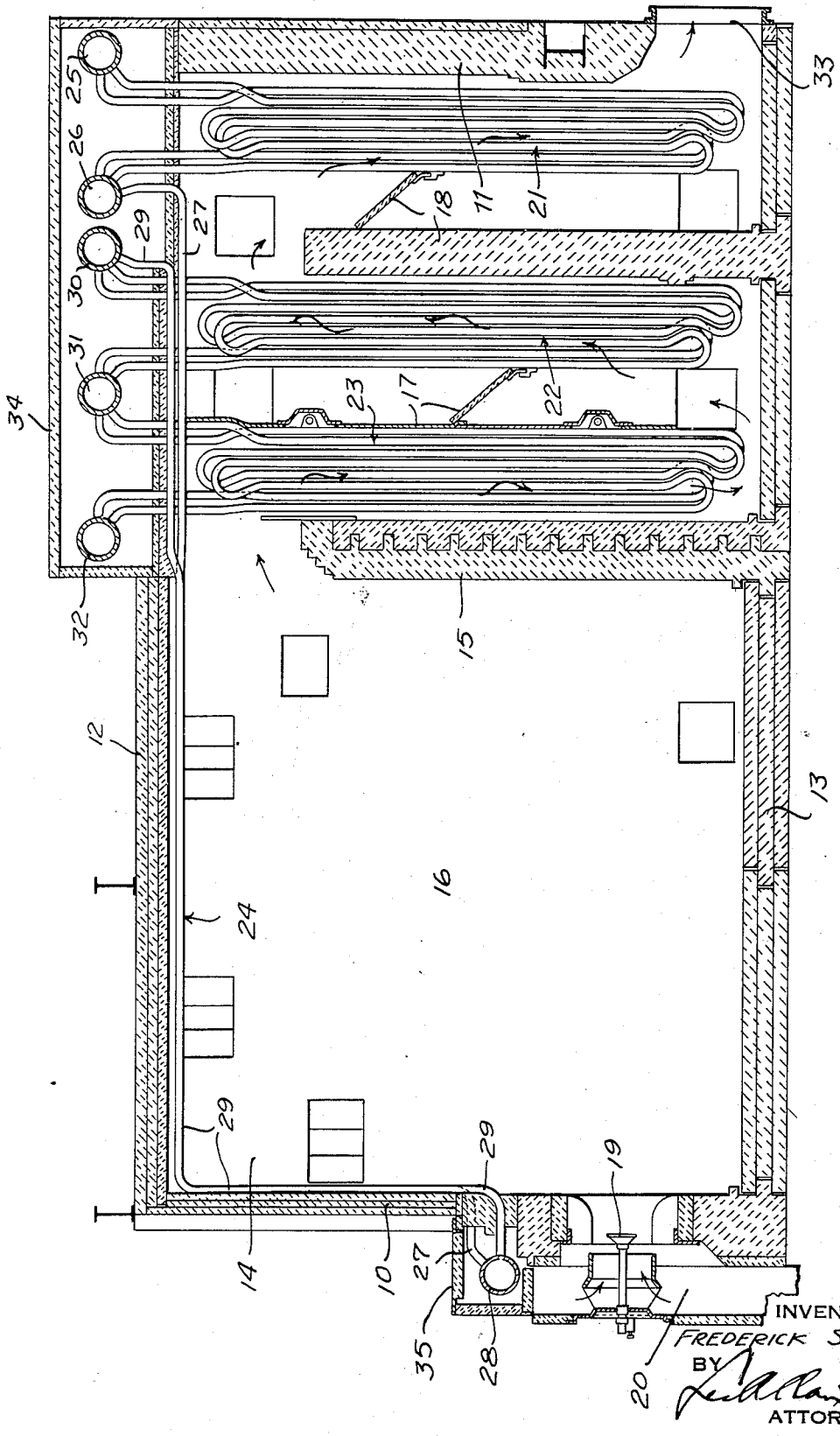
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SUPERHEATER

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SUPERHEATER

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This invention relates to the superheating of vapors, and more particularly pertains to separately fired superheaters.

