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RADIANT VAPOR GENERATING AND SUPERHEATING UNIT
WITH RADIANT SUPERHEATER PLATENS
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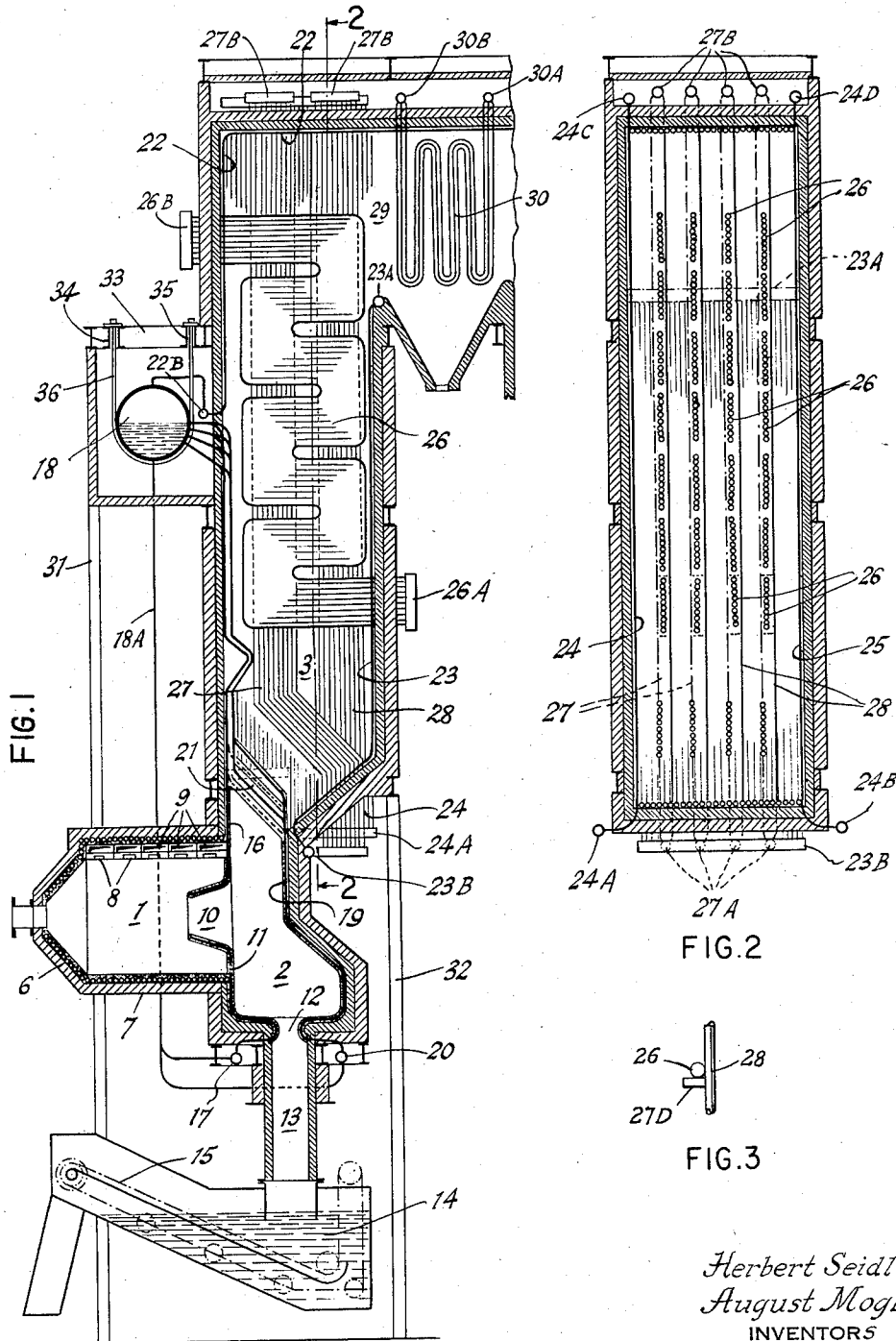


FIG. 2

FIG. 3

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RADIANT VAPOR GENERATING AND SUPER-HEATING UNIT WITH RADIANT SUPERHEATER PLATENS

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5 Claims. (Cl. 122-478)

This invention relates to a high pressure vapor generating and superheating unit having a high temperature combustion zone, the gases from which pass to a radiation zone or radiation pass in which there is a plurality of widely spaced radiant superheater platens or panels formed by closely arranged vapor superheater tubes. In one aspect of the invention, vapor generating tubes are included in the walls of a cyclone furnace to receive heat directly therefrom, and a portion of the boundary walls of the radiation pass include vapor generating tubes.

