

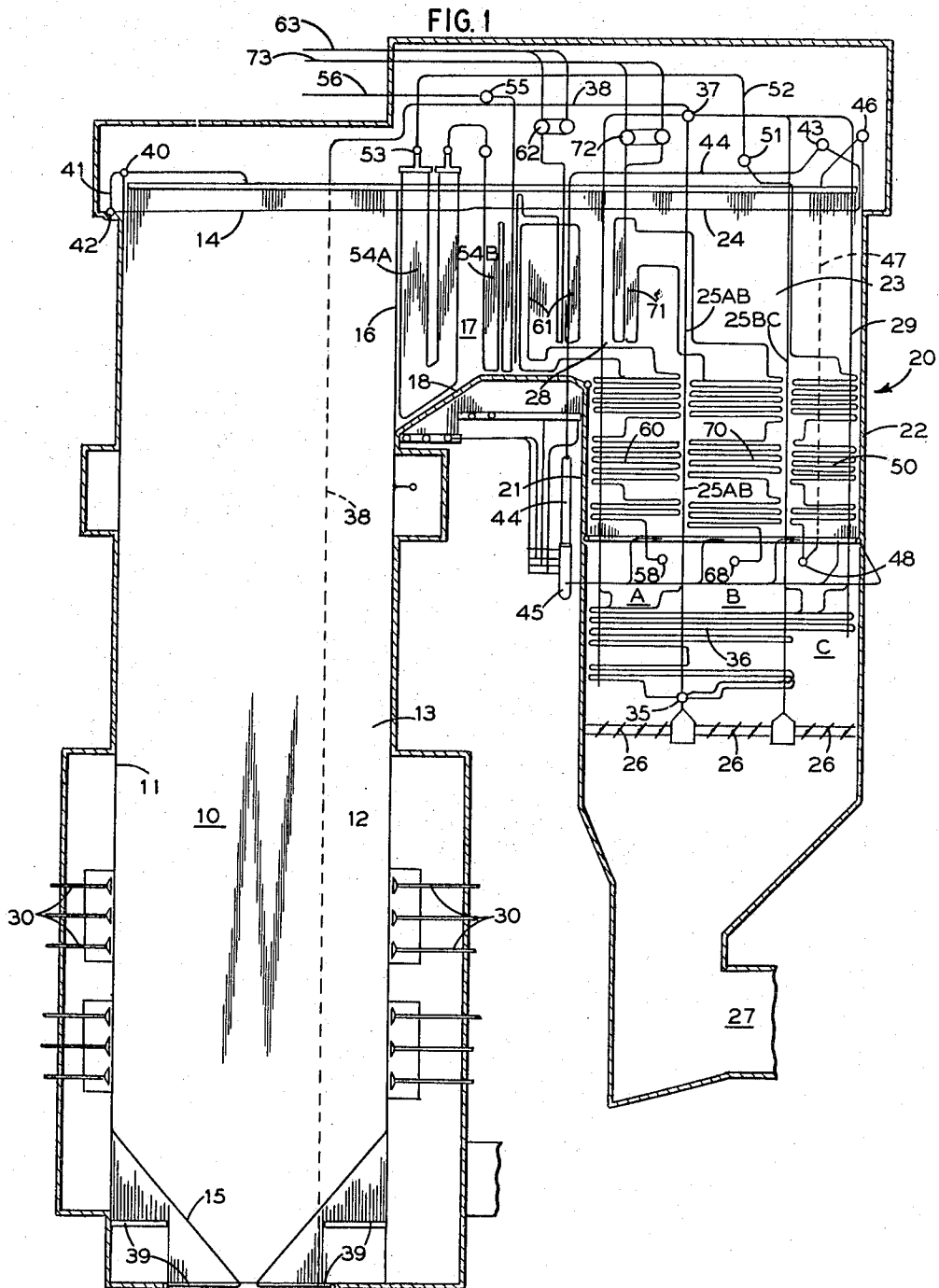
March 21, 1967

W. A. HANSEN ET AL  
VAPOR GENERATOR HEATING GAS PASS TUBE SUPPORT  
AND PARTITION WALL CONSTRUCTION

3,310,041