The invention provides a separately fired vapor superheater having a plurality of sections connected for series flow of vapor therethrough, at least one section being a radiant heat absorbing section which is disposed between convection heat absorbing sections with respect to the path of flow of the vapor being superheated. Superheaters embodying the invention possess numerous advantages which will be mentioned hereinafter.

The invention will be understood from the following description when considered in connection with the accompanying drawing forming a part thereof, and in which the single figure is a longitudinal vertical sectional view of a separately fired steam superheater embodying the invention.

Referring to the drawing, the separately fired superheater illustrated, has a setting comprising a front wall 10, a rear wall 11, a roof 12, a floor 13, a side wall 14, and an opposite side wall not shown. A bridge wall 15 divides the interior of the setting into a furnace 16 and a convection heating chamber between the rear wall 11 and the bridge wall, the heating chamber being divided into three gas passes by baffle means 17 and 18. One or more burners 19 which fire the furnace 16 are disposed in the lower portion of the front wall 10. Air is supplied to these burners through an air duct 20.

In the form of the invention shown, the superheater has three convection sections 21, 22 and 23 and one radiant heating section designated 24. These sections are connected for series flow of the steam therethrough, with the radiant section 24 connected between convection sections 21 and 22. Each convection section is arranged for one pass of the steam therethrough, and the radiant section is arranged for two passes of the steam therethrough.

Steam enters inlet header 25 of convection section 21 which is disposed adjacent rear wall 11 of the third gas pass of the convection heating chamber, and after passing through the tubes of section 21, flows into outlet header 26, from which it flows through tubes 27 disposed along the roof of the setting above the convection sections 22 and 23 and along the roof of the furnace 16 and the upper portion of front wall 10 to intermediate header 28, from which the steam flows through tubes 29 to the inlet header 30 of the second convection section 22. From inlet header 30, the steam flows through section 22 to header 31 and therefrom through the tubes of convection section 23 to the outlet header 32 of the superheater. Gases produced by the one or more burners 19, flow through furnace 16 in radiant heat absorbing relationship with the tubes of the radiant section 24 and over the top of bridge wall 15, over the tubes of section 23 in a downward and rearward direction, thence upwardly and rearwardly over the tubes of section 22, and thereafter over the top of baffle 18 and downwardly and rearwardly over section 21, and from the setting through outlet 33. The tubes of the radiant heat absorbing section 24 are disposed substantially out of the path of the products of combustion flowing through the setting.

The inlet and outlet headers of the front section are enclosed in a removable housing 34, and intermediate header 28 of the radiant section 24 is enclosed in a removable housing 35. The portion of roof 12 below the housing 34 is also removable to provide access to the convection sections of the superheater.

With this arrangement, with the radiant heat absorbing surface in the furnace, the unit may be operated with lower excess air than ordinarily, while still maintaining reasonable furnace and gas temperatures entering the convection sections, thereby increasing the overall efficiency of the superheater. The location of the radiant heating section between convection heating sections, permits operation of the superheater without obtaining high steam temperatures in the radiant heating section, thus eliminating the necessity for the use of expensive alloy tubing in the radiant heating section, and in some instances making it possible to eliminate alloy tubing entirely, depending upon the final steam temperature which the unit is required to deliver. The inlet or first convection section 21 is disposed in the coolest gas zone, thus increasing the efficiency of the unit. The steam flow through all of the convection sections is countercurrent to the gas flow in all of the gas passes.

With the radiant heating elements extending above convection sections 22 and 23, as shown, it is possible to employ a simple roof construction which eliminates any complicated suspended arch in this location and permits relatively easy removal of the convection elements. The use of headers for connecting the convection and radiant heating sections, tends to cause a thorough mixing of the steam between each section, thus providing even distribution of steam to the superheater elements and preventing the elements from

overheating due to stratification of the steam flow.