In the pertinent type of vapor generating and superheating units, operated at pressures in excess of 2000 p. s. i., and delivering superheated vapor at temperatures in excess of 1000° F., the proportion of the total fluid absorbed heat required for superheating generated vapor is increased to such an extent that the heat necessary for superheating is more than half of the total. To attain such a result involving an increase in the percentage of heat for superheating and a decrease in the percentage of heat for vaporization, the present invention involves radiant superheater tubes along the boundary walls of the radiation pass, and under some circumstances, the extent of the use of such radiant superheater wall tubes is such that the wall defining tubes of the radiation pass are predominantly radiant superheater wall tubes.

The above indicated arrangement produces an additional result when the radiation pass wall tubes adjacent some of the radiant superheater platens are radiant superheater tubes. Such radiant superheater wall tubes minimize non-uniform superheating as compared to an arrangement wherein the radiation pass wall tubes adjacent the radiation superheater platens are vaporizing tubes. In the latter case, the cooling effect of such radiation pass vaporizing tubes upon the adjacent superheater platens is such that these superheater platens may deliver steam at a temperature of 100° C. less than the temperature of the vapor delivered by adjoining superheater platens, such unequal heating tending to develop undesirable stresses in the superheater tubes. Such results are minimized by the present arrangement of radiation pass wall tubes parallel to and adjacent to some of the radiant superheater platens, as radiant superheater tubes.

The invention also involves some radiant superheater platens with horizontally extending tubular sections supported by the adjacent radiant superheater platen tubes which extend vertically throughout the radiation pass.

The invention also involves such a decrease in the vertical extent of the vapor generating tubes forming parts of the walls of the radiation pass that the vapor and liquid drum of the unit may be disposed at an elevation considerably below that of the top of the radiation pass thus promoting a material reduction in the expensive steel work required for the support of the drum, and its associated components of the complete unit.

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The invention will be concisely set forth in the appended claims, but for a complete understanding of the invention, its mode of operation, uses and advantages, recourse should be had to the following description which refers to the accompanying drawing in which a preferred embodiment of the invention is illustrated.

In the drawings:

Fig. 1 is a sectional side elevation of the illustrative unit;

Fig. 2 is a partial vertical section on the section line 2-2 of Fig. 1 showing the arrangement of the vertically disposed radiant superheater platens within the radiation chamber; and

Fig. 3 is a detail view showing the superheater tube supporting arrangement.

The illustrative unit involves a cyclone furnace 1 of the type described in U. S. patent to Kerr et al. 2,594,312 of April 29, 1952. The gases from this chamber pass through the outlet throat 10 into a primary furnace chamber 2 and thence upwardly to and through the radiation pass 3 in which there are disposed a plurality of widely spaced vapor superheater platens.

The walls of the cyclone furnace 1 and the primary furnace chamber 2 include vapor generating tubes having welded on studs and covered with a continuous layer of high temperature refractory material. Toward the outside, the walls are protected by insulation 6 and pressure tight casing 7.

Mixtures of particle form solid fuel and air enter the cyclone furnace 1 through nozzles 8, and secondary air enters through the nozzles 9, both entering streams being high velocity streams directed substantially tangentially into the cyclone, liquid slag resulting from combustion within the cyclone flowing through an opening 11 into the primary furnace chamber 2 and thence through floor opening 12 into passage 13 leading to the water bath of the slag pit 14 which has a scraper belt 15 for discharging solidified and granulated slag.

The front wall of the primary furnace 2 is lined with vapor generating tubes 16 leading from the lower header 17 through the wall of the slag discharge opening 12, along the front wall and around the throat 10 of the cyclone, and thence along the front wall of the radiation pass 3 to a position intermediate the height of the radiation chamber wherein the upper ends of the tubes communicate with the vapor and liquid drum 18.

Another group of vapor generating tubes 19 lead from the lower header 20 along parts of the wall of the slag discharge opening 12 and thence along part of the floor of the primary furnace chamber 2. From this position they lead upwardly along the rear wall of the primary furnace chamber, and then across the flow of gases from the primary furnace chamber, as the tubular screen 21. Upwardly from this screen these tubes extend along the front wall of the radiation pass 3 where they are preferably in wall alignment with the other tubes 16. The upper ends of the tubes 19 are similarly in direct communication with the drum 18.

