Oct. 18, 1932. C. W. GORDON 1,883,708

SUPERHEATER

Filed Nov. 17, 1931

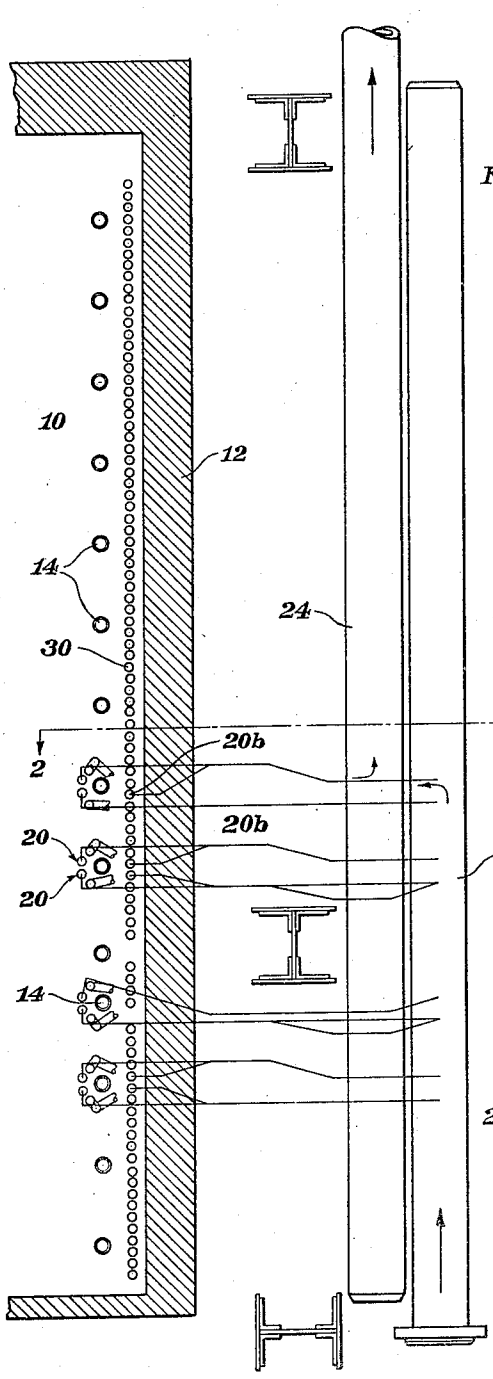


Fig 1.

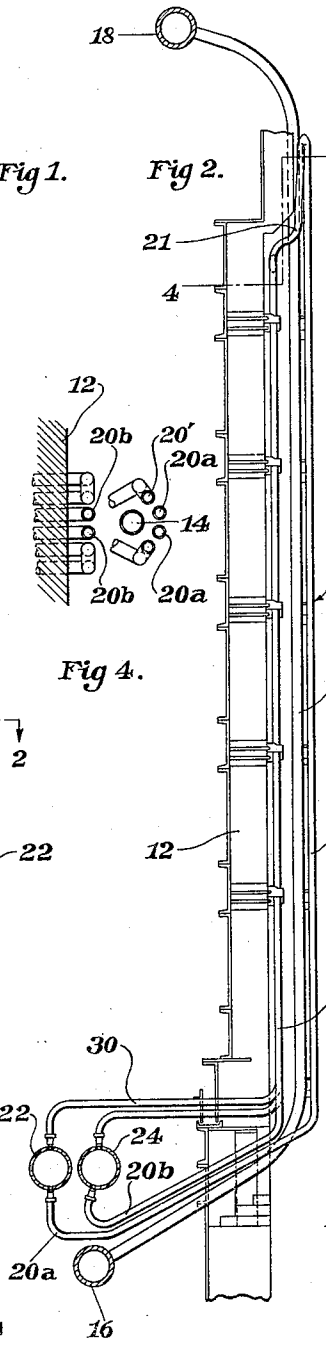


Fig 2.

Fig 4.

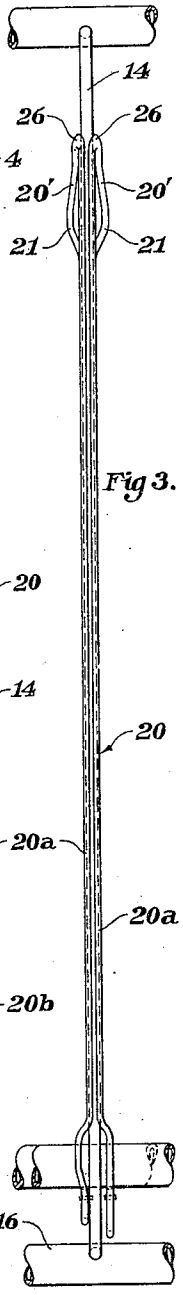


Fig 3.

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SUPERHEATER

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The present invention relates to superheater elements for radiant type superheaters and aims to provide an arrangement whereby a radiant type superheater element designed to deliver steam of comparatively high temperature and have a satisfactory commercial life.

It has been proposed to use radiant type superheater elements, but difficulty has been encountered in finding arrangements whereby the theoretic advantages of radiant heat absorption may be utilized without incurring technical disadvantages outweighing the advantages gained by using the feature of radiant heat absorption.

It is an object of my invention to provide a design whereby the above mentioned difficulty may be overcome.

In accordance with my invention, a superheater having radiant type elements is combined with the water wall of a furnace chamber so that both the portion of the elements receiving the most intense radiation and the portion of the elements carrying the highest temperature steam are protected from overheating by counter-radiation to an element of the water wall while the portion of the elements carrying the highest temperature steam is also somewhat screened from radiation by the water wall.

The novel features of the invention will be pointed out in the appended claims. The invention itself, however, and its objects and advantages will best be understood from a detailed description of an arrangement in accordance with the invention and such a description will now be given, in connection with the accompanying drawing, of a reheater superheater installation selected by way of example from a number of possible embodiments of the invention.

In the drawing:

Fig. 1 is a horizontal sectional view through a portion of a boiler furnace having a combined water wall and radiant type superheater installed along one side thereof.

Fig. 2 is a vertical section on the line 2—2 of Fig. 1.

Fig. 3 is an elevation of a portion of an arrangement illustrated in Fig. 1.

Fig. 4 is a detailed sectional view on the line 4—4 of Fig. 2.

The elements of a radiant type superheater or reheater are subject to severe conditions at times when the steam flow is reduced after a period of full load, since the radiant heat does not drop off nearly as rapidly as the load. The consequence has been that, if the superheater is designed to furnish steam at the temperature which the steel is capable of standing at full load, the metal will be damaged when the load falls off, but if the superheater is designed so that the maximum temperatures attained do not damage the metal of its tubes, the steam temperature at full load is not as high as desirable for reasons of efficiency.

In accordance with my invention, the superheater elements are exposed sufficiently to direct radiation in their portions closer to their inlets to ensure a high steam temperature at their outlets, their portions nearer their inlets being protected from overheating to some extent by radiation to a cooler surface and their portions nearer their outlets being protected to some extent by lying at a greater distance from the source of heat as well as by being screened somewhat from radiation by a cooler object. Preferably also the outlet sections of the elements are close enough to such cooler object to be protected somewhat by radiation thereto.

The installation illustrated in the drawing comprises a furnace chamber 10 having a wall 12. Parallel to the wall 12, I arrange a row of water wall tubes 14, 14, each substantially vertical and parallel to wall 12, and connected at its lower end to inlet header 16 and at its outer end to an outlet header 18. In the average case, the headers 16 and 18 are connected into the thermo-syphonic circulation of the boiler. Associated with certain of the tubes 14, I have shown superheater elements 20, 20 in accordance with my present invention. The elements 20 have inlet portions 20*a* connected to a header 22 for saturated steam and outlet portions 20*b* connected to header 24 for superheated steam. The headers 22 and 24 are placed outside the wall 12 and the elements 20 extend thru suit-

able apertures in the lower portion of such wall into the furnace chamber, the portions 20*a* of the elements which receive the saturated steam extending upwardly, each one in front of a water tube 14. Sections or portions 20*a* of the elements therefore receive the full furnace radiation without screening and also receive heat by direct contact with the furnace gases. They are, however, prevented from overheating by the fact that they receive relatively cool steam and, further, by the fact that they are close enough to the front faces of the water tubes 14 to discharge heat to such tubes by radiation. It will be seen further that the inlet portions 20*a* of elements 20 are arranged in pairs one on each side of the perpendicular to wall 12 through the centre of one of tubes 14. This forms a symmetrical arrangement whereby the elements 20 receive substantially equal amounts of radiant heat, but I do not limit myself to this. At their upper ends, inlet portions 20*a* are connected to the outgoing portions 20*b* by return bends 26, 26. Headers 22 and 24 may therefore be conveniently placed at the same level outside wall 12, as shown. The outlet portions 20*b* of elements 20 receive steam at a considerable temperature and, to prevent them from overheating, when the flow of steam is less than that at full load, the portions 20*b* are run close to the wall 12 whereby they receive less radiation due to their greater distance from the combustion zone of the furnace and they are further protected by placing them where they are at least partly shielded from radiation by tubes 14. As appears clearly in Fig. 1, the outlet portions 20*b* of some element 20 are not directly behind their associated water wall tubes 14, but they, nevertheless, are shielded thereby from the radiation from a considerable sector of the combustion zone. The entire lengths of portions 20*b*, however, need not be screened from the full radiation of the furnace and, as best appears in Fig. 3, I have shown relatively short sections 20′ on the outlet sides of the return bends 26 which are exposed to the furnace radiation without any protecting screening whatever. At point 21, however, not far below the bends 26, each discharge section or portion of the elements bends rearwardly toward wall 12 and, in most instances, toward the perpendicular to wall 12 thru the centre of one of the water tubes 14. By so bending the tube to the rear of the plane of tubes 14, the radiation received by portions 20*b* is decreased both on account of the additional distance from the furnace and on account of the partial screening of one of the tubes 14. When the portion 20*b* bends also toward the perpendicular to the tube the screening effect is, of course, increased. Portions 20*b* are further protected from overheating by radiation to tubes 14. It will be seen that two elements 20 preferably are associated with one water wall tube 14. However, I do not limit myself to this.

As shown more particularly in Fig. 1, the elements 20, in the particular installation illustrated, form only a portion of the total superheating elements of the superheater. In the same plane as the portions 20*b* of elements 20 there are shown both inlet and outlet portions of elements 30, 30. Elements 30 being entirely behind the plane of tubes 14 do not heat the steam passing therethru quite to the extent as do elements 20. They form, therefore, a convenient means of reducing the temperature of the steam delivered from header 24 whenever the flow of temperature of the steam from elements 20 is greater than that needed for the prime mover or other steam using device supplied by the installation.

A convenient arrangement of elements 20 and 30 is one illustrated in Fig. 2 and in which the elements 20 are connected into the lower faces of headers 22 and 24 while elements 30 are connected into the upper faces of such headers. It will be apparent further from Fig. 1 that the elements 30 as well as the portions 20*b* of elements 20 receive substantial amounts of heat by convection as well as by radiation.

What I claim is:

1. The combination with a water wall tube of a furnace of a superheater element having a pipe length in the furnace close to the furnace side of said tube and connected to receive saturated steam, and a length connected to receive steam directly from said first length and to discharge steam from the element, said second length having its greater portion farther from the furnace than said wall tube and screened from radiation thereby to some extent, but arranged to receive heat by convection.

2. The combination of a furnace provided with a water wall having spaced substantially vertical tubes, and a superheater having elements arranged to receive radiant heat from the furnace and some of which are farther from the furnace than said tubes thru their entire extent and others of which have inlet portions extending into the furnace farther than said water wall tubes and lying closely adjacent to the furnace face thereof and have outlet portions farther from the furnace than said water wall tubes throughout their greater portions and partially screened from radiation thereby.

3. The combination as set forth in claim 2 and in which the superheater elements are all approximately twice the length of the water wall tubes.

4. The combination as set forth in claim 2 and in which the outlet portions of the elements are further protected from overheating by being arranged to radiate to some extent to the water wall tubes.

5. The combination as set forth in claim 2 together with inlet and outlet headers at substantially the same level and connected to the inlet and outlet portions of the elements.

6. The combination with water wall tubes of a furnace, of a pair of superheater elements associated with each of said tubes and each having a pipe length in the furnace close to the furnace side of its associated tube, said lengths lying one on each side of the perpendicular to the furnace wall thru the water tube and connected to receive saturated steam, said elements having also each a length connected to receive steam directly from said first length and to discharge steam from the element, said second length having its greater portion farther from the furnace than said wall tubes and screened from radiation thereby to some extent as well as being further protected from overheating by being arranged to radiate heat to some extent to one of said wall tubes.

7. The combination as set forth in claim 6 together with a group of elements having both their inlet and outlet portions farther from the furnace than the water wall tube, and common inlet and outlet headers for both groups of elements.

In testimony whereof I affix my signature.

CHARLES W. GORDON.