Filed Aug. 4, 1965

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FIG. 2

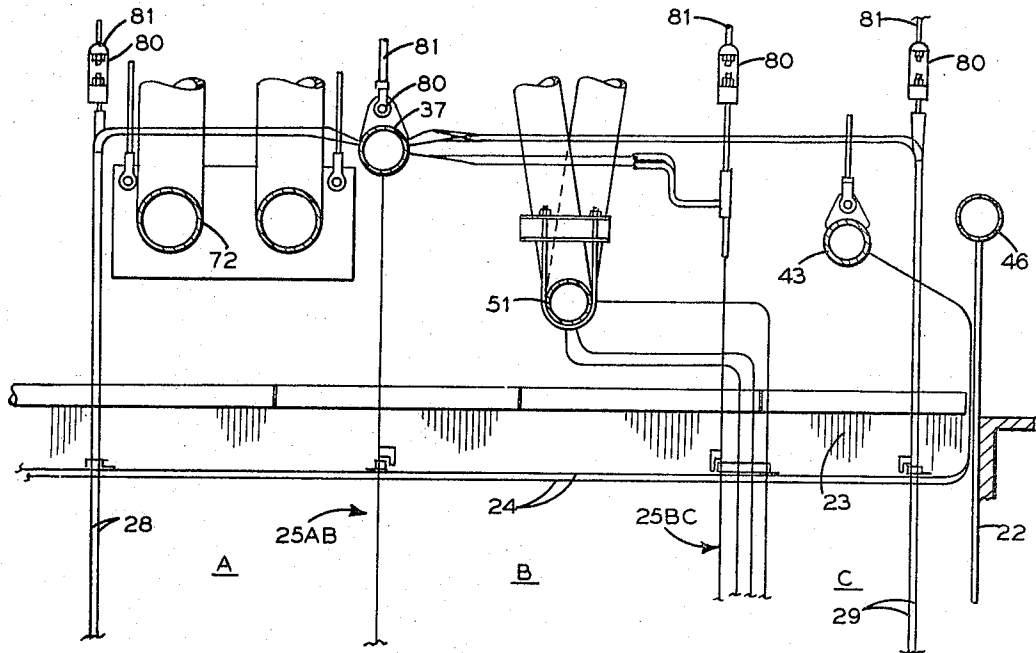
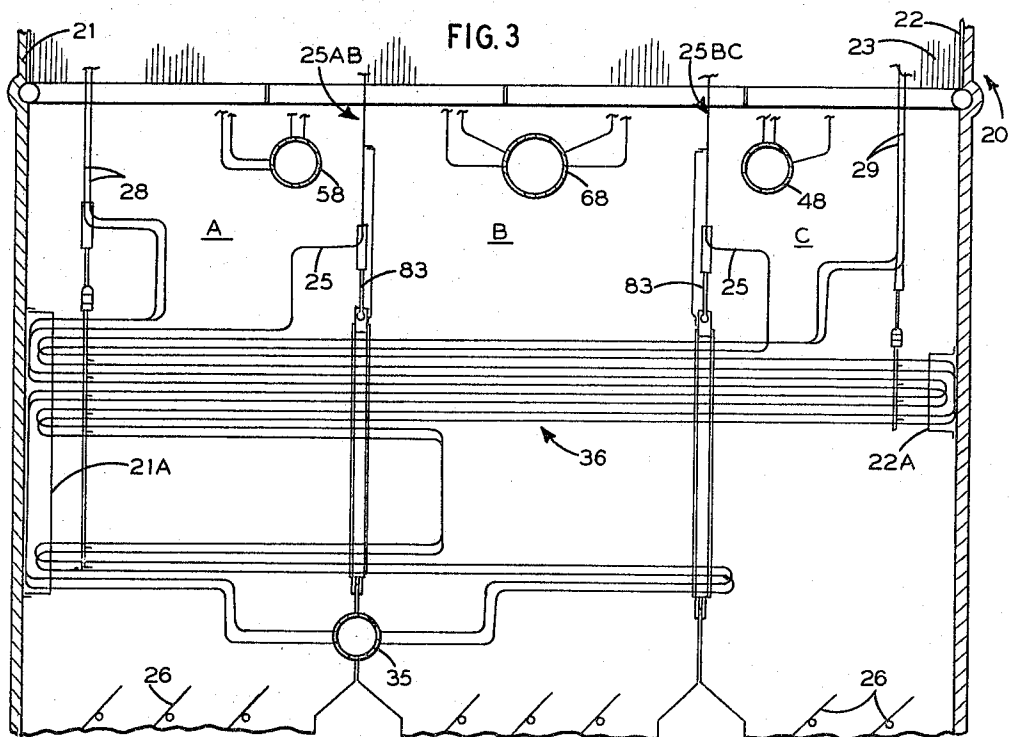


