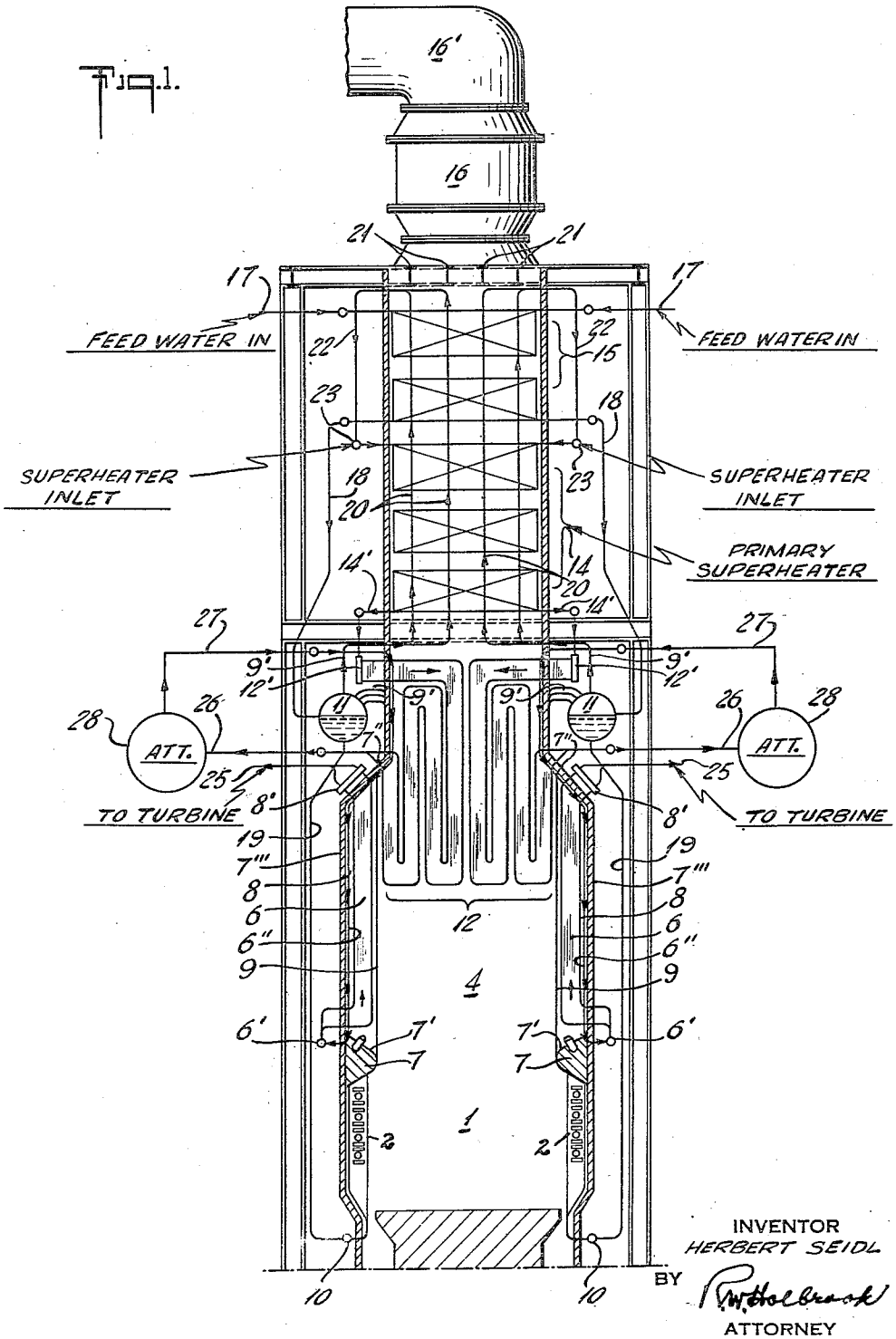
Jan. 28, 1958 H. SEIDL 2,821,175

RADIANT VAPOR GENERATOR WITH RADIANT SUPERHEATER IN FURNACE WALL QUIESCENT ZONES

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Fig. 1.