Changes may be made in the form, location and relative arrangement of the several parts of the superheater disclosed without departing from the principles of the invention. In view thereof, it will be understood that the invention is not to be limited excepting by the scope of the appended claims.

What is claimed is:

1. A separately fired vapor superheater having a setting, means for producing products of combustion in the setting, and a plurality of heat absorbing sections in the setting connected for series flow of vapor therethrough, at least one section being located to absorb radiant heat from said products of combustion, other sections being disposed to absorb convection heat from said products of combustion, the at least one radiant section being disposed between convection sections with respect to the flow of the vapor to be superheated, the convection sections and the at least one radiant section disposed therebetween being positioned in relation to the flow of the gases of combustion so that said gases flow over one of the convection sections after flowing in heat exchange relationship with the radiant section and the other convection section, said one convection section receiving vapor prior to passage thereof into the radiant section.

2. A separately fired vapor superheater having a setting, means for producing products of combustion in the setting, a plurality of tubular heat absorbing sections in the setting, at least one section being located to absorb radiant heat from said products of combustion, other sections being disposed to absorb convection heat from said products of combustion, and a header for connecting each pair of succeeding sections in the path of flow of the vapor to be superheated, the at least one radiant section being disposed between convection sections with respect to the flow of the vapor to be superheated, the convection sections and the at least one radiant section disposed therebetween being positioned in relation to the flow of gases of combustion so that said gases flow over one of the convection sections after flowing in heat exchange relationship with the radiant section and the other convection section, said one convection section receiving vapor prior to passage thereof into the radiant section.

3. A separately fired vapor superheater having a setting, means for producing products of combustion in the setting, and a plurality of heat absorbing sections in the setting connected for series flow of vapor therethrough, at least one section being located to absorb radiant heat from said products of combustion, other sections being disposed to absorb convection heat from said products of combustion, the at least one radiant section being disposed between convection sections with respect to the flow of the vapor to be superheated and in heat exchange relationship with the products of combustion of highest temperature in the setting, the vapor to be superheated being delivered to a convection section located in heat exchange relationship with the products of combustion of lowest temperature in the setting.

4. A separately fired vapor superheater comprising a setting, a furnace in the setting, means for firing the furnace, a radiant vapor superheating section in the furnace, and a plurality of convection vapor superheater sections in the setting outside said furnace, said convection superheater sections being connected for series flow of vapor therethrough with the radiant section connected between convection sections with respect to the flow of vapor to be superheated, the convection section and the radiant section disposed therebetween being positioned in relation to the flow of the gases of combustion so that said gases flow over one of the convection sections after flowing in heat exchange relationship with the radiant section and the other convection section, said one convection section receiving vapor prior to passage thereof into the radiant section.

5. A separately fired vapor superheater comprising a setting, a furnace in the setting, means for firing the furnace, a radiant vapor superheater section in the furnace, the setting having an outlet for the products of combustion produced in the furnace, means providing a plurality of passes for the products of combustion flowing from the furnace to said outlet, and a convection vapor superheater section in each of said passes, said superheater sections being connected for series flow of vapor therethrough with the radiant section connected between convection sections with respect to the flow of vapor to be superheated, the convection section and the radiant section disposed therebetween being positioned in relation to the flow of the gases of combustion so that said gases flow over one of the convection sections after flowing in heat exchange relationship with the radiant section and the other convection section, said one convection section receiving vapor prior to passage thereof into the radiant section.

6. A separately fired vapor superheater comprising a setting, a furnace in the setting, means for firing the furnace, a radiant vapor superheater section in the furnace, the setting having an outlet for the products of combustion produced in the furnace, means providing a plurality of passes for the products of combustion flowing from the furnace to said outlet, and a convection vapor superheater section in each of said passes, said superheater sections being connected for series flow of vapor therethrough with the radiant section connected between convection sections with respect to the flow of vapor to be superheated, the convection section to which the vapor to be superheated is delivered being in the last of said passes.