Adequate natural circulation of the vaporizable liquid through the tubes 16 and 19 is promoted by the use of appropriate downcomers leading from the liquid space of the drum 18 to the headers 17 and 20 as indicated by the line 13A.

The upper part of the front wall of the radiation chamber 3 is lined with radiant superheater tubes 22, parts of which also extend along the roof of the unit, these tubes having their inlet and outlet ends connected to appropriate headers. The inlet header 22B is appropriately connected to receive vapor generated by the tubes 16 and 19 and discharged into the drum 18.

The rear wall of the radiation pass is lined with radiant superheater wall tubes 23 having their upper ends con-

nected to the header 23A and their lower ends connected to the header 23B.

The side walls of the radiation chamber 3 are lined with radiant superheater wall tubes 24 and 25 in pressure tight communication at their lower ends with the headers 24A and 24B, and in similar communication at their upper ends with the headers 24C and 24D.

Distributed in widely spaced relationship throughout the upper part of the radiation pass 3 are intermediate radiant superheater platens 26. These platens include vertically aligned tubes with serially connected horizontally extending portions. These tubes lead from the lower superheater headers 26A to the upper headers 26B. The platens formed by these tubes are disposed between the vertical tubes of pairs of upright superheater platens 27 and 28 leading from the lower headers 27A to the upper headers 27B. As shown in Fig. 1 the tubes of the vertical tube platen 27 of each pair are bent forwardly to extend upwardly in transverse relation to the forward return bend portions of the tube platens 26, while the tubes of the tube platen 28 of each pair extend directly upwardly in transverse relation to the rear return bend portions of the tube platens 26. The last mentioned platens are appropriately supported from the upper headers 27B which, in turn, are appropriately supported at the top of the unit. The tubes of the radiant superheater platens 27 and 28 have appropriate support lugs 27D welded thereto for maintaining the intermediate radiant superheater platens 26 in their operative relationships.

Generated vapor may pass, by appropriate connections, from the vapor space of the drum 18 to the inlet headers 22B, 24C and 24D in parallel, thence through tubes 22, 24 and 25 to the outlet headers 24A and 24B. It may then pass through appropriate connections to the headers 23B, 27A and 26A, and through their associated platen tubes to the outlet headers 23A, 27B and 26B. From the latter, steam may pass to the inlet header 39A of the convection superheater 39, through the tubes of that superheater to its outlet header 36B, and thence to a point of use.

The drum 18, the weight of which constitutes a substantial part of the weight of the entire unit, is disposed at an elevation considerably below the maximum elevation of the unit and is supported by appropriate steel work, including the uprights 31 and 32 and the top beam 33. Auxiliary beams or channels 34 and 35, disposed in pairs, are transversely secured to the top beams 33 and spaced apart to receive the drum straps 36.

When one intermediate radiant superheater platen 26 is considered in combination with its closely associated platens 27 (or 28) the three platens may be considered as unit radiant superheater means in platen form and heated equally on opposite sides.

Although the invention has been described with reference to the details of a preferred embodiment, it is to be understood that the invention is not to be considered as limited to all of the details thereof. It is rather to be taken as of a scope commensurate with the scope of the subjoined claims.

What is claimed is:

1. In a high pressure vapor generating and superheating unit, a cyclone furnace forming at least a part of a high temperature combustion zone, upright walls forming a vertically attenuated radiation gas pass receiving combustion gases generated in the cyclone furnace, upright widely spaced platens of radiant vapor superheating tubes vertically disposed within the gas pass, vapor generating tubes directly receiving heat from the gases generated in the cyclone furnace and having parts included within a wall of the gas pass normal to the planes of the platens, rows of radiant superheater wall tubes lining the remaining wall portions of the gas pass, a vapor and liquid drum directly communicating with the upper ends of the vapor generating tubes and disposed at a vertically intermediate

position relative to the height of the gas pass, headers at the lower part of the unit directly connecting with the vapor generating wall tubes, means connecting the outlets of the vapor generating tubes to the inlets of said superheater tubes, and downcomer means establishing communication between the water space of the drum and headers, some of said platens of radiant superheater tubes extending through the gas pass having means thereon for supporting other radiant superheater platens.

2. In a natural circulation steam generating and superheating unit, upright wall means forming a vertically elongated radiation chamber, fluid heating tubes lining the walls of said chamber, a steam and water separating drum disposed at one side of the chamber at an elevation intermediate its height, fuel burning means disposed adjacent the lower part of the chamber at an elevation below the elevation of the drum and arranged to normally provide high temperature combustion products for passage upwardly through the chamber, the fluid heating tubes in the lower part of the chamber being steam generating tubes having their upper ends in communication with the drum, means including downcomers connecting the water space of the drum and the inlets of the steam generating tubes, the chamber lining tubes above the elevation of the drum being wall tubes of a radiant superheater receiving the generated steam, the radiant steam superheater also including spaced parallel platens of vertically aligned nested sinuous tubes disposed in the upper part of the chamber with the platens distributed between opposite wall portions of the chamber and extending above and below the elevation of said drum, vertically arranged superheater tubes between said platens having means thereon for supporting said platens, and means forming a gas outlet at the upper part of the chamber.

3. In a natural circulation steam generating and superheating unit, upright walls forming a vertically elongated radiation chamber of polygonal horizontal section, fluid heating tubes lining the walls of said chamber, a steam and water separating drum disposed at one side of the chamber at an elevation intermediate its height, fuel burning means disposed adjacent the lower part of the chamber at an elevation below the elevation of the drum and arranged to normally provide high temperature combustion products for passage upwardly through the chamber, the fluid heating tubes in the lower part of the chamber being steam generating tubes having their upper ends in communication with the drum, means including downcomers connecting the water space of the drum and the inlets of the steam generating tubes, the chamber lining tubes above the elevation of the drum being wall tubes of a radiant superheater receiving the generated steam, the radiant steam superheater also including spaced parallel platens of vertically aligned nested sinuous tubes disposed in the upper part of the chamber with the platens parallel with opposite walls of the chamber, vertically arranged platens of horizontally aligned vertical tubes positioned between said sinuous tube platens, adjacent vertical platens being arranged along horizontally spaced portions of said sinuous tube platens, means on said vertical platens for supporting adjacent portions of said sinuous tube platens, and means forming a gas outlet at the upper part of the chamber.

4. A natural circulation vapor generating and superheating unit comprising upright front, rear and side walls defining a lower primary furnace chamber and an upper radiation chamber, a cyclone furnace arranged to discharge high temperature heating gases through the lower part of said front wall into said primary furnace chamber, vapor generating tubes lining the walls of said cyclone furnace and the front and rear walls of said primary furnace chamber and extending upwardly along the front wall of said radiation chamber and terminating at an elevation approximately one-half the height of the front wall of said radiation chamber, a vapor and liquid separating drum arranged externally of the front wall of

said radiation chamber at an elevation adjacent to the upper ends of said vapor generating tubes and connected thereto, external downcomer tubes connecting the liquid space of said drum to the inlet ends of said cyclone furnace and primary furnace chamber vapor generating tubes, vertically extending vapor superheating tubes lining the side and rear walls of said radiation chamber and the portion of said radiation chamber front wall above the upper ends of said vapor generating tubes, means for supplying vapor to be superheated from said drum to said radiation chamber front, side and rear wall superheater tubes, and a plurality of transversely spaced vertically extending radiantly heated superheater tube platens in the upper part of said radiation chamber above the level of said separating drum separate from and serially connected to said front, side and rear wall superheater tubes.

5. In a vapor generating and superheating unit, upright wall means forming a vertically elongated radiation chamber, vapor generating tubes lining a wall of said chamber, a vapor and liquid separating drum connected to the upper ends of said vapor generating tubes, fuel burning means disposed adjacent the lower part of the chamber and arranged to normally provide high temperature combustion products for passage upwardly through the chamber, means including downcomers connecting the liquid space of the drum to the inlet end of

said vapor generating tubes, a radiant vapor superheater connected to said drum and including spaced parallel platens of vertically aligned nested sinuous tubes disposed in the upper part of the chamber, each of said sinuous tube platens having vertically spaced groups of horizontally extending vertically aligned tube portions, vertically arranged platens of horizontally aligned vertical tubes positioned between said sinuous tube platens, adjacent vertical platens being arranged along horizontally spaced portions of said sinuous tube platens, and means on said vertical platens for supporting adjacent horizontal portions of said sinuous tube platens.

References Cited in the file of this patent

UNITED STATES PATENTS

2,424,476	Marshall	July 22, 1947
2,685,279	Caracristi	Aug. 3, 1954
2,687,708	Beute	Aug. 31, 1954
2,730,080	Stallkamp	Jan. 10, 1956

FOREIGN PATENTS

701,270	Germany	Jan. 13, 1941
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OTHER REFERENCES

B & W Bulletin G 67 A of 1950, page 41.