Nov. 3, 1964 W. H. CLAYTON 3,155,074

VAPOR GENERATOR

Filed Dec. 27, 1961 3 Sheets-Sheet 1

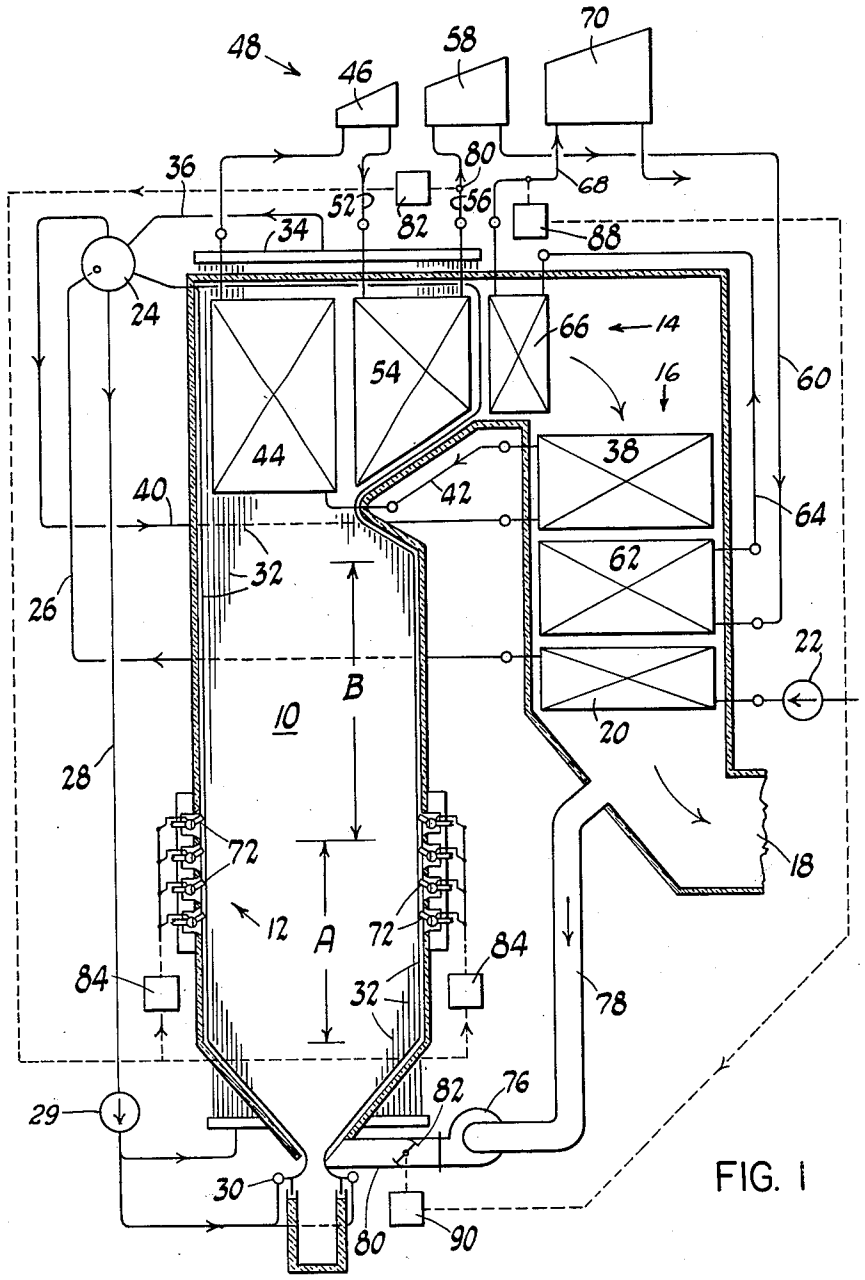


FIG. 1

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VAPOR GENERATOR

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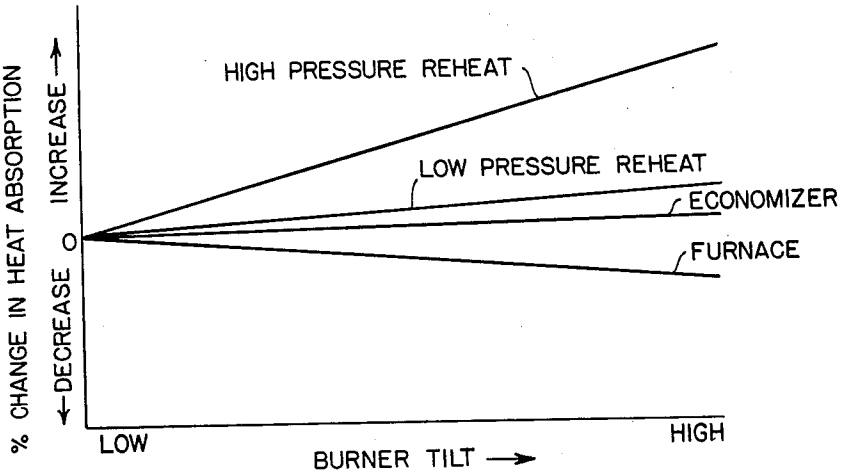


FIG. 2

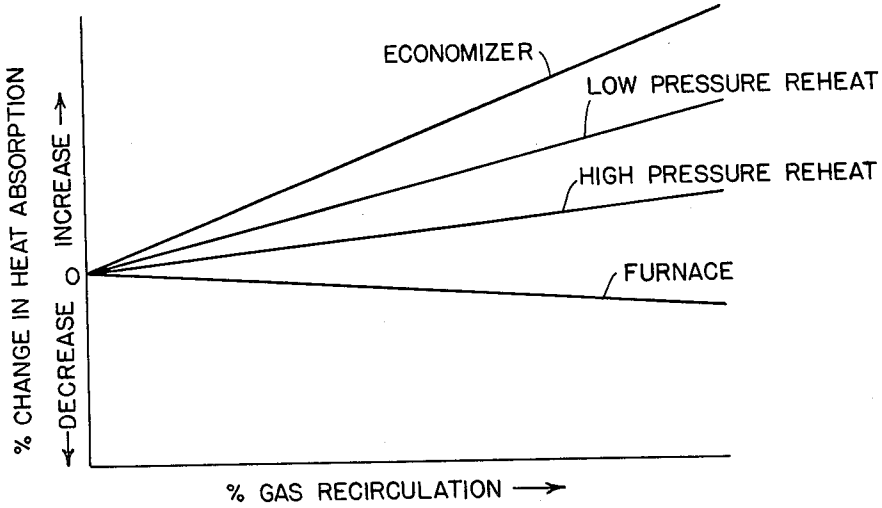


FIG. 3

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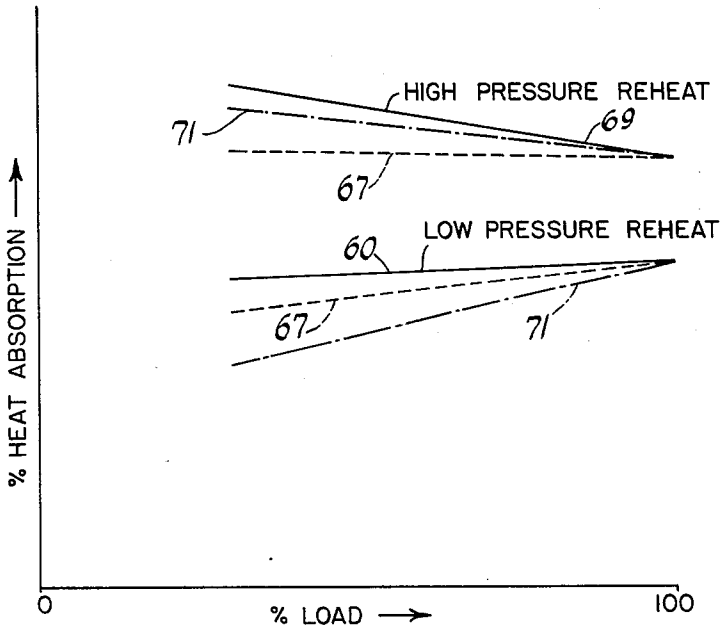


FIG. 4

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United States Patent Office 3,155,074 Patented Nov. 3, 1964

3,155,074

VAPOR GENERATOR

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Filed Dec. 27, 1961, Ser. No. 162,328
8 Claims. (Cl. 122—479)

This invention relates generally to the art of vapor generation wherein high capacity vapor generators supply the driving medium for turbines which in turn drive electric generators, with the invention being particularly concerned with a method of operation of a vapor generator and a vapor generator organization for carrying out such method wherein the double reheat cycle is employed with the cycle being of a particular characteristic and with the temperature of the two reheat vapors being regulated at their desired value throughout the operating load range.

