

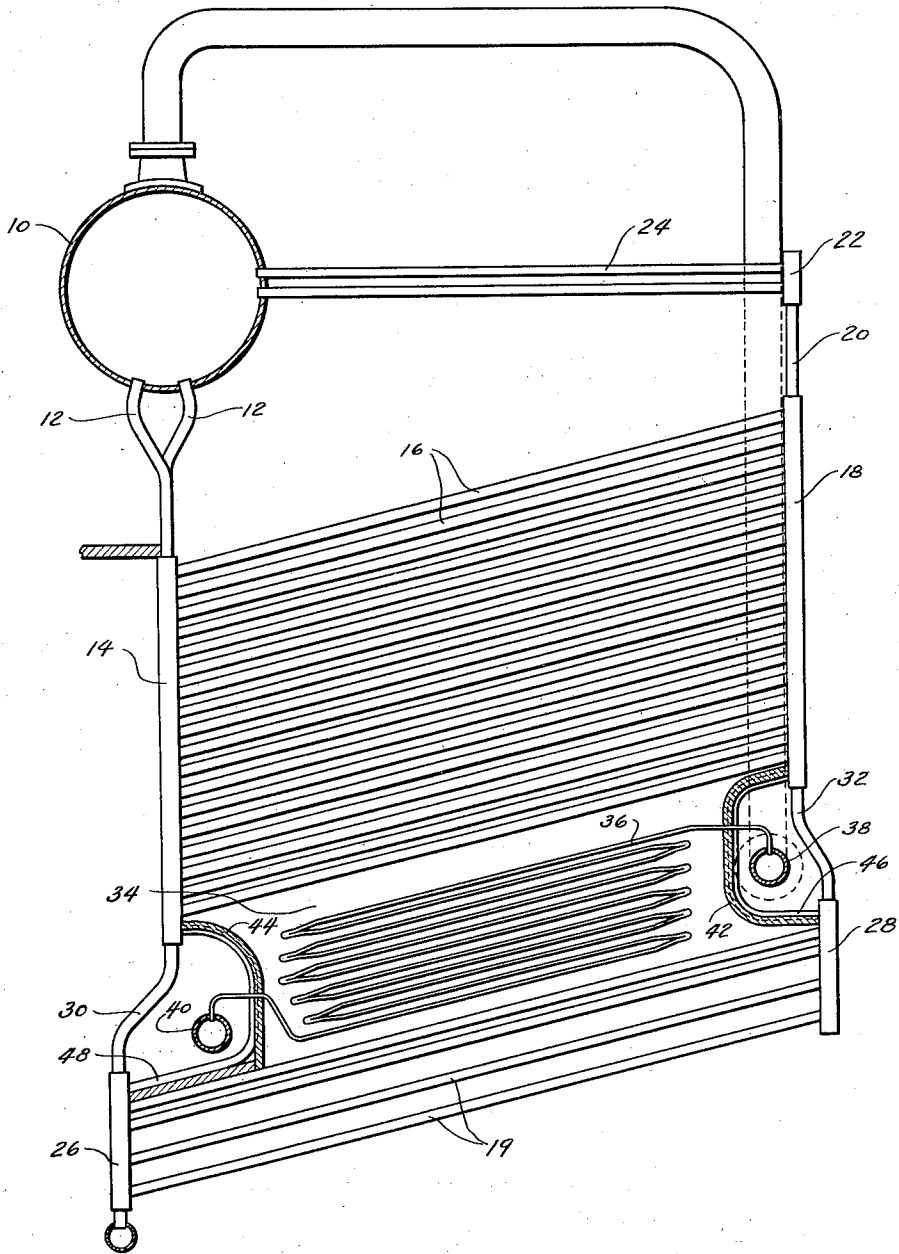
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SUPERHEATER BOILER

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SUPERHEATER BOILER

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My invention relates to boilers equipped with superheaters and particularly to those arrangements in which the superheaters lie in zones in which the gas temperatures are high compared with the steam temperatures.

Difficulties due to overheating the superheater elements are apt to be encountered in boiler installations in which the superheater elements are subjected to gases of comparatively high temperature due to the fact that the estimates for the final steam temperature are necessarily based on the average temperature of the gases while it is difficult to prevent the formation of lanes in the gases in which the temperature is much higher than the average with consequent local overheating of the superheater elements.

It is an object of the present invention to provide an arrangement whereby the said difficulties from local overheating may be minimized.

My present invention is based on the observation that the component parts of a stream of hot gases tend to mix to produce a more uniform temperature thruout the cross section of such stream when the stream of gases passes thru a channel of restricted free area as compared with the free area of the path of the gases leading up to and away from such restricted channel. In accordance with my invention, therefore, I place the superheater between two generating banks of a boiler, the free area for the flow of gases thru the superheater being reduced as compared with the free area for the flow of gases thru the bank beyond the superheater by the use of baffling for restricting or dimensioning the space for the superheater in the direction lengthwise of the generating tubes or by the close spacing of the superheater units or otherwise.

In order that my invention, together with its objects and advantages, may be more fully and easily understood, I will now describe in detail in connection with the accompanying drawing a superheater boiler forming a preferred embodiment of my invention, it being understood that such embodiment is illustrative only and that the invention may be embodied in other types of apparatus. In the drawing:

The figure is a vertical sectional elevation thru a single pass cross drum superheater boiler.

In the arrangement illustrated, 10 is a boiler drum for holding and storing steam and water and from the lower side of which extend downcomer nipples, 12, 12 connecting at their lower ends with headers, one of which appears at 14. Headers 14 are connected to a bank of straight horizontally inclined tubes 16, 16. Tubes 16 connect

at their ends opposite headers 14 with riser headers, one of which appears at 18 and the upper ends of which connect by means of the ordinary circulators and subheaders 20, 22 and 24 with the drum 10 to provide a thermal circulation thru the generating tubes 16.