FIG. 3



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FIG. 4

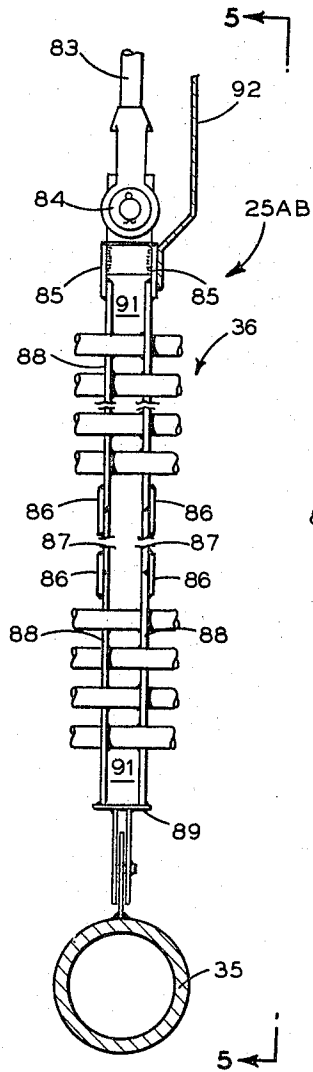
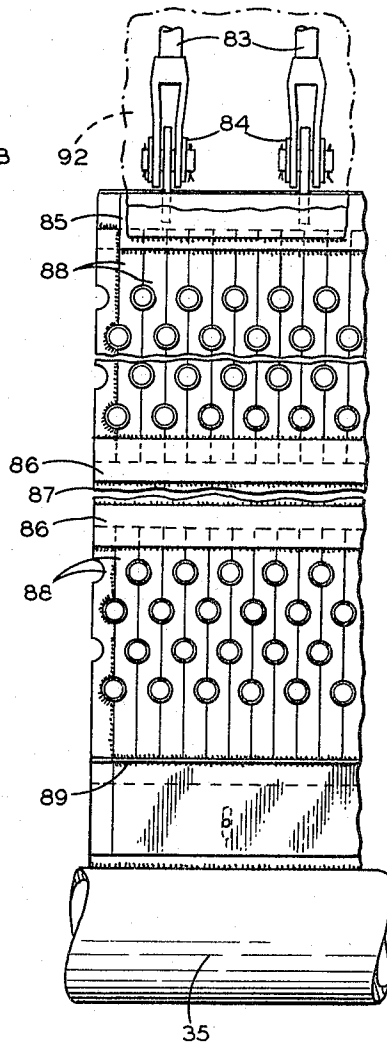


FIG. 5





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**VAPOR GENERATOR HEATING GAS PASS TUBE SUPPORT AND PARTITION WALL CONSTRUCTION**

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8 Claims. (Cl. 122-510)

This invention relates generally to vapor generating units and more particularly to an improved arrangement for the support of fluid cooled tubular heat exchange elements within the divided flow convection heating gas pass of a high capacity vapor generating unit.

It is known in the vapor generator art to provide, as a means of final steam temperature control, a plurality of parallel flow convection gas passes with dampers arranged to proportion the flow of heating gases therethrough so that the heat absorption of the tubular heating surfaces positioned in the parallel flow gas passes can be regulated. In order to support the tubular heat exchange banks within the multiple gas passes, it has been customary to provide fluid-cooled support tubes in the convection pass, which tubes also have advantageously been used to form a part of the convection pass partition wall or walls. Since the convection pass is normally bounded by fluid-cooled tubes, and since the tubular heat exchange banks positioned within the convection pass are normally supported in part by the convection pass walls and in part by the aforementioned support tubes, it has been considered necessary heretofore that the support tubes be in parallel fluid flow relation (with respect to cooling fluid) with the convection pass wall tubes to avoid the problems attendant with differential linear thermal expansion between the two support members, i.e. the convection pass walls and the support tubes. In such a conventional divided convection pass arrangement the partition wall or walls have customarily been formed by filling the intertube spaces of the support tubes with refractory tile or studs and refractory material to render the partition walls gas impervious.

Although this conventional divided convection pass arrangement has proved satisfactory in service, the refractory filled partition wall design has been found to require a considerable amount of maintenance because of its exposure to relatively high temperature gases, i.e. up to about 1500° F. The refractory filler material has been found to be prone to cracking and deterioration occasioned by the expansion and contraction of pressure parts, which deterioration allows leakage through the convection pass partition walls, thus reducing the steam temperature control range normally obtainable by manipulation of the proportioning dampers. Moreover, in later vapor generator design studies, especially those of the once-through type vapor generator, it has been found that, because of furnace design considerations restricting the available mass flow of cooling fluid for the convection pass boundary walls, divided convection pass heat exchange tube bank support designs of the above-described conventional type are not possible.

It is therefore the major object of this invention to provide an improved divided convection pass construction and arrangement wherein the above-mentioned cooling fluid mass flow design limitation is eliminated and the maintenance problems attendant with the construction of refractory filled convection pass division walls are eliminated.

To accomplish these and other objects that will become apparent hereinafter, in accordance with the invention, a top supported vapor generator is provided with walls

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forming an upright furnace chamber having a heating gas outlet. Means are provided for burning fuel in the furnace chamber to produce high temperature heating gases. Walls including convection heat absorbing fluid heating tubes form an upright convection gas pass which communicates at its upper end with the heating gas outlet of the furnace and is laterally adjacent thereto. The convection pass is divided by one or more partition walls into a plurality of parallel down-flow gas sections. A vapor superheating tube bank is positioned in one of these gas sections, and a vapor reheating tube bank is preferably positioned in another of the gas sections. An economizer tube bank extends substantially wholly across the convection pass below the vapor superheating and reheating tube banks, and dampers are disposed below the economizer tube bank for proportioning the heating gas flow through the parallel gas sections. The weight of the economizer and all of the fluid heating tube banks within the parallel gas flow sections is supported, substantially free of load-bearing attachment to the convection pass boundary walls, by a plurality of economizer outlet tubes extending from the economizer tube bank upwardly through the convection pass. Some of the economizer outlet tubes are arranged in side-by-side parallel relationship and are rigidly weld-united along at least a portion of their lengths to form a gas impervious tubular panel wall portion of the partition wall above the economizer tube bank. One end of the vapor reheating and superheating tube banks is connected by support lugs to the tubular panel wall portion of the partition wall. Another portion of the economizer outlet tubes is disposed adjacent the other ends of the vapor superheating and reheating tube banks, and support lugs are provided to connect the vapor reheating and superheating tube banks to the last mentioned portion of the economizer outlet tubes. The portion of the division wall extending through the economizer tube bank includes a plurality of scalloped support bars disposed in substantially the same plane as the weld-united economizer outlet tubes and attached in load-bearing relationship to the economizer outlet tubes and engaged with the tubes of the economizer tube banks for the support thereof.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