In accordance with the invention the cycle of the double reheat unit is such that as the load on the unit decreases from maximum value down toward its lowermost desired limit or what is termed the "control load" the percentage of heat absorption of the first or high pressure reheat increases with relation to the total heat absorption of the vapor generator while the percentage of heat absorption of the low pressure reheater decreases. The reheat surfaces are arranged in the vapor generator so that the high pressure reheat is influenced to a greater extent that the low pressure reheat through or as a result of adjusting the zone of combustion in the fluid cooled furnace toward or away from the outlet of the furnace while the low pressure reheat is effected to a greater extent than the high pressure reheat through gas recirculation type of control wherein combustion gases are introduced into the fluid cooled furnace in a manner to increase the heating effect or heat content of the combustion gases leaving the furnaces. Control of the two reheat temperatures is provided throughout at least a substantial portion of the control range over which the unit is operated through a combination of gas recirculation control and adjustment of the firing zone with relation to the outlet of the furnace.

In operation of the unit, in accordance with the invention, at maximum load condition the zone of combustion is adjusted so that it is at a relatively remote location from the furnace outlet and little if any gases are recirculated to the furnace with the high pressure and the low pressure reheat temperatures being at their desired value under these operating conditions and at this load. As the load on the unit progressively decreases from this maximum value the zone of combustion is progressively moved toward or closer to the furnace outlet while the quantity of gases recirculated to the furnace is increased. Through this operation the high pressure and the low pressure reheat temperatures are maintained at their desired value throughout a substantial range of load below the maximum load, with adjustment of the zone of combustion and regulation of the recirculated combustion gases being such as to effect this result.

It is an object of this invention to provide an improved method of and apparatus for vapor generation.

Another object of this invention is to provide such an improved method and organization operating on the double reheat cycle, with the characteristic of the cycle being such that of the total heat absorption of the vapor generator the percentage of the high pressure reheat increases while that of the low pressure reheat decreases as the load is decreased from its maximum value.

Still another object of the invention is to provide such an improved method and organization operating on the double reheat cycle and wherein the high pressure and the low pressure reheat temperatures are maintained at their desired value throughout a substantial load range through the simultaneous adjustment of the zone of combustion in the furnace and the admission of the recirculation gases to the furnace, respectively.

Other and further objects of the invention will become apparent to those skilled in the art as the description proceeds.

With the aforementioned objects in view, the invention comprises an arrangement, construction and combination of the elements of the inventive organization in such a manner as to attain the results desired as hereinafter more particularly set forth in the following detailed description of an illustrative embodiment, said embodiment being shown by the accompanying drawings wherein:

FIG. 1 is a diagrammatic representation in the nature of a vertical sectional view through a high capacity vapor generator organized in accordance with the present invention;

FIG. 2 is a graphical representation illustrating the control effect obtained by adjusting the zone of combustion in the furnace;

FIG. 3 is a similar graphic representation illustrating the control effect obtained by introducing the combustion gases into the furnace; and

FIG. 4 is a graphic representation illustrating the heat absorption characteristics of the high pressure and the low pressure reheats in the vapor cycle with which the present invention is concerned.