7. A separately fired vapor superheater comprising a setting, a furnace in the setting, means for firing the furnace, a radiant vapor superheater section in the furnace, the setting having an outlet for the products of combustion produced in the furnace, means providing a plurality of passes for the products of combustion flowing from the furnace to said outlet, and a convection vapor superheater section in each of said passes, said superheater sections being connected by headers for series flow of vapor therethrough with the radiant section connected between convection sections with respect to the flow of vapor to be superheated, the convection section and the radiant section disposed therebetween being positioned in relation to the flow of the gases of combustion so that said gases flow over one of the convection sections after flowing in heat exchange relationship with the radiant section and the other convection section, said one convection section receiving vapor prior to passage thereof into the radiant section.

8. A separately fired vapor superheater comprising a setting, a bridge wall in the setting dividing the interior thereof into a furnace and a heating chamber, means for firing the furnace,

baffle means for dividing the heating chamber into a plurality of gas passes, the setting having a gas outlet connecting with the last gas pass, a convection superheater section in each of a plurality of said gas passes, a radiant superheater section having tubular members disposed adjacent at least one wall of the furnace, the vapor to be superheated being delivered to the convection section in the last gas pass, means for connecting said section in the last gas pass to the radiant section, and means for connecting said radiant section to a convection section in another of said gas passes.

9. A separately fired vapor superheater comprising a setting, a bridge wall in the setting dividing the interior thereof into a furnace and a heating chamber, means for firing the furnace, baffle means for dividing the heating chamber into a plurality of gas passes, the setting having a gas outlet connecting with the last gas pass, a convection superheater section in each of a plurality of said gas passes, a radiant superheater section having tubular members disposed adjacent at least one wall of the furnace, the vapor to be superheated being delivered to the convection section in the last gas pass, means for connecting said section in the last gas pass to the radiant section, and means for connecting said radiant section to a convection section in another of said gas passes, parts of the tubular members of the radiant section being disposed above at least one of said convection sections.

10. A separately fired vapor superheater comprising a setting, a bridge wall in the setting dividing the interior thereof into a furnace and a heating chamber, means for firing the furnace, baffle means for dividing the heating chamber into a plurality of gas passes, the setting having a gas outlet connecting with the last gas pass, a convection superheater section in each of a plurality of said gas passes, a radiant superheater section having tubular members disposed adjacent at least one wall of the furnace, the vapor to be superheated being delivered to the convection section in the last gas pass, a header for connecting said section in the last gas pass to the radiant section, and a header for connecting said radiant section to a convection section in another of said gas passes.

11. A separately fired vapor superheater comprising a setting, a bridge wall in the setting dividing the interior thereof into a furnace and a heating chamber, means for firing the furnace, baffle means for dividing the heating chamber into three gas passes, the setting having a gas outlet connecting with the last gas pass, a convection superheater section in each gas pass, a radiant superheater section having tubular members disposed adjacent the roof of the furnace, the vapor to be superheated being delivered to the convection section in the last gas pass, a header for connecting the section in the last gas pass to the radiant section, a header for connecting the radiant section to the convection section in the second gas pass, and a header for connecting the convection section last mentioned to the convection section in the first gas pass.

12. A separately fired vapor superheater comprising a setting, a bridge wall in the setting dividing the interior thereof into a furnace and a heating chamber, means for firing the furnace, baffle means for dividing the heating chamber into three gas passes, the setting having a gas outlet connecting with the last gas pass, a convection superheater section in each gas pass, a radiant superheater section having tubular members disposed adjacent the roof of the furnace, the vapor to be superheated being delivered to the convection section in the last gas pass, a header for connecting the section in the last gas pass to the radiant section, a header for connecting the radiant section to the convection section in the second gas pass, and a header for connecting the convection section last-mentioned to the convection section in the first gas pass, parts of the tubular members of the radiant section being disposed above the convection sections in the first and second gas passes.

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