In the drawings:

FIG. 1 is a partially diagrammatic sectional side view of a vapor generating and superheating, double-reheat unit embodying the invention;

FIG. 2 is an enlarged partial sectional side view of the upper end of the convection gas passage of the unit shown in FIG. 1;

FIG. 3 is an enlarged partial sectional side view of the economizer and lower portion of the convection gas passage of the unit shown in FIG. 1;

FIG. 4 is an enlarged view of a portion of an economizer tube support and partition wall shown in FIG. 3;

FIG. 5 is a fragmentary view taken along line 5-5 of FIG. 4;

FIG. 6 is an enlarged sectional side view of a portion of a fluid heating tube bank showing the typical support thereof in the convection gas passage of the unit of FIG. 1;

FIG. 7 is a sectional view taken along line 7-7 of FIG. 6;

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FIG. 8 is a sectional view taken along line 8—8 of FIG. 6; and

FIG. 9 is an enlarged fragmentary sectional view taken along line 9—9 of FIG. 6 and showing the seal arrangement between an end of a convection pass partition wall and a convection pass side wall.

In the drawings, the invention has been illustrated as embodied in a top-supported, forced flow, once-through, supercritical vapor generating and superheating unit designed to burn fuel for the production of over 2 million pounds of steam per hour at 3880 p.s.i and 1000° F., with two subsequent stages of reheat of slightly higher temperatures. It will be understood that, although described in terms of a specific vapor generator, the invention disclosed herein is not intended to be limited thereby and can be advantageously used in other types of fluid heating units.

Referring particularly to FIG. 1, the main portions of the unit illustrated include an upright furnace chamber 10 of substantially rectangular horizontal cross-section defined by a front wall 11, a rear wall 12, and side walls 13, a roof 14, and a hopper floor 15 and having a gas outlet 16 at its upper end opening to a horizontally extending gas pass 17 of rectangular vertical cross-section formed by extensions of the furnace roof 14 and side walls 13 and a floor 18. The boundary walls of the furnace chamber 10 are formed by fluid heating tubes with insulation and metallic casing secured externally thereto. The gas pass 17 communicates at its rear end with the upper end of an upright convection gas passage 20 of rectangular horizontal cross-section defined by a front wall 21, a rear wall 22, side walls 23, and a roof 24. As will be described hereinafter in greater detail, the convection gas passage 20 is divided into three parallel flow gas sections, A, B and C, by a pair of vertically disposed spaced partition walls 25AB and 25BC. Disposed at the lowermost ends of the three parallel flow gas sections are dampers 26, and the lowermost end of the convection gas passage 20 is formed with an outlet 27.

Fuel and combustion air are introduced via burners 30 into the furnace chamber 10 wherein combustion is completed to produce high temperature heating gases which pass upwardly through the furnace chamber 10 and through the gas outlet 16 into the horizontal gas pass 17. The hot gases then flow downwardly in parallel flow relationship through the gas sections A, B and C of the convection gas passage 20 to the outlet 27, from which the gas may be conducted to an air heater and a cleaning apparatus (neither of which are shown) before being discharged to the atmosphere. It will be recognized that by proper manipulation of the dampers 26 the gas flow through the parallel flow sections A, B and C can be proportioned as desired.

Vaporizable heating fluid, as feedwater, is supplied by a high pressure feed pump (not shown) to the economizer inlet header 35, from whence the feedwater flows through the economizer 36 and upwardly in parallel through the tubes of the partition walls 25AB and 25BC and the stringer tubes 28 and 29 to the economizer outlet header 37. The heated feedwater is then conducted via line 38 downwardly to the lower end of the furnace chamber 10 where it is distributed to the furnace wall lower supply headers 39 for passage upwardly through the tubes lining the furnace chamber 10 to be collected subsequently in the collection header 40. The heating fluid is then transferred via line 41 to the roof supply header 42 from whence it flows through the tubes lining the roof 14 and the convection passage roof 24 to the roof collection header 43. The heating fluid is then transferred via line 44 to the distributor 45, from which it is apportioned to the various headers serving the tubes which line the upper portion of the convection pass front, rear and side walls 21, 22 and 23 and the boundary walls of the horizontal gas pass 17. The fluid is collected in the convection passage rear wall header 46 from which it passes down-