Referring now to the drawings, wherein like reference characters are used throughout to designate like elements, the illustrative and preferred embodiment of the invention includes the furnace 10 into which fuel and air are introduced by the burners 12 with the fuel being burned in the furnace and the combustion gases thus generated passing up through the furnace and through the lateral outlet at the upper end thereof from which extends the horizontally directed gas pass 14 that is, in turn, connected with the downwardly extending gas pass 16. This latter gas pass extends downwardly in parallel, spaced relation with the furnace and the combustion gases egressing from the furnace and after traversing the horizontal gas pass 14 are directed down through this vertical gas pass and out the outlet 18 to a suitable air heater and stack or other conventional equipment. The primary fluid of the vapor generator is passed through the primary circuit during which traversal it is heated with the fluid leaving this primary circuit as a vapor and at a desired, predetermined high temperature. In the illustrative organization the primary circuit of the vapor generator includes the economizer 20 through which the primary fluid is forced by the feed pump 22. From the economizer 20 this primary fluid is conveyed to the chamber 24 through conduit 26 and from this chamber primary fluid is conveyed through conduit 28 into which is connected the pump 29 with the fluid being directed to the supply headers 30 at the lower end of the furnace. Connected with these headers 30 are the tubes 32 which line the walls of the furnace, with the furnace preferably being generally of rectangular transverse section and with tubes 32 extended upwardly along the inner surfaces of the furnace walls and connecting with suitable outlet or collecting headers 34 at their upper ends. From the header 34, the primary fluid is conveyed to the chamber 24 as through the conduit 36 and from this chamber 24 primary fluid is conveyed to the heat exchange section 38 in gas pass 16 via the conduit 40. After traversing this heat exchange section 38 the primary fluid is directed through conduit 42 through the finishing or high temperature heating section for the primary fluid and wherein the fluid is heated to its desired final high temperature and with the vapor

being conveyed from this final heating section to the high pressure stage or section 46 of the multistage turbine which is designated generally 48.

After utilizing a portion of the energy of the high temperature, high pressure vapor issuing from the heat exchange section 44 in the high pressure stage 46 of the turbine, the vapor is returned to the vapor generator for reheating with the exhaust from the high pressure stage 46 being conveyed through conduit 52 to and through the high pressure reheater 54 illustratively disclosed as located in the gas pass 14. In traversing the high pressure reheater 54, the temperature of the vapor is raised to a desired value and from this reheater the vapor is conveyed through conduit 56 to the intermediate stage 58 of the turbine.

After having a further portion of its energy utilized in the turbine stage 58 the vapor is reheated a second time by being conveyed through conduit 60 from the exhaust of the intermediate stage of the turbine to the low temperature section 62 of the low pressure reheater which section 62 is located in the vertically extending gas pass 16. After being partially reheated in this heat exchange section 62, the low pressure reheat vapor is conveyed through conduit 64 to the high temperature section 66 of the low pressure reheater. This high temperature section 66 is located just downstream of the high pressure reheater 54 relative to the direction of combustion gas flow and upstream of the heat exchange section 38 of the primary fluid heating circuit with this latter section being interposed between the high temperature and the low temperature sections of the low pressure reheater. Incident to passing through the high temperature section 66 of the low pressure reheater, the low pressure reheat steam is then heated to its desired temperature and is conveyed through conduit 68 to the low pressure stage 70 of the turbine. The exhaust from this low pressure stage is conveyed to the usual condensor and then to the condensate system which is conventionally found in vapor generator systems of the type to which the invention pertains with the fluid being returned to the primary circuit of the vapor generator via the feed pump 22.

In the operating cycle to which the present invention is directed, the heat absorption characteristics of the high pressure reheat and the low pressure reheat are of the nature graphically depicted in FIGURE 4. As the load on the vapor generator decreases from its maximum or 100% value, the percentage of the heat absorption of the high pressure reheat with relation to the total heat absorption of the unit has an increasing characteristic or value while that of the low pressure reheat has a decreasing characteristic or value. These are the heat absorption characteristics of these reheats when the reheats are maintained at their desired predetermined temperature with variation in load. Accordingly, if the high pressure reheat temperature is to be maintained at its desired value as the load on the vapor generator decreases from its maximum of 100% rating, the percentage of heat absorption imparted to the high pressure reheat vapor with relation to the total percentage of heat absorption of the unit must progressively increase while an opposite requirement is necessary in order to maintain the low pressure reheat vapor at its desired value as the load on the vapor generator decreases from the 100% rating.

While this is the characteristic that prevails with regard to the distribution of the percent of total heat absorption in order to maintain the temperature of the high pressure and the low pressure reheat vapor at their desired value or control point throughout the load range it should be pointed out that if there were no controls on the unit to perfect this result, i.e., if there were no gas recirculation control or the control produced by adjustment of the zone of combustion in the furnace as previously mentioned, both the temperature of the high pressure reheat and the low pressure reheat vapor would decrease rapidly with a decrease in load. Accordingly it should be appreciated that it is necessary to provide control action that will increase the heat imparted to these two reheats as the load is decreased from maximum value over that which would otherwise prevail.