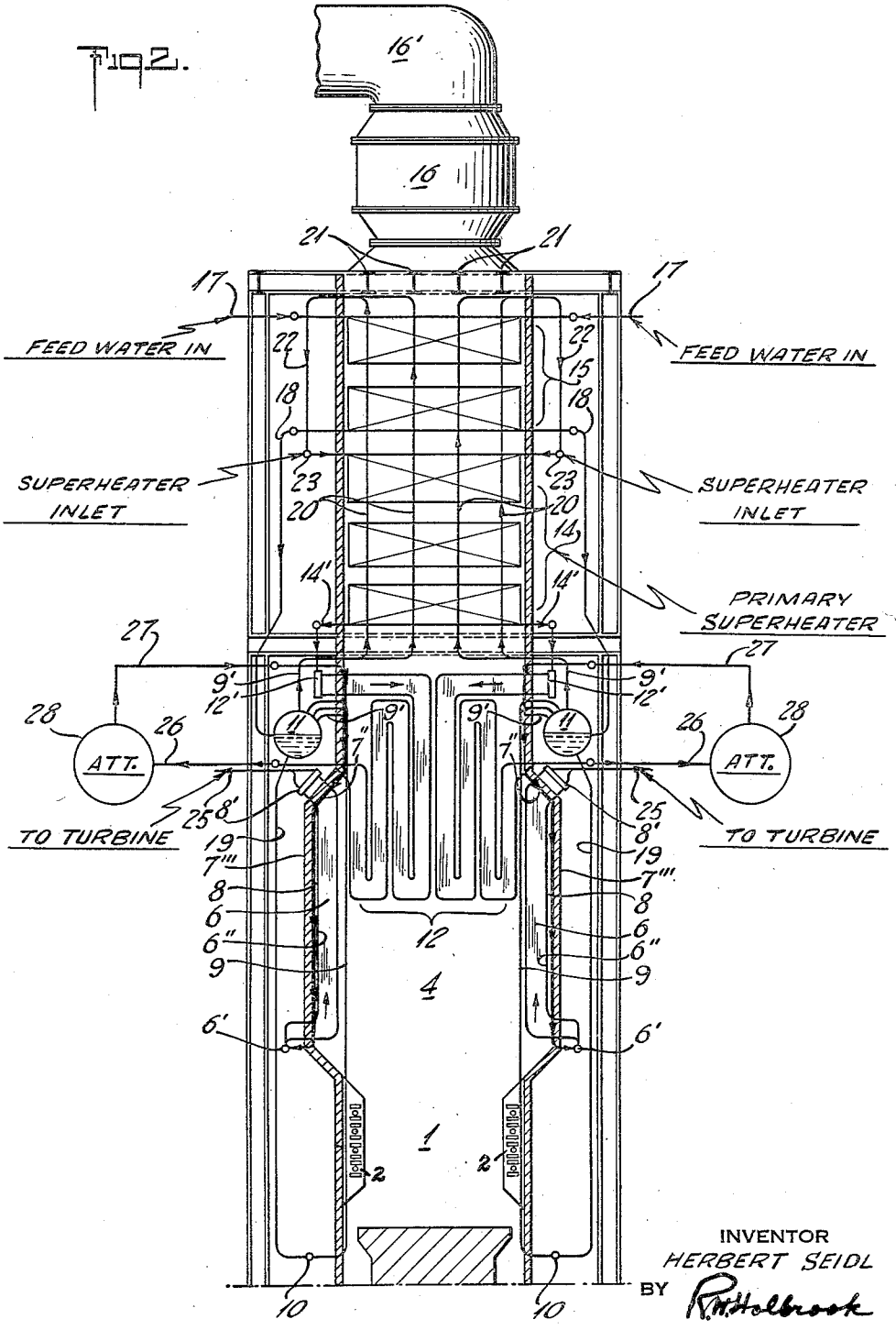


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Fig 2.



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RADIANT VAPOR GENERATOR WITH RADIANT SUPERHEATER IN FURNACE WALL QUIESCENT ZONES

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3 Claims. (Cl. 122—481)

This invention relates to the high temperature vapor unit involving a high temperature furnace with vapor generating wall tubes included therein, in combination with a superheater including parallel superheater tube platens disposed in recesses in the furnace walls at positions beyond the burner zone. These superheater platens effect high temperature superheating of vapor mainly by heat radiantly transmitted from a centrally disposed high temperature section of the furnace to a relatively quiescent zone.

Vapor generating and superheating units of the type involved in this invention are required to superheat steam to high temperatures of the order of 1000 to 1100° F. and this requirement necessitates very high combustion gas temperatures. Also, when the pertinent high temperature superheating is effected by heat radiantly transmitted from the products of combustion from the burning of an ash bearing fuel such as pulverized coal, it is important that the deposition of combustion particles on the superheater tubes be minimized in the interest of high availability of the vapor generating and superheating units.

In one embodiment of the invention, the pertinent vapor generating and superheating unit includes a vertically elongated furnace having corner burners in the lower part of the furnace for tangentially firing the furnace. In this embodiment, the high temperature radiant superheater has its upright parallel platens disposed in a recess or recesses in one or more of the furnace walls at positions above the burner zone. The high temperature radiant superheater is thus disposed laterally and well out of the path of gas flow in the main or highest temperature combustion zone. The furnace gas outlet is preferably at the upper part of the furnace, and, interposed between this outlet and the high temperature radiant superheater, is a convection heating section preferably including a primary convection superheater from which steam is passed to the high temperature radiant superheater in the furnace recess. This convection section also includes an economizer beyond the primary superheater with reference to gas flow. In this pertinent unit, a baffle or arch may be added providing projections into the furnace at a position between the radiant superheater and the fuel burning means.

In the pertinent type of vapor generating and superheating unit, the tangential firing of the furnace by corner burners results in the disposition of a main combustion zone and a zone of maximum flow of combustion products centrally of the furnace, and this furnace firing action may be spoken of as firing the furnace in a coring manner.

To minimize the deposition of solids upon the superheater platens, they are not only located laterally of the main flow of combustion products, but the superheater platens are presented by upright tubes, and the platens are widely spaced so as to prevent any bridging over of successive platens by the deposition of slag or other combustion solids upon the superheater tubes. This wide

spacing of the successive superheater platens and the disposition of the superheater platens in a comparatively quiescent or stagnant zone relative to the flow of combustion products results in the optimum prevention of decreases in availability of the unit. Because the superheater platens are disposed in the recesses, they will not be swept by particle laden gases to any such substantial degree as would be involved in other arrangements.

The invention is particularly set forth in the subjoined claims, but for a complete understanding of the invention and its advantages or use, recourse should be made to the following description which refers to similarly characterized components shown in the accompanying drawings.

In the drawings:

Fig. 1 is a vertical section of a vapor generating and superheating unit in which inwardly projecting refractory arches are disposed between the burner zone and the superposed zone of the radiant superheater; and

Fig. 2 is a vertical section of a similar unit involving a burner zone which is restricted in horizontal cross-section, as compared to the horizontal cross-section of the superposed radiant superheater zone.

The vapor generating and superheating unit illustrated in the drawings has furnace walls forming firing chamber 1 at the lower end of the unit. It is preferably fired by tilting corner burners 2 projecting pulverized fuel streams directed transversely of the firing chamber. At the bottom of the firing chamber is a slag melting or slag receiving floor or table 3 composed of refractory material of high heat resistance.

Fig. 1 shows the radiation chamber 4 as having outwardly jutting and inwardly opening wall recesses 8 at the bottom of each of which there is an arch 7 having an upper surface 7' downwardly inclined toward the middle of the firing chamber 1. These wall recesses have upwardly inclined upper wall surfaces 7'' joined to the arches 7 by the upright walls 7'''. Within the recesses are disposed upright platens 6 of high temperature radiant superheater tubes with the platens set edgewise toward the middle of the firing chamber, these platens receiving superheated vapor from lower headers 6', which, in turn, receive superheated vapor by reason of their connection with the superheater supply wall tubes 6'' extending along the inner surfaces of the walls 7''' of the wall tube recesses. The superheater platens have their outlet ends connected to the headers 8' from which superheated steam flows through the lines 25 to a point of use.

Disposed transversely of the gas flow upwardly from the radiation chamber 4 are dependent tubular platens of a second radiant superheater 12. The superheater tubes of these platen receive superheated steam from the banks of tubes 14 forming the primary or convection superheater of the convection fluid heating section disposed in superposed relation to the firing and radiant chambers. Superheated steam flows through the tubular connections 14' at the base of the convection superheater (or primary superheater) 14 to the inlet headers 12' which are connected to the inlet ends of the tubes constituting the dependent platens of the second (or intermediate) superheater 12.

Above the convection superheater 14 are banks of tubes extending across upward gas flow and forming the economizer 15. The tubes of this economizer receive feed water through the inlet connections 17, the feed water flowing downwardly from the bottom of the economizer through the tubes 18 to the vapor and liquid drums 11. Leading downwardly from the water or liquid spaces of these drums are downcomer tubes 19 connected at their lower ends to the headers 10 disposed adjacent the level

of the lower end of the firing chamber 1. Leading into the firing chamber and then upwardly along its walls are vapor generating tubes 9 at least some of which continue as screen tubes between the center of the radiation space 4 and the tubular platens 6 of the first radiant superheater. These vapor generating tubes continue upwardly along the wall of the gas pass to the level of the upper parts of the drums 11 where they are connected to the vapor or steam spaces of those drums by the circulators 9'.