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wardly via line 47 into the primary superheater inlet header 48. The vaporized heating fluid then passes upwardly through the multiple tube bank primary superheater 50 disposed in the gas flow section C to the primary superheater outlet header 51. The superheated vapor is then transferred via line 52 to the secondary superheater inlet header 53 from which it is suitably distributed to flow serially through the secondary superheater tube banks 54A and 54B to the secondary superheater outlet header 55 for delivery to the high pressure turbine (not shown) via line 56. After a portion of the energy is extracted from the steam in the high pressure turbine, the steam is returned to the first stage reheater inlet header 58. The steam then flows upwardly through the multiple bank first stage reheater 60 and the final first stage banks 61 to the first stage reheater outlet headers 62 from which the reheated vapor is delivered via line 63 to the first stage or high pressure reheat turbine. The steam is then returned to the second stage reheater inlet header 68 for passage upwardly through the multiple bank second stage reheater 70 disposed in gas section B, and then through the final reheat tube bank 71 to the second stage reheater outlet headers 72 for delivery via line 73 to the second stage or low pressure reheat turbine.

Referring to FIGS. 2 and 3, the economizer 36 comprises a plurality of multi-looped horizontally disposed spaced tubes extending substantially wholly across the depth of the convection pass 20 between the front and rear walls 21 and 22. The return flow bends at the ends of the tubes of the economizer 36 adjacent the front and rear walls 21 and 22 are enclosed within shields 21A and 22A which prevent the bypassing of heating gases around the ends of the economizer 36. It should be noted that the shields 21A and 22A do not contribute materially to the support of the economizer 36.

Economizer outlet tubes extend upwardly from the economizer 36 through the convection passage 20 in four groups: the stringer support tubes 28 in the gas flow section A; the tubes 25 which form a portion of the partition wall 25AB; the tubes 25 which form a portion of the partition wall 25BC; and the stringer support tubes 29 in the gas flow section C. All of these economizer outlet tubes are connected at their upper ends for the discharge of heated feedwater into the economizer outlet header 37 which is disposed directly above and connected to the partition wall 25AB. The stringer tubes 28 and 29, the tubes 25 of partition wall 25BC, and the header 37 are each attached by suitable support brackets 80 to support rods 81 which connect with rigid structural steel members (not shown) disposed above the vapor generating unit.

The top-supported economizer outlet tubes 25 serve a dual function—they form a portion of the partition walls 25AB and 25BC; and they, in conjunction with the stringer support tubes 28 and 29 comprise the support elements for the tube banks of the primary superheater 50, the first stage reheater 60, the second stage reheater 70 disposed respectively in the gas flow sections C, A and B, and the tubular economizer 36.

Each of the partition walls 25AB and 25BC includes an upper fluid cooled portion and a lower portion, the junction of these portions being at the elevation at which the economizer outlet tubes 25 enter the planes of the partition walls. Above this elevation, and up to approximately the elevation of the floor 18 of the horizontal gas pass 17, the economizer outlet tubes 25 are arranged in co-planar side-by-side relationship and are weld-united along their lengths so as to form gas impervious fluid cooled panels which are portions of partition walls 25AB and 25BC. A portion of the cross-sectional view of the partition wall 25AB is shown in FIG. 9, wherein the tubes 25 are connected together by inter-tube web members or bars 25A; however, it should be recognized that the tubes could also be weld-united directly to each other so as to

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form a "tangent tube" gas impervious panel wall construction.

As shown generally in FIG. 3, and in greater detail in FIGS. 4 and 5, the lower portion of each partition wall is supported from the economizer outlet tubes 25 by a multiplicity of rods 83 spaced across the width of the convection gas passage 20. Each of the rods 83 is connected by a pin and clevis assembly 84 to a pair of horizontally disposed, spaced, parallel collecting bars 85 which extend between the convection gas passage side walls 23. Extending downwardly from each of the bars 85 is a plurality of scalloped bars 88 formed with staggered semi-circular notches and arranged with their longitudinal edges touching so as to form, in effect, an integral plate structure engaging and maintaining the alignment of the tubes of the economizer 36 for the support thereof. Intermediate the banks of economizer tubes, the scalloped bars 88 may suitably be welded to intermediate plates 87, and seal plates 86 may be used to strengthen the longitudinal butt weld between the ends of the scalloped bars 88 and the edges of the intermediate plates 87. Below the lowermost tube of the economizer 36, the scalloped bars 88 are welded to a horizontally disposed tie plate 89 which connects to the economizer inlet header 35 through an overlapping plate assembly 90 which is arranged to permit relative vertical movement between the economizer inlet header 35 and the depicted partition wall 25AB. The space 91 between the parallel rows of scalloped bars 88 may, if desired, be filled with a suitable refractory material to improve the seal between adjacent gas flow sections. A light gauge seal plate 92 extends from the collecting bars 85 to the upper fluid cooled portion of the partition wall to seal the wall in the vicinity of the rods 83 and the pin and clevis assemblies 84.

From the above, it can be seen that the lower portion of each partition wall also serves to support the weight of the economizer 36. It should also be noted that similar scalloped bar support assemblies are arranged beneath the stringer tubes 28 and 29 to thereby support the ends of the tubes of the economizer 36. The above described scalloped bar economizer support assembly is particularly well adapted to the modular prefabrication of the economizer sections so that the cost of field erection can be reduced and the benefits of shop quality control procedures can be utilized.

FIGS. 6 and 7 show the typical support of a tube bank within one of the gas flow sections, the particular tube bank shown being a portion of the first stage reheater 60 arranged within the gas flow section A between the convection passage front wall 21 and the partition wall 25AB. The tube bank includes a plurality of horizontally disposed multilooped tubes 60A arranged in a plurality of co-planar laterally spaced sections, one of which is shown in FIG. 6, and two (adjacent sections) of which are shown in FIG. 7. The end of the tube bank adjacent the partition wall 25AB is supported by conventional lugs 94 welded to the partition wall 25AB (which is formed of economizer outlet tubes 25 as described above) and engaging the lower corner of one of the tubes 60A. The other end of the tube bank is supported by economizer outlet stringer support tubes 28 which are laterally spaced from the convection passage front wall 21 within the gas flow section A. As shown in FIG. 7, each pair of stringer tubes 28 directly supports the adjacent pair of tube sections. The weight of the tube sections is picked up by a pair of brackets 95 subjacent the bank, which brackets are welded to the stringer tubes 28. Each of the superjacent tubes 60A in each pair of tube sections is successively supported and maintained in its proper vertical position by a conventional saddle support lug 96 which is secured, as by welding, to the tube directly under the tube being supported so as to allow the supported tube to slide relative thereto in its axial horizontal direction. The lateral position of the tubes 60A is maintained by an upper inverted U-shaped clamp 96A and a smaller

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similarly shaped lower clamp 96B, which clamps embrace a pair of tube sections. Spacer lugs 97 may be provided between adjacent tubes 60A on opposite sides of the stringer tubes 28 to maintain proper spacing between adjacent tube sections. Side spacers 98 project laterally outwardly from the pair of tube sections to maintain side spacing with respect to an adjacent pair of tube sections (not shown).

It should be noted that all of the tubular heat exchange banks within the gas flow sections A, B and C are supported within the convection gas passage 20 free of load-bearing attachment to the convection passage walls 21, 22 and 23. In this regard, referring to FIGS. 6 and 8, it should be observed that the outermost tubes 60A of each tube section are spaced a small distance from the convection passage 21 and are not connected thereto. A bumper plate 101 is welded to the tubes on the inside of the convection passage front wall 21, and bumper pads 102 are welded to the tubes 60A adjacent the bumper plate 101 on the outside of the outermost return bends so as to avoid the possibility of damage to any of the pressure parts due to seismic shock. Referring particularly to FIG. 9, at the end of the partition wall 25AB, a reasonable degree of sealing is effected between gas flow sections A and B by positioning the end tube of the partition wall 25AB between a pair of inwardly projecting vertically extending plates 104 which are welded to the convection passage side wall 23.

The above description has been in terms of a tube bank of the first stage reheater 60 disposed within gas flow section A; however, it should be recognized that the tube banks of the primary superheater 50 in gas flow section C are similarly constructed and supported, i.e., one end of the primary superheater tube banks 50 is connected to the partition wall 25BC and the other end is supported by stringer support tubes 29. The tube banks of the second stage reheater 70 in gas flow section B are supported at their ends by partition walls 25AB and 25BC in a manner similar to the support lug assembly of the in-board ends of the primary superheater and first stage reheater tube banks 56 and 60. It should also be recognized that the ends of both partition walls 25AB and 25BC are sealed with respect to their adjacent convection passage side walls 23 in the manner shown in FIG. 9 so as to reasonably inhibit the passage of flue gas between adjacent gas flow sections and to provide clearance for relative expansion movements between the partition walls 25AB, 25BC and the convection passage side walls 23.

The advantages of the above-described convection passage construction and arrangement are manifold. Since all of the tubular heat exchange surface within the convection passage 20 is supported by the economizer outlet tubes 25, 28 and 29, and since these tubes are at substantially the same temperature, expansion movements in the vertical direction are uniform and load distribution is consequently uniform at all operating conditions. Moreover, the supporting tubes (economizer outlet tubes 25, 28 and 29) are in a fluid flow circuit that is assured of positive flow under all firing conditions, thereby assuring adequate cooling of the support tubes under all operating conditions. The relatively low temperature of the support tubes results in greater cooling effect on the support lugs, thereby assuring their strength and immunity to high temperature corrosion; moreover, the number, complexity and alloy requirements of support lugs are reduced because of the cooling effect of the supporting tubes. Since, in the above-described arrangement, the convection passage walls 21, 22 and 23 do not carry any of the weight of the tubular heat exchange elements within the convection passage 20, these walls can be designed primarily for their heat exchange characteristics, thus resulting in savings of material in their design.

Although the invention has been described above in terms of a double-reheat vapor generator with a three section parallel flow convection gas passage, obviously other vapor generator designs are within the scope of the inven-

tion. For example, the invention could be embodied in a single reheat vapor generator having a two section parallel gas flow convection gas passage, with the primary superheater heat absorbing surface being disposed in one gas section, and the reheater heat absorbing surface being disposed in the other gas section.

While in accordance with the provisions of the statutes there is illustrated and described herein a specific embodiment of the invention, those skilled in the art will understand that changes may be made in the form of the invention covered by the claims, and that certain features of the invention may sometimes be used to advantage without a corresponding use of the other features.

What is claimed is:

1. In a vapor generator, wall means forming an upright gas pass, means supplying high temperature heating gases to said gas pass for flow therethrough, partition means dividing said gas pass into a plurality of parallel flow gas sections, a first fluid heating tube bank positioned in one of said gas sections, a second fluid heating tube bank positioned in another of said gas sections, a third fluid heating tube bank disposed below said first and second fluid heating tube banks and having portions thereof positioned within the gas sections in which said first and second fluid heating tube banks are positioned, damper means arranged for proportioning the flow of heating gases through said gas sections, and means for supporting the weight of the first and second tube banks and the third tube banks substantially free of load-bearing attachment to said wall means, said last named means including a plurality of tubes connected to said third tube bank and extending upwardly therefrom through said gas pass, at least a portion of said tubes being arranged in side-by-side parallel relation and being rigidly weld-united along at least a portion of their lengths to form a gas impervious wall portion of said partition means, means connecting said first and second and third fluid heating tube banks to said tubes forming said wall portion of said partition means in load-bearing relationship, and means for top supporting said tubes.

2. In a vapor generator, wall means forming an upright gas pass, means supplying high temperature heating gases to said gas pass for flow therethrough, partition means dividing said gas pass into a plurality of parallel flow gas sections, a vapor superheating tube bank positioned in one of said gas sections, a vapor reheating tube bank positioned in another of said gas sections, economizer tube bank means positioned in said gas pass below said vapor superheating and reheating tube banks, damper means arranged for proportioning the flow of heating gases through said gas sections, and means for supporting the weight of the economizer tube bank means and the vapor superheating and reheating tube banks substantially free of load-bearing attachment to said wall means, said last named means including a plurality of economizer tubes connected to and extending upwardly from said economizer tube bank means and through said gas pass, at least a portion of said economizer tubes being arranged in side-by-side parallel relation and being rigidly weld-united along at least a portion of their lengths to form a gas impervious wall portion of said partition means, means connecting said first and second fluid heating tube banks to said impervious wall portion of said partition means, and means for top supporting said economizer tubes.

3. In a vapor generator, wall means forming an upright gas pass, means supplying high temperature heating gases to said gas pass for flow therethrough, partition means dividing said gas pass into a plurality of parallel flow gas sections, a first fluid heating tube bank positioned in one of said gas sections, a second fluid heating tube bank positioned in another of said gas sections, a third fluid heating tube bank disposed below said first and second fluid heating tube banks and having portions thereof positioned within the gas sections in which said first and

second fluid heating tube banks are positioned, damper means arranged below said third fluid heating tube bank for proportioning the flow of heating gases through said gas sections, and means for supporting the weight of the first and second tube banks and the third tube banks substantially free of load-bearing attachment to said wall means, said last named means including a plurality of tubes connected to said third tube bank and extending upwardly therefrom through said gas pass to form a portion of said partition means, means connecting said first and second fluid heating tube banks to said tubes in load-bearing relationship, plate means forming another portion of said partition means connected to said tubes and extending downwardly therefrom and engaging the tubes of said third fluid heating tube bank for the support thereof, and means for top supporting said tubes.

4. In a vapor generator, wall means forming an upright gas pass, means supplying high temperature heating gases to said gas pass for flow therethrough, an economizer tube bank extending across said gas pass, partition means dividing said gas pass into a plurality of parallel flow gas sections, said partition means including a first portion comprising a plurality of economizer tubes connected to and extending upwardly from said economizer tube bank, at least a portion of said economizer tubes being arranged in side-by-side parallel relation and being rigidly weld-united along a portion of their lengths, and a second portion comprising a plurality of scalloped bars attached to said economizer tubes and extending downwardly therefrom in substantially the same plane as the weld-united tubes, said scalloped bars being connected together and engaged with the tubes of the economizer tube bank for the support thereof, a vapor superheating tube bank positioned in one of said gas sections above said economizer tube bank, a vapor reheating tube bank positioned in another of said gas sections above said economizer tube bank, and damper means arranged below said economizer tube bank for proportioning the flow of heating gases through said gas sections.

5. In a top supported vapor generator having a structural steel supporting frame thereabove, walls forming an upright furnace chamber having a heating gas outlet, means for burning fuel in said furnace chamber to produce heating gas, wall means including convection heat absorbing fluid heating tubes forming an upright convection gas pass laterally adjacent and communicating at its upper end with said heating gas outlet, partition means dividing said upright convection pass into a plurality of parallel down-flow gas sections, a vapor superheating tube bank positioned in one of the parallel gas flow sections, a vapor reheating tube bank positioned in another of the parallel gas flow sections, damper means for proportioning the heating gas flow through said parallel gas sections, an economizer tube bank extending across said convection gas pass below said vapor superheating and reheating tube banks, and means for supporting the weight of the economizer and vapor superheating and vapor reheating tube banks substantially free of load-bearing attachment to said convection pass wall means, said last named means including a plurality of economizer outlet tubes extending upwardly from said economizer tube bank and through said convection pass, means connecting said economizer outlet tubes to said supporting frame in a load-bearing relationship, a portion of said economizer outlet tubes being arranged in side-by-side parallel relationship and being rigidly weld-united along at least a portion of their lengths to form said partition means, means connecting said reheating and superheating tube banks at one end thereof to said partition means, another portion of said economizer outlet tubes being disposed adjacent the other ends of said superheating and reheating tube banks, and means connecting said reheating and superheating tube banks to the last named portion of said economizer outlet tubes.

6. In a top supported vapor generator having a struc-

tural steel supporting frame thereabove, walls forming an upright furnace chamber having a heating gas outlet, means for burning fuel in said furnace chamber to produce heating gas, wall means forming an upright convection gas pass laterally adjacent and communicating at its upper end with said heating gas outlet, partition means dividing said upright convection pass into a plurality of parallel down-flow gas sections, a vapor superheating tube bank positioned in one of the parallel gas flow sections, a vapor reheating tube bank positioned in another of the parallel gas flow sections, an economizer tube bank extending substantially wholly across said convection pass below said vapor superheating and reheating tube banks, damper means arranged for proportioning the heating gas flow through said parallel gas sections, and means for supporting the weight of said economizer and said vapor superheating and vapor reheating tube banks substantially free of load-bearing attachment to said convection pass wall means, said last named means including a plurality of economizer tubes extending upwardly from said economizer tube bank and through said convection pass, means connecting said economizer tubes to said supporting frame in load-bearing relationship, a portion of said economizer tubes being arranged in side-by-side parallel relationship and being rigidly weld-united along at least a portion of their lengths to form a tubular panel wall portion of said partition means above said economizer tube bank, means connecting one end of said reheating and superheating tube banks to said tubular panel wall portion, another portion of said economizer tubes being disposed adjacent the other ends of said superheating and reheating tube banks, means connecting said reheating and superheating tube banks to the last mentioned portion of said economizer tubes, and plate means disposed in substantially the same plane as said tubular panel wall portion and attached to said economizer tubes and engaging the tubes of said economizer tube bank for support thereof.

7. In a top supported vapor generator having a structural steel supporting frame thereabove, walls forming an upright furnace chamber having a heating gas outlet, means for burning fuel in said furnace chamber to produce heating gas, wall means including convection heat absorbing fluid heating tubes forming an upright convection gas pass laterally adjacent and communicating at its upper end with said heating gas outlet, partition means dividing said upright convection pass into a plurality of parallel down-flow gas sections, a vapor superheating tube bank positioned in one of the parallel gas flow sections, a vapor reheating tube bank positioned in another of the parallel gas flow sections, an economizer tube bank extending substantially wholly across said convection pass below said vapor superheating and reheating tube banks, damper means disposed below said economizer tube bank for proportioning the heating gas flow through said parallel gas sections, and means for supporting the weight

of said economizer and said vapor superheating and vapor reheating tube banks substantially free of load-bearing attachment to said convection pass wall means, said last named means including a plurality of economizer outlet tubes extending upwardly from said economizer tube bank and through said convection pass, means connecting said economizer outlet tubes to said supporting frame in load-bearing relationship, a portion of said economizer outlet tubes being arranged in side-by-side parallel relationship and being rigidly weld-united along at least a portion of their lengths to form a tubular panel wall portion of said partition means above said economizer tube bank, means connecting one end of said reheating and superheating tube banks to said tubular panel wall portion of said partition means, another portion of said economizer outlet tubes being disposed adjacent the other ends of said superheating and reheating tube banks, means connecting said reheating and superheating tube banks to the last mentioned portion of said economizer outlet tubes, and a plurality of scalloped support bars attached to said economizer outlet tubes and engaging the tubes of said economizer tube bank for support thereof, at least a portion of said support bars being disposed in substantially the same plane as the weld-united economizer outlet tubes and connected together to form another portion of said partition means.

8. In a vapor generator, wall means forming an upright gas pass, means supplying high temperature heating gases to said gas pass for flow therethrough, a tube bank extending across said gas pass, partition means dividing said gas pass into a plurality of parallel gas flow sections, said partition means including a first portion comprising a plurality of tubes connected to and extending upwardly from said tube bank, at least a portion of said tubes being arranged in side-by-side parallel relation and being rigidly weld-united along a portion of their lengths to form a gas impervious panel, and a second portion comprising plate means attached to and supported by the tubes forming said gas impervious panel and extending downwardly therefrom in substantially the same plane as the weld-united tubes, said plate means being engaged with the tubes of the tube bank for the support thereof, a vapor heating tube bank positioned in one of said gas sections above the first mentioned tube bank, an additional fluid heating tube bank positioned in another of said gas sections above the first mentioned tube bank, and damper means arranged below said first mentioned tube bank for proportioning the flow of heating gases through said gas sections.

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