In accordance with the invention, the control of the high pressure and the low pressure reheat vapor is provided by a combination of the control actions, i.e., the combination of gas recirculation and adjustment of the zone of combustion longitudinally of the furnace. The reheaters or reheater surface is so disposed in the unit and these two control actions are so manipulated that both the high pressure and the low pressure reheat temperatures may be maintained at the desired value throughout a substantial range of load below the 100% maximum rating of the unit.

By adjustment of the zone of combustion, within the furnace, the temperature of the combustion gases which egress from the furnace may be varied to a substantial extent. The zone of combustion in the furnace may be varied longitudinally thereof toward and away from the furnace outlet in a number of ways with one preferred way being by having the burners 12 arranged in accordance with the burner organization disclosed in the U.S. Patent 2,575,885, of November 20, 1951. In such an arrangement, the burner nozzles illustrated generally as 72 in FIG. 1, are vertically tiltable so that the zone of combustion may be moved from a lower range identified as A to an upper range identified as B, with the zone of combustion being adjustable to any position intermediate these extreme ranges. Another way of adjusting the zone of combustion is to provide burners throughout the entire vertical extent of the upper and lower extremities of the adjustment of the zone and then by manipulation of selective burners vary the position of the zone with relation to the furnace outlet.

While variation of the zone of combustion within the furnace as aforesaid will vary the temperature of the gases egressing from the furnace, the control effect obtainable by means of adjustment of the zone of combustion or in other words, the change in heat absorption that can be effected by means of adjusting the adjustment of the zone of combustion is greatest at the location in the combustion gas stream adjacent the furnace outlet and becomes progressively less as the distance from the furnace outlet in the downstream direction of combustion gas flow is progressively increased. Accordingly, in the organization of FIG. 1, adjustment of the zone of combustion in the furnace 10 will have a substantial effect upon the heat absorption of the high pressure reheater 54 and a much less significant effect upon the heat absorption of the low pressure reheat which is comprised of the low temperature section 62 and the high temperature section 66.

This control effect that is obtained by means of adjustment of the zone of combustion is illustrated in the set of curves of FIG. 2. From these curves it will be seen that as the zone of combustion is moved upward from its lowermost to its highermost position, the change in heat absorption of the high pressure reheat is quite substantial and is greater than that of both the low pressure reheat and the economizer which are located downstream of the high pressure reheat in the gas flow sense. The heat absorption of the furnace is decreased as the zone of combustion is moved toward the furnace outlet since the heat exchange surface lining the lower region of the furnace becomes less effective when the zone of combustion is so adjusted.

The gas recirculation control utilized with the invention includes a recirculating fan 76 which is connected at its inlet through duct 78 with the lower portion of gas pass 16 and discharges through duct 80 into the lower region or extremity of the furnace 10. The quantity of gases recirculated to the furnace is regulated by means of the damper 82 located in the duct 80. Introduction of combustion gases into the furnace in this manner has the

effect of increasing the heat content of the gases leaving the furnace so that the heat imparted to the convection heat exchange surface over which the combustion gases pass is increased over what it would otherwise be. In contrast with adjustment of the zone of combustion in the furnace, however, the recirculation of combustion gases has its greatest control effect on the heat exchange surface that is furthest downstream with relation to the furnace combustion gas outlet and in a gas flow sense. Thus, in the FIG. 1 organization, the change in heat absorption that is produced by means of recirculation of combustion gas to the furnace is greatest in the economizer 20, is next greatest in the low pressure reheater and is of substantially less magnitude in the high pressure reheater.

This operating characteristic of gas recirculation is graphically depicted in FIG. 3. In this FIG. 3 illustration, it will be seen that as the recirculation of combustion gases is increased or in other words the amount of combustion gases recirculated is increased, the increase in heat absorption of the economizer is very substantial and the increase in heat absorption of the low pressure reheater is very much greater than that of the high pressure reheater. The heat absorption in the furnace 10 will decrease with an increase in the recirculation of combustion gases as illustrated by the "furnace" curve in FIG. 3.

