Oct. 2, 1934. O. ENGLER 1,975,503

SUPERHEATER

Filed Sept. 30, 1931

Fig. 1.

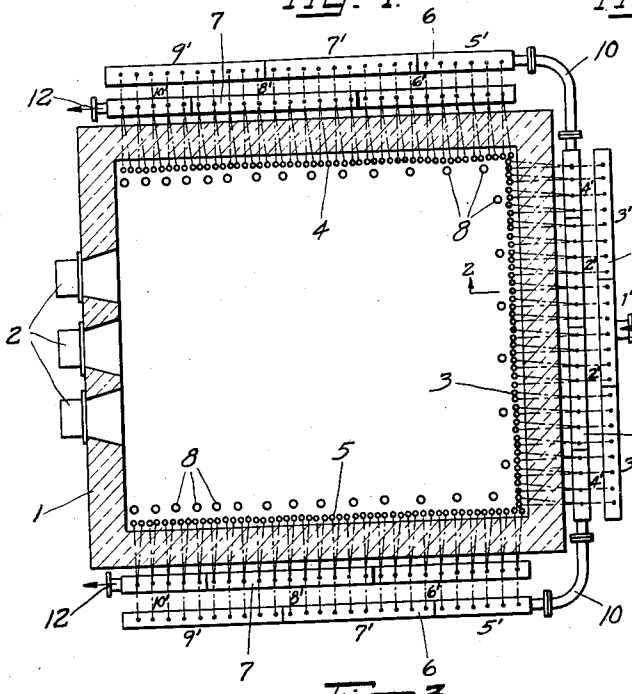


Fig. 2.

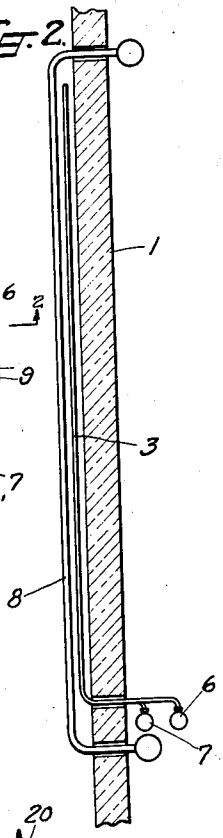
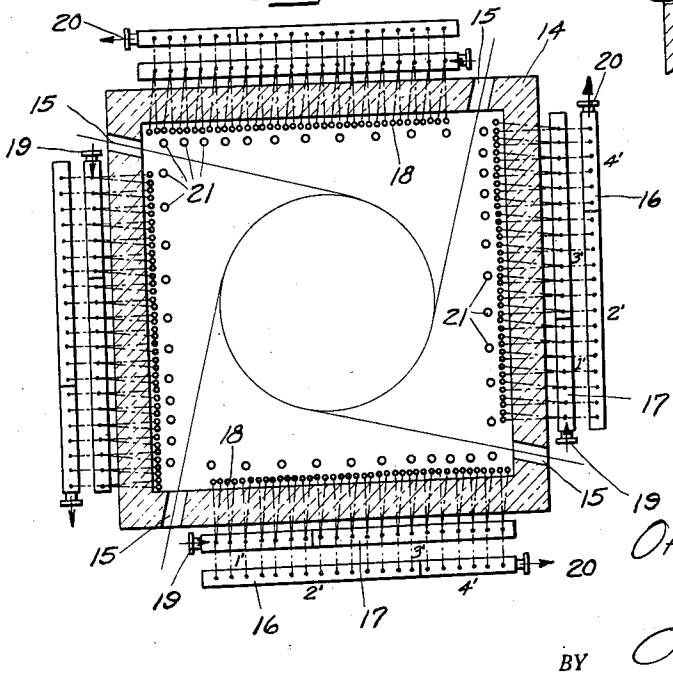


Fig. 3.



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# UNITED STATES PATENT OFFICE

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## SUPERHEATER

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2 Claims. (Cl. 122—485)

Tests with radiant superheaters having water cooled tubes in front of them have shown that the latter absorb a great deal of radiant heat so that it is not easy to obtain high superheat temperatures with such a radiant superheater alone. On the other hand, it is just when high superheater temperatures are desired that the protection afforded by the water cooled tubes is necessary as otherwise the superheater tubes will attain too high temperatures.

The present invention is based on the consideration that the walls of the combustion space which are exposed to radiant heat are subject to temperatures of varying intensity and the radiant superheater in accordance with the present invention is therefore given such an arrangement that the saturated steam which is to be superheated is carried through superheater tubes which are disposed in front of walls exposed to successively cooler temperatures. In this manner a similar result is obtained from a radiant type superheater as is attained in the case of superheaters heated by convection by applying the counter-current principle. By means of the present invention the average superheater temperature can be raised while the danger of too high a wall temperature of the superheater tubes is diminished; in other words, a higher superheat can be obtained with such a radiant superheater while at the same time the number of water cooled tubes arranged in front of the superheater can be diminished. In connection with this characteristic sequence of superheater tubes along the radiant walls, the arrangement of the water cooled tubes in front of the superheater can be such that they are not uniformly distributed along the entire wall but that their spacing becomes greater the higher the temperature is to which the wall is exposed. The invention can be utilized not only for furnaces in which the firing is from one side, but also for such as are fired tangentially from the corners.

