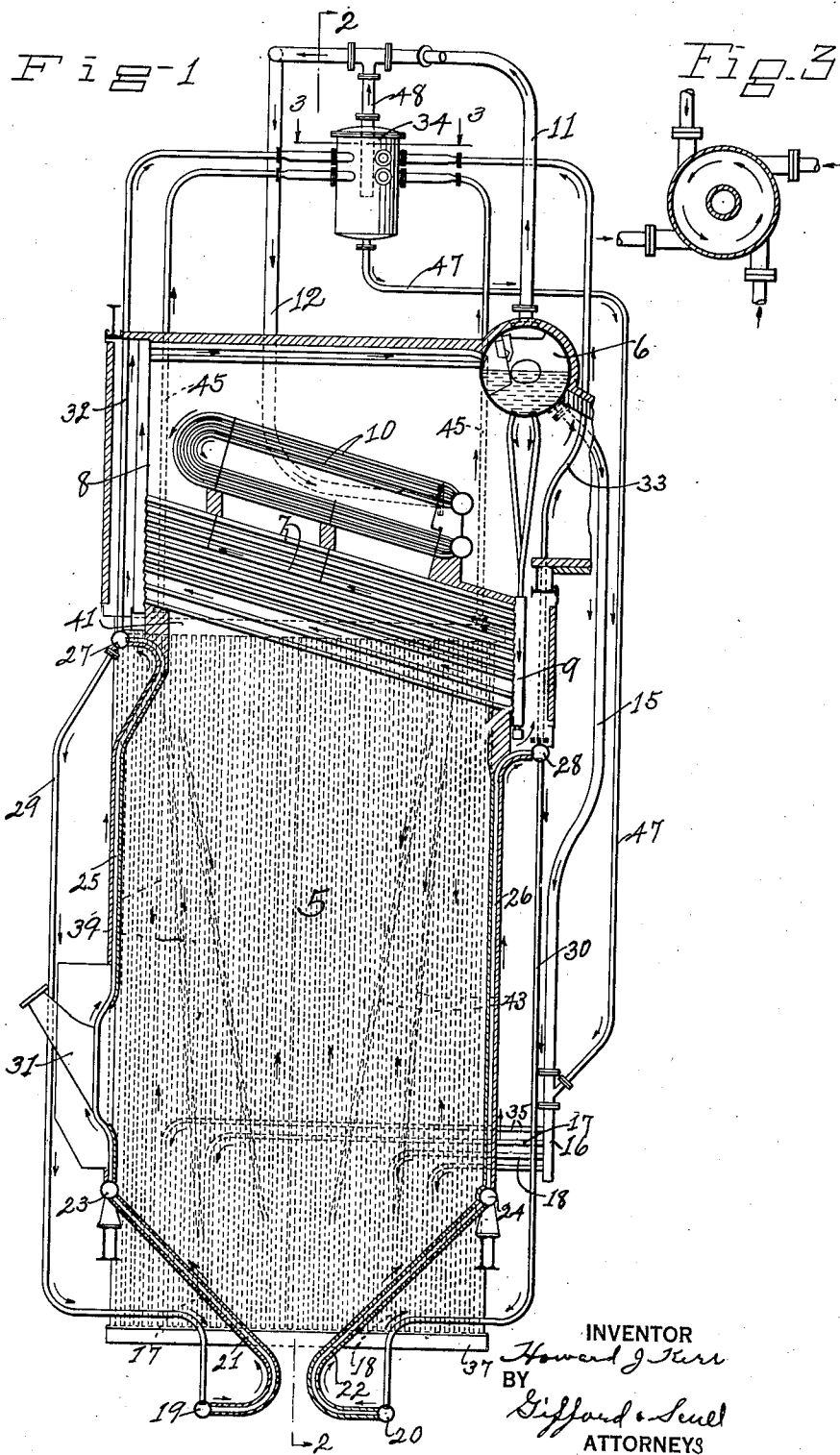
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STEAM BOILER

Filed Aug. 23, 1928

2 Sheets-Sheet 1



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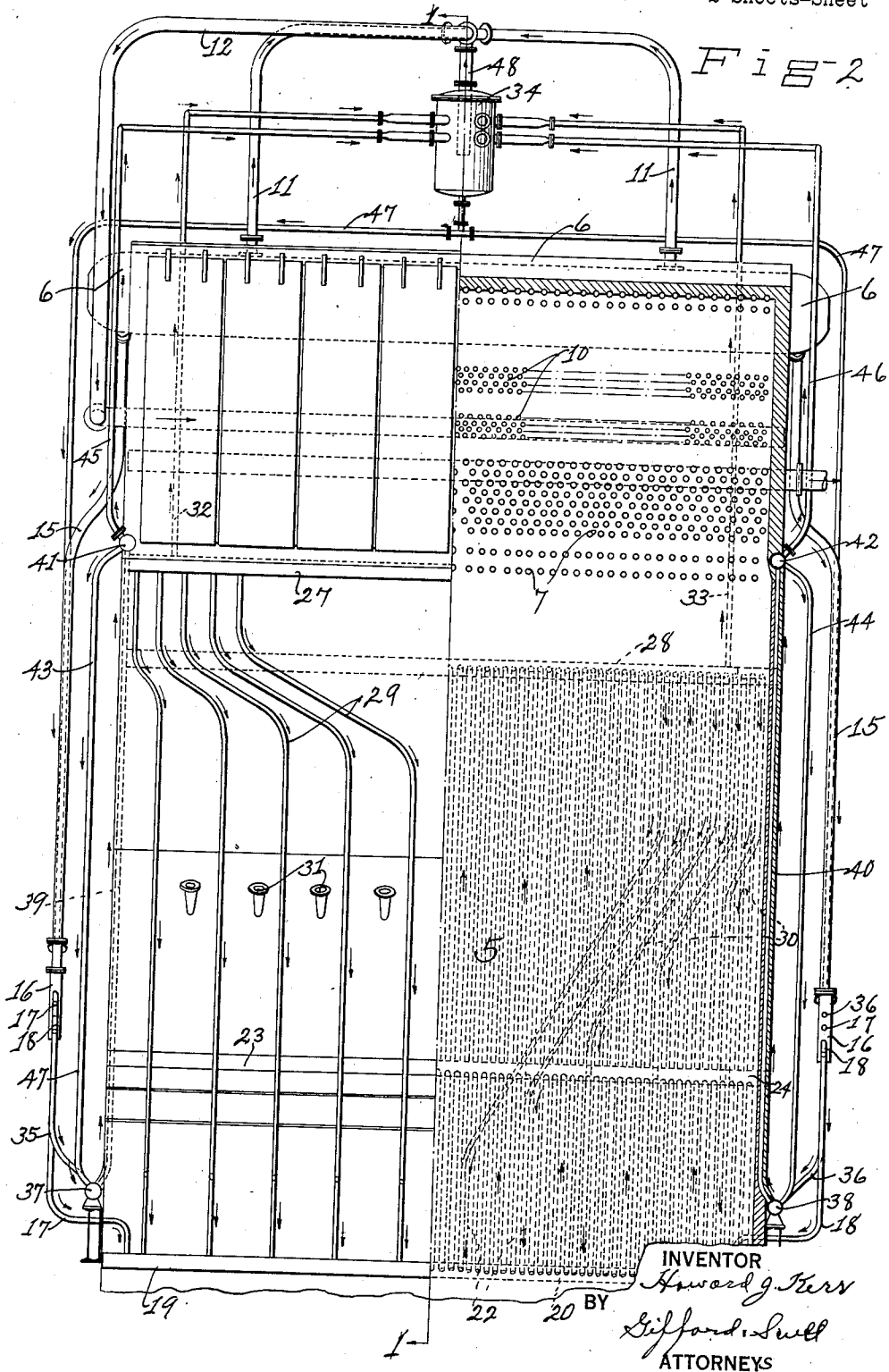
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UNITED STATES PATENT OFFICE

HOWARD J. KERR, OF WESTFIELD, NEW JERSEY, ASSIGNOR TO FULLER LEHIGH COMPANY, OF FULLERTON, PENNSYLVANIA, A CORPORATION OF DELAWARE

STEAM BOILER

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This invention relates to a steam boiler that is provided with furnace wall cooling tubes that are connected to a steam and water separator which may in turn be connected to the steam and water drum of the boiler.