The reheat exchange surfaces, i.e. high, pressure reheater and the low pressure reheater are arranged, in accordance with the invention, so as to take advantage of the operating characteristics of the previously described two controls so that these reheat vapor temperatures may be maintained at their desired value over a substantial load range below the maximum load on the vapor generator. While the low pressure reheat is comprised of a high temperature section 66 and a low temperature section 62, this latter section has a substantially greater heat absorbing capacity than the former so that the effective heat absorption of the low pressure reheater is located well downstream in the gas flow sense of the high pressure reheater 54. It is necessary to provide a high temperature and a low temperature section of the low pressure reheater in order to effect this result and still heat the low pressure steam to its desired high temperature. The low temperature section of the low pressure reheater is located sufficiently far downstream in a gas flow sense that the temperature of the gases at this location are not sufficiently high to finally heat the low pressure reheat vapor to its desired final high temperature. By locating the primary heat exchange section 38 intermediate the major portion or low temperature section 62 of the low pressure reheater and the high pressure reheater 54 the effectiveness of the two control actions on the two reheats is increased so that optimum operation or control may be provided.

Since adjustment of the zone of combustion in the furnace has its greatest effect upon the high pressure reheat and since the high pressure reheat requires a greater percentage of the total heat absorption with decrease in load, the high pressure reheat vapor may be regulated by adjusting the zone of combustion toward the outlet of the furnace as the load is decreased. Since the introduction of recirculated combustion gases into the furnace has a much greater effect upon the heat absorption of the low pressure reheat vapor than on the high pressure reheat vapor, the low pressure reheat may be regulated through adjustment of the recirculation of combustion gases to the furnace with the quantity of gases recirculated to the furnace being increased in order to maintain the temperature of the low pressure reheat vapor at its desired value.

It is the combination of the adjustment of the zone of combustion and the recirculation of combustion gases which provides the necessary control for the two reheat temperatures with these control actions simultaneously being effected or adjusted as the load is changed. This is apparent from FIG. 4 where the dotted line curves 67 represent the change in heat absorption with load variation produced by gas recirculation per se. It will be evident from the disposition of these two curves 67 that the low pressure reheat heat absorption is brought close to its required value as represented by the solid line curve 69 where the temperature of the low pressure reheat is at its desired value while the high pressure reheat is still considerably away from the solid line curve 69 representing the characteristic for the high pressure reheat vapor when it is at its desired value. The dot-dash curve 71 represents the heat absorption characteristic for the two reheats obtained by adjustment of the zone of combustion per se. It will be evident that by thus adjusting the zone of combustion the heat absorption of the high pressure reheat is brought close to its desired value or characteristic as represented by curve 69 while that of the low pressure reheat falls considerably short of its desired characteristic. By combining the two controls, i.e., gas recirculation and the adjustment of the zone of combustion, the heat absorption of the high pressure and the low pressure reheat falls along the solid line curves 69.

Accordingly, in operating in accordance with the invention, at maximum load on the vapor generator, the zone of combustion in the furnace is adjusted so it is at a remote location from the furnace outlet and a predetermined quantity of combustion gases are recirculated into the furnace with the high pressure reheat vapor egressing from the high pressure reheater 54 and the lower pressure reheat vapor egressing from the high temperature section 66 of the low pressure reheater being at their desired values at this maximum load. As the load is progressively decreased, from this maximum of 100% value, the zone of combustion in the furnace is progressively moved towards its extreme position closest to the furnace outlet and the quantity of gases recirculated to the furnace is progressively increased with the effect of these actions being to maintain the high pressure reheat vapor and the low pressure reheat vapor at their desired values throughout a substantial load range.

Control of the high pressure and the low pressure reheat vapor temperatures may be provided through automatic control means and to diagrammatically illustrate such a control system there is shown in FIG. 1 a temperature sensing device 80 responding to the temperature at the outlet of the high pressure reheater and connected with the control device 82 which in turn is connected with the control members 84 so as to position the nozzles 72 to adjust the zone of combustion in the furnace in a manner to maintain the temperature of the high pressure reheater at its desired value. Similarly there is provided temperature sensing device 86 which responds to the temperature at the outlet of the low pressure reheater and which is connected with the control device 88. This device is in turn connected with the actuator 90 so as to regulate the damper 82 to control the recirculation of combustion gases in a manner to maintain this low pressure reheat temperature at its desired value.