The drawing shows two illustrative examples, one for each of the two methods of firing.

Fig. 1 shows a cross section through the combustion chamber of a furnace fired from one side. Fig. 2 shows a vertical section on the line 2—2 of Fig. 1. Fig. 3 shows a transverse section through the combustion chamber of a furnace fired tangentially from the corners.

In Figs. 1 and 2 the wall of the chamber is designated by the reference numeral 1. In accordance with this form the fuel, which may be pulverized coal or oil, is fed in through one wall at the point 1. The other three walls of the combustion chamber are equipped with the tubular walls 3, 4 and 5 of the radiant superheater. The ends of the looped superheater tubes are connected to the three groups of headers 6 and 7 which surround the combustion chamber on three sides and which in turn are again subdivided into smaller chambers by means of dividing walls. In front of the superheater walls are located the water cooled tubes 8. The saturated steam enters through the connection 9 in the middle of the header 6 at the rear of the combustion chamber. The steam first enters the distributing chamber 1' from which it flows through looped superheater tubes of the wall 3 to be delivered from the other ends of such units into the two chambers 2'—2' of the header 7 which lie symmetrically on each side of the center line. Further looped superheater elements which have their first ends connected to these chambers 2'—2' and their other ends to the chambers 3'—3' of the header 6 convey the steam back to the latter chambers. From here superheater tubes having their first ends attached to these chambers 3'—3' and their other ends to the chambers 4'—4' of the header 6 carry the steam back to the latter chambers. From the outer ends of the chambers 4'—4' bent pipes 10, 10 carry the steam to the first chambers of the headers 6, 6 lying at the two sides of the combustion chamber respectively. The two sets of headers 6 and 7 at the sides of the combustion chamber are subdivided into the chambers 5' to 10' in a manner similar to those at the rear of the combustion chamber. Out of the last chambers 10'—10' of the inner lateral headers 7 the superheated steam flows through the flanged connections 12, 12 to the turbine or other engine.

It will thus be seen that saturated steam enters the radiant superheater and is carried symmetrically in a zig-zag path toward the two sides so that the portion of the rear wall which is exposed to the most intense radiant heat receives the coolest steam, whereas the forward ends of the two side walls which are exposed to the lowest radiant temperature are transversed by the steam which has been superheated to the highest point, for example, up to 450° to 500° C. At the latter point the water cooled tubes 8 in front of the superheater are spaced most closely as will be seen from the drawing, whereas in the central portion of the rear wall opposite the point where the fuel is introduced the spacing is widest.

In Fig. 3 the reference numeral 14 designates a furnace which receives the fuel (oil or pulverized coal) in the known manner as for example

in the Wood boiler, at an angle from the four corners as at 15 so that a tangential vortex is formed. In this case there is a central area of most intense heat, for example of 1400° C., whereas in the wedge shaped portions lying between the walls and the axes of the firing the temperature varies with the distance from the point of firing in such a way that near the entrance of the fuel it might be 800° C. and at the farther end about 1200° C. The radiant superheater comprising the superheater elements 18 is here subdivided into four independent sections with headers 16 and 17 which are subdivided into internal chambers similar to those in Fig. 1 to which the ends of the looped elements 18 of the radiant superheater wall are connected in such a way that the saturated steam enters chamber 1' at 19 in each case and leaves chamber 4' in each case at 20. Here also those superheater tubes which have the coolest steam flowing through them, lie adjacent to the wall portions at which the radiation is most intense and at the point of the lowest temperature lie those tubes which have the highest temperature steam flowing through them. Just as in Fig. 1, the spacing of the water cooled tubes 21 which are arranged in front of the radiant superheater is smallest at the outlet ends and increases toward the inlet ends.

While the examples of furnaces with radiant superheater which I have pointed out to illustrate my invention are equipped with pulverized fuel or oil firing, the invention can also be applied in the case of solid fuel burned on travelling grates or other types of stokers, the general arrangement being similar to that of Figs. 1 and 2.

What I claim is:

1. A radiant superheater having protecting water tubes in front of it and characterized by the fact that the steam which is to be superheated is carried successively through superheater tubes arranged along a wall of a furnace, successive tubes being exposed to progressively lower temperatures, and that the spacing of the water tubes in front of the superheater tubes increases as the temperature to which the walls are exposed increases.

2. A radiant superheater comprising a furnace and superheater tubes arranged along its four walls, characterized by the fact that the fuel is introduced into the furnace tangentially at the corners and that the superheater is subdivided into four sections each arranged along one of the walls, the portions of each section being connected to each other and the steam inlet and outlet in such manner that the steam enters at the end of the wall where the temperature is highest, flows generally in a direction through such superheater section toward the other end of the wall, and leaves at the end where the temperature is lowest.

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