Steam or vapor flows from the upper portions or steam spaces of the drums 11 through the saturated super heater supply tubes 9' to the upright superheater and economizer supporting tubes 20 preferable hung from the steelwork elements 21 and disposed between adjacent platens of the convection superheater and economizer banks of tubes to support the latter.

From a level just below the steelwork elements 21, the steam flow continues outwardly of the gas pass and then downwardly through the tubes or tubular sections 22 to the inlet headers 23 for the convection superheater 14.

Above the economizer is an air heater 16, preferably of the regenerative type heated by the gasses as they pass to the flue 16'.

It will be noted that the firing chamber 1 of Fig. 2 is of a horizontal cross-section less than the cross-section of the radiation chamber 4. This arrangement enhances the coring manner in which the furnace is fired when tangentially firing corner disposed pulverizer fuel burners are utilized. With this operation, there is an upright central zone of highest temperature in the firing chamber and in the radiation chamber. This zone may be considered as the main combustion zone, and also a central zone of maximum furnace temperature, from which heat is radiated to the superheater platens 6 disposed out of the main path of the upwardly flowing gases. When pulverized coal is utilized as a fuel, this arrangement, and method of operation, minimizes slagging of the tubes of the superheater platens 6 and thereby promotes maximum availability and optimum heat transfer conditions. The vertical disposition of the super-heater platen 6 and the arrangement of the recesses 8 with their inclined lower surface 7' also enhances the downward separation and removal of any solid particles which may enter the superheater wall recesses as a result of the firing of the furnace with this type of fuel.

Although the invention has been described with reference to the details of preferred embodiments, 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 vapor generating and superheating unit, means forming a firing chamber at the bottom of the unit, means forming a radiation chamber above the firing chamber and having a horizontal cross-section substantially greater than that of the firing chamber, the radiation chamber having jutting-out wall portions, corner burners tangentially firing the firing chamber with a slag forming fuel in a coring manner with the combustion products passing freely in a main gas flow path centrally up through the radiation chamber, a first radiant superheater in the jutting-out wall portions of the radiation chamber and laterally of the main path of the gas flow from the firing chamber, a second radiant super-heater having platens across upward gas flow from the radiation chamber and disposed edgewise toward oncoming combustion gases, tubular fluid heating means disposed across gas flow directly upward from the second superheater, and wall

vapor generating tubes connected to the superheaters and forming a tubular screen between the main gas flow path and the first radiant superheater.

2. A steam generating and superheating unit comprising vertically extending walls arranged to define a lower combustion chamber and a communicating superjacent radiation chamber substantially in vertical alignment therewith and having a heating gas outlet at its upper end, a plurality of pulverized slag-forming fuel burners spaced about the wall portions defining said combustion chamber and arranged to burn slag-forming fuel in suspension, said burners producing a stream of heating gas flowing in a coring manner in a main gas flow path upwardly and axially through said combustion and radiation chambers to said gas outlet, vertical wall portions defining said radiation chamber having recessed portions positioned laterally of said main gas flow path and extending substantially throughout the height of said radiation chamber, and a radiant steam superheater having a series of vertical tube platens transversely spaced in and wholly within said recessed wall portions, each of said tube platens having a plurality of vertically extending parallel tubes in lateral alignment in a plane normal to the corresponding radiation chamber wall portion.

3. A steam generating and superheating unit comprising vertically extending walls arranged to define a lower combustion chamber and a communicating superjacent radiation chamber substantially in vertical alignment therewith and having a heating gas outlet at its upper end, a plurality of pulverized slag-forming fuel burners spaced about the wall portions defining said combustion chamber and arranged to burn slag-forming fuel in suspension, said burners producing a stream of heating gas flowing in a coring manner in a main gas flow path upwardly and axially through said combustion and radiation chambers to said gas outlet, vertical wall portions defining said radiation chamber having recessed portions positioned laterally of said main gas flow path and extending substantially throughout the height of said radiation chamber, a radiant steam superheater having a series of vertical tube platens transversely spaced in and wholly within said recessed wall portions, each of said tube platens having a plurality of vertically extending parallel tubes in lateral alignment in a plane normal to the corresponding radiation chamber wall portion, and a second radiant superheater having platens of vertically extending tubes positioned in said radiation chamber gas outlet with the lower ends of said platens arranged edgewise to the main gas stream and at a level below the upper ends of the superheater tube platens in said recessed wall portions.

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