It will be appreciated that each of the heat exchange surfaces 44, 54, 66, 38, 62 and 20 are comprised of tubular members, as is conventional in vapor generators of the type to which the invention is directed with these tubes preferably being in the form of a tube bundle comprised of sinuously bent tubes that are positioned in side-by-side relation across the gas pass.

With the organization of the invention a process and system is provided for operating a vapor generator on the double reheat cycle with the characteristic of the cycle being such with relation to the disposition of the heat exchange surface and the control functions applied as to provide an efficient control of the vapor temperatures of the two reheats.

While I have illustrated and described a preferred embodiment of my invention it is to be understood that such is merely illustrative and not restrictive and that variations and modifications may be made therein without departing from the spirit and scope of the invention. I therefore do not wish to be limited to the precise details set forth but desire to avail myself of such changes as fall within the purview of my invention.

What I claim is:

1. A vapor generator operating on the double reheat cycle and having the characteristic that the percentage of the total heat absorption of the unit which is accounted for by the high pressure reheat increases with decrease in load from the maximum load while the percentage accounted for by the low pressure reheater decreases as the load is decreased from the maximum and including a furnace having primary fluid carrying tubes on its walls, means introducing fuel and air into said furnace, said means being operative to adjust the zone of combustion in the furnace toward and away from the furnace outlet, high pressure reheater means and low pressure reheater means disposed in the combustion gas path in series with regard to combustion gas flow with these reheater means being located such that the low pressure reheater is effected primarily by the characteristics of the combustion gas streams at a location downstream of the high pressure reheater means, means operative to recirculate combustion gases to the furnace in a manner to increase the heat content of the gases with an increase in the quantity of gases recirculated and means for controlling the adjustment of the zone of combustion predominantly in response to the high pressure reheater temperature with varying load and means for simultaneously controlling the recirculation of gases to the furnace predominantly in response to the low pressure reheater temperature.

2. A vapor generator operating on the double reheat cycle and having the characteristic that, of the total heat absorption of the unit, the percentage of the high pressure reheat increases and that of the low pressure reheater decreases with decrease in load, said generator including an elongated furnace having a combustion gas outlet adjacent one end and being fired at a location remote therefrom and in a manner whereby the zone of combustion in the furnace is adjustable toward and away from the furnace outlet, said furnace having fluid cooled tubes on its walls and having means for introducing recirculated gases in the region thereof remote from the furnace outlet, a high pressure reheater disposed so that combustion gases generated in the furnace pass thereover and a low pressure reheater similarly disposed and located so that it receives a major portion of its heat at a location in the gas stream well downstream of the high pressure reheater, means primarily responsive to the high pressure reheat vapor leaving the high pressure reheater operative to regulate the adjustment of the zone of combustion toward and away from the furnace outlet to maintain said temperature at the desired value with variation in load and means primarily responsive to the low pressure reheat vapor leaving the low pressure reheater to regulate the recirculation of combustion gases to the furnace to maintain this latter temperature at its desired value with variation in load.

3. The organization of claim 2 including heat exchange surface forming part of the primary circuit of the vapor generator disposed between the location of the high pressure reheater and the location of the low pressure reheater.

4. In a vapor generator operated on the double reheat cycle and having the characteristic that of the total heat absorption the percentage required by the high pressure reheat increases with decreasing load while that required by the low pressure reheat decreases with decrease in load, the improved method of operation comprising burning fuel in the furnace of the vapor generator and thereby creating a combustion gas stream, passing the primary fluid of the vapor generator in heat exchange relation with the burning fuel, passing the high pressure reheat vapor in heat exchange relation with the combustion gas stream primarily at one location, passing the low pressure reheat vapor in heat exchange relation with the combustion gas stream primarily at another location spaced downstream relative to combustion gas flow from said one location, introducing recirculated combustion gases which have traversed said reheaters into said furnace at maximum load and in a manner to increase the heat transfer to the low pressure reheat vapor, sensing the final temperature of the high pressure reheat vapor and predominantly in response hereto regulating the adjustment of the zone of combustion with relation to the furnace outlet and sensing the final temperature of the low pressure reheat vapor and predominantly in response thereto adjusting the recirculation of combustion gases to the furnace.