The invention will be understood from the description in connection with the accompanying drawings in which Fig. 1 is a vertical section through an illustrative embodiment of the invention taken along the line 1—1 of Fig. 2; Fig. 2 is a view half in section taken along the line 2—2 of Fig. 1, and Fig. 3 is a horizontal section through a separator for the boiler. In the drawings reference character 5 indicates a boiler furnace having water cooled walls. A boiler of the Babcock & Wilcox type is located above the furnace and comprises the usual steam and water drum 6, and a bank of inclined tubes 7 connected to the headers 8 and 9 that are in turn connected to the steam and water drum 6. A superheater 10 is illustrated as being connected to the steam and water drum 6 by means of the pipes 11 and 12.

The water space of the drum 6 is connected by pipes 15 near opposite ends of the drum to vertically disposed headers 16 located near the lower portion of the rear side of the furnace 5. Pipes 17 connect the headers 16 to a horizontal lower header 19 and pipes 18 connect the headers 16 to a horizontal lower header 20. The headers 19 and 20 are located at the lower end of the ash hopper of the furnace 5 and are connected by rows of tubes 21 and 22, respectively, located in the sloping walls of the ash hopper to headers 23 and 24. A row of front furnace wall tubes 25 connects the header 23 to the upper header 27 and a row of rear furnace wall tubes 26 connects the header 24 to the upper header 28. Recirculating pipes 29 outside of the furnace wall connect the headers 19 and 27, and recirculating pipes 30 also outside of the furnace wall connect the headers 20 and 28. Riser pipes 32 and 33 connect the headers 27 and 28, respectively, to a steam and water separator 34 that is usually preferably located at a higher elevation than the steam and water drum 6. The pipes 32 and 33 enter the separator 34 tangentially.

Pipes 35 on one side of the furnace 5 connect one of the headers 16 to a lower horizontal side wall furnace tube header 37 and corresponding pipes 36 connect the other header 16 to a corresponding header 38 on the other side of the furnace. Rows of furnace side wall tubes 39 and 40 connect the headers 37 and 38, to upper headers 41 and 42, respectively. Recirculating pipes 43 connect the headers 37 and 41 on the outside of the furnace walls, and recirculating pipes 44 also outside the furnace walls connect the headers 38 and 42. Riser pipes 45 and 46 connect the headers 41 and 42 to the separator 34. A pipe 47 extends from the water space of the separator 34 to each of the headers 16. A pipe 48 extends into the upper end of the separator 34 and is connected to the pipe 12 leading to the superheater.

The operation is as follows: Steam is generated in the steam generating tubes 7 of the boiler in the regular way. The steam collecting in the steam space of the drum 6 passes through the pipes 11 and 12 to the superheater 10. Water from the water space of the steam and water drum 6 passes through the pipes 15 into the headers 16 and from thence into the lower headers 19, 20, 37 and 38. The water passes upwardly through the rows of furnace wall tubes into the upper headers 27, 28, 41 and 42, where the mixture of steam and water generated in the furnace wall tubes is partially separated, the water recirculating through the recirculating tubes 29, 30, 43 and 44 to the lower headers and again through the water wall tubes. Steam carrying some water passes from the upper headers 27, 28, 41 and 43 through the riser pipes 32, 33, 45 and 46 to the steam and water separator 34 where the steam and water is separated. The separated water passes downwardly through the pipes 47 into the headers 16 and thence again through the water wall tubes. The separated steam passes from the separator 34 through the pipe 48 into the pipe 12 to the superheater 10.

Heretofore in boilers provided with furnace wall tubes that are connected to the water circulation system of the boiler, the steam generated in the furnace wall tubes

frequently carries so much water entrained therewith that it is difficult to keep the steam from the boiler from becoming wet. Even when recirculation tubes are provided for the water wall tubes this danger occurs. By the present invention the wet steam from the water wall tubes is carried to a steam and water separator so that the water is separated out and returned to the furnace wall tubes, and the steam can be safely passed to the steam line on its way to the superheater.

I claim:

1. A steam boiler having furnace wall tubes, a steam and water drum connected to said tubes, and a separator located outside of said drum at an elevation at least as high as the normal water level in said boiler and connected to said tubes, the water space of said separator being connected to the lower portion of said tubes.
2. A steam boiler having furnace wall tubes connected to the circulation system of said boiler and a drum, and a separator located outside of said drum at an elevation at least as high as the normal water level in said boiler and connected to said tubes, the water space of said separator being connected to the lower portion of said tubes and the steam space of said separator being connected to the steam space of said boiler.
3. A steam boiler having furnace wall tubes, a steam and water drum connected to said tubes, means to provide local circulation in said wall tubes, and a separator located outside of said drum above the normal water level in said boiler and connected to said tubes.
4. A steam boiler having furnace wall tubes, a steam and water drum connected to said tubes, recirculation tubes outside of the furnace of said boiler connected to said wall tubes, and a separator located outside of said drum at an elevation above the normal water level in said boiler and connected to said tubes.
5. A steam boiler having furnace wall tubes connected to the circulation system of said boiler and a drum, and a separator located outside of said drum at an elevation at least as high as the normal water level in said boiler having its steam space connected to the steam space of said boiler and its lower portion connected to the lower ends of said wall tubes.
6. A boiler having a steam and water drum, a furnace having wall tubes, a connection from said drum to said tubes, and a steam and water separator outside of said drum at an elevation at least as high as said drum and having its upper and lower portions connected respectively to the upper and lower ends of said wall tubes.
7. A boiler having a steam and water drum, a furnace having wall tubes, a connection from said drum to said tubes, and a steam

and water separator outside of said drum above said drum and connected to said wall tubes and to the steam space of said drum.

8. A boiler having a steam and water drum, a furnace having wall tubes, means to provide local circulation in said wall tubes, a connection from said drum to said tubes, and a steam and water separator outside of said drum above said drum and connected to said wall tubes.

9. A boiler having a steam and water drum, a furnace having wall tubes, a connection from said drum to said tubes, a steam and water separator outside of said drum at an elevation at least as high as said drum, said separator being connected to said wall tubes, and a drain from said separator to the lower portion of said wall tubes.

10. A boiler having a steam and water drum, a furnace having wall tubes, upper and lower headers outside of said furnace to which the ends of said tubes are connected, a connection from said drum to said tubes, and a steam and water separator comprising a vertically disposed cylinder outside of said drum at an elevation at least as high as said drum and connected to said wall tubes.

11. A boiler having a steam and water drum, a furnace having wall tubes, upper and lower headers outside of said furnace to which the ends of said tubes are connected, a connection from said drum to said lower headers, and a steam and water separator comprising a vertically disposed cylinder outside of said drum at an elevation at least as high as said drum and connected to said upper headers.

12. A boiler having a steam and water drum, a furnace having wall tubes, a connection from said drum to said tubes, and a cylindrical steam and water separator at an elevation at least as high as said drum and connected to said wall tubes by tubes that enter said separator tangentially.

13. A boiler having a steam and water drum, a furnace having wall tubes, a connection from said drum to said tubes, and a vertically disposed steam and water separator at an elevation at least as high as said drum and having its steam and water space connected respectively to opposite ends of said tubes.

HOWARD J. KERR.

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