Spaced from the bank of tubes 16 is a lower or slag screen bank composed of tubes 19, 19 extending parallel to the tubes 16 and connecting to lower headers 26 and upper headers 28. Headers 26 receive water from headers 14 by downcomer members 30 and the upper headers 28 connect with the riser headers 18 by riser members 32. As shown, tubes 19 are longer than tubes 16 but I do not limit myself to this. The bank of tubes 19 being spaced from that of tubes 16 by the members 30 and 32, a space 34 is provided which is adapted to contain a superheater and I have illustrated therein a superheating means having a number of parallel units, one of which appears at 36 and each of which extends from an inlet header 38 to an outlet header 40. The bank composed of tubes 19, however, ordinarily is only a few rows high so that the gases from the furnace will be understood as leaving the tubes 19 and entering the space 34 while at a high temperature. If the temperature of the steam at any point in the superheater rises above a certain maximum, damage can occur from either of two causes. Either the outer surface of the elements 36 will be oxidized or the steam will attack the inner surface of the elements. Both difficulties may, of course, occur simultaneously. It is, therefore, important that the gases be well mixed before striking the superheater elements 36 so that the maximum temperature of any portion of the gases will be as near as possible to the average temperature. In the arrangement shown, the free area for passage of gases of the space 34 is restricted compared to the free area for the passage of gases in both the banks above and below it by baffling 42 and 44. Baffling 42 extends inwardly from the upper ends of headers 28 and thence upwardly and outwardly to the lower ends of headers 18, similarly baffling 44 extends inwardly from headers 26 and thence upwardly and outwardly to headers 14. The free area for flow of gases of space 34 is thereby considerably restricted in the direction longitudinally of the tubes 16 and 19 and the gases thereby well mixed to produce a nearly uniform temperature. I do not limit myself, however, to producing the restriction of free gas area thru the superheater space 34 in the manner illustrated and described herein above, but may obtain such an effect by other

means. I may for instance produce sufficient restriction of the free gas area in the space between the two groups of boiler tubes merely by placing the superheater units close enough together.

5 In the arrangement illustrated in the drawing, the baffling 42 and 44 for restricting the space 34 is supported by sets of auxiliary connectors 46 and 48 respectively. The auxiliary connectors 46 between the riser headers 18 and 28, however, per-
 10 form an important additional function in supplying sufficient space for the steam and water from tubes 19 to enter the lower ends of headers 18. Owing to the high rates at which the tubes 19 are operated in single-pass boilers difficulty has been
 15 experienced with the circulation and I have found that such difficulty arises from insufficient area in the connectors between the upper headers 28 of the lower set of generating tubes and the upper headers 18 of the upper set of generating tubes.
 20 The area obtainable in a set of connectors such as that shown at 32 is, of course, limited by the size of the headers and it is impossible to give the connectors as large a free area as the headers. However, auxiliary connectors running from vertical
 25 faces of headers such as 28 in U shape arrangement to the vertical faces of headers such as 18 provide ample space for the steam and water to pass between the two groups of headers and overcome the difficulty. It is evident that, tubes
 30 19 being longer than tubes 16, headers 26 and 28 lie outside of headers 14 and 18 and members 30 and 32 must bend in order to connect the lower ends of the headers 14 to the upper ends of headers 26 and the lower ends of headers 18 to the
 35 upper ends of headers 28. There is therefore a resistance to the flow of water and steam through members 32 and to the flow of water to the members 30 due to such bends so that the members 46 are valuable as supplying added capacity for
 40 flow between the headers 28 and 18. It will be evident also, that the path for water and steam from drum 10 through the tubes 19 and return is very long and that any additional resistance in such path may starve the tubes 19 of water. The
 45 additional capacity of auxiliary connecting members 48 between headers 14 and 26 is therefore of value in reducing the total resistance of the path through the tubes 19.

What I claim is:

50 1. The combination of a straight tube single

pass boiler having a main generating bank and a transverse drum connected therewith so as to produce thermal circulation through said bank and drum, a slag screen bank below said main bank and spaced therefrom, headers at both ends of said banks, spacing members connecting the lower and upper ends respectively of the headers of said banks in the usual manner, a super-heater in the space between said banks, additional connecting members between those of said headers at the higher ends of the tubes of said banks and projecting inwardly toward the lower ends of the tubes of the banks, baffling material on said additional connecting members for constricting the length of the space between the two banks, additional connecting members between the headers at the lower ends of the tubes of the banks, such additional connecting members projecting inwardly toward the upper ends of the tubes of the banks, and baffling material on said additional connecting members at the lower ends of the tubes for further restricting the length of the opening between the two banks.

2. The combination of a straight tube single pass boiler having a main generating bank and a steam and water drum connected therewith so as to produce thermal circulation through said bank and drum, a slag screen bank below said main bank and spaced therefrom, headers at both ends of said banks, spacing members connecting the lower and upper ends respectively of the headers of said banks in the usual manner, additional connecting members between those of said headers at the higher ends of the tubes of said banks and projecting inwardly toward the lower ends of the tubes of said banks, additional connecting members between the headers at the lower ends of the tubes of the banks and projecting inwardly toward the upper ends of tubes of the banks, baffling material on said additional connecting members for constricting the length of the space between the two banks, and a superheater in the space between said banks, said superheater having one header between the spacing and connecting members at the higher ends of the tubes of said banks and another header between the spacing and connecting members at the lower ends of the tubes of such banks.

WILBUR H. ARMACOST.