5. The method comprising creating a stream of hot combustion gases by delivering fuel to and burning the same at a burning zone, passing confined streams of a primary fluid in bounding heat exchange relation with said combustion zone and imparting heat from the burning fuel and the combustion gases to the primary fluid thereby generating a vapor at a desired temperature and pressure, utilizing a portion of the energy in said vapor and thereafter reheating said vapor a first time by passing it in heat exchange relation with the combustion gas stream, after thus reheating said vapor utilizing a further portion of the energy therein and then reheating the same a second time by again passing it in heat exchange relation with said combustion gas stream, the location at which heat is imparted to the vapor for effecting said first reheat relative to this location for the second reheat being such that the former is effected to a substantially greater extent by adjustment of the zone of combustion in the direction of the combustion gas flow than is the second reheat and with an opposite effect being realized from introducing combustion gases into the zone of combustion, said first and said second reheat having the characteristic that as the rate of fuel delivery is decreased from maximum the percentage of heat absorption with relation to the total heat absorption increases for the first reheat and decreases for the second reheat, introducing combustion gases into the firing zone and increasing the introduction of such gases with a decrease in fuel delivery rate, and adjusting the zone of combustion in a downstream direction with regard to combustion gas flow with a decrease in fuel delivery rate, dominantly controlling the recirculation of combustion gases in response to the final temperature of said second reheat and dominantly controlling the adjustment of the zone of combustion in response to the final temperature of said first reheat to maintain the final temperature of said second and said first reheat at their desired value notwithstanding that the rate of delivery and burning of fuel at said zone and vaporization of the primary fluid varies.

6. In a vapor generator operating on the reheat cycle and including a vertically disposed elongated furnace having a combustion gas outlet at its upper region and fired in a lower region, with a gas pass extending from the furnace outlet and with the generator operating on the double reheat cycle and having the characteristic that of the total heat absorption of the vapor generator the percentage absorption of the high pressure reheat increases with decreasing load while that of the low pressure reheat decreases with decreasing load, the improved method of operation comprising heating the high pressure reheat vapor by conveying it in heat exchange relation with the combustion gas stream at a location where the change in heat imparted to the high pressure reheat vapor is substantial as a result of adjusting the zone of combustion toward and away from the furnace outlet and is more pronounced than to the low pressure reheat vapor, heating the low pressure reheat vapor by passing it in heat ex-

change relation with the combustion gas stream and at a location such that it is effected to a substantial extent and to a substantially greater extent than the high pressure reheat vapor as a result of introducing combustion gases into the furnace in such a manner as to increase the heat content of the combustion gas stream egressing from the furnace, sensing the temperature of the high pressure vapor, supplying a control action in response thereto, preponderantly adjusting the zone of combustion in the furnace in response thereto with varying load, sensing the temperature of the low pressure vapor, supplying a control action in response thereto, and preponderantly regulatingly introducing combustion gases to the furnace in response thereto in a manner to maintain the high pressure reheat vapor temperature and the low pressure reheat vapor at their desired value throughout a substantial load range.

7. The method of claim 6 including decreasing the load from maximum and, with such decrease, increasing the amount of combustion gases recirculated to the furnace and adjusting the zone of combustion to move said zone toward the furnace outlet.

8. A high capacity vapor generator operating on the double reheat cycle and including a fluid cooled furnace fired by a suitable fuel and having a combustion gas outlet, passageway means for combustion gases leading from said outlet, means for adjusting the zone of combustion relative to said outlet, means for recirculating combustion gases to the furnace to increase the heat content of the gases issuing from the furnace, low pressure and high

pressure reheat means respectively disposed in said passageway means such that the former is effectively well downstream of the latter relative to combustion gas flow with the former including a high temperature and a low temperature section and with primary heat exchange surface being interposed therebetween in the gas pass, means operative to regulate the temperature of the high and low pressure reheat wtih varying load including over-riding means predominantly responsive to the high pressure reheat temperature operative to control said means for adjusting the zone of combustion and adjust it towards said outlet with decrease in load, and over-riding means predominantly responsive to the low pressure reheat temperature operative to regulate the recirculation of combustion gases to the furnace to increase such recirculation with decrease in load.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,155,074 November 3, 1964

William H. Clayton

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 30, for "that" read -- than --; column 8, line 13, for "hereto" read -- thereto --.

Signed ans sealed this 30th day of March 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents