

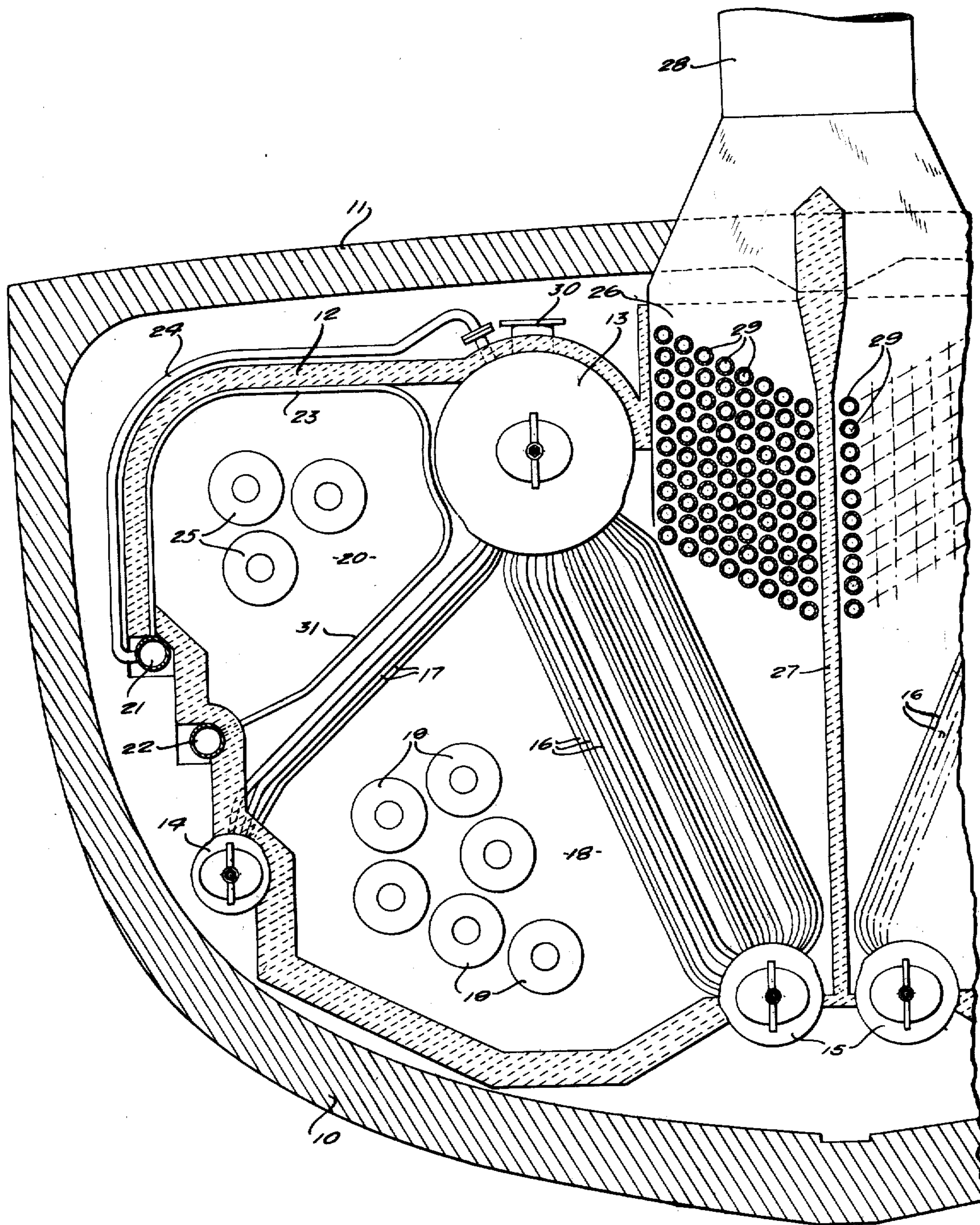
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STEAM GENERATOR

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INVENTOR

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# UNITED STATES PATENT OFFICE

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## STEAM GENERATOR

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11 Claims. (Cl. 122-473)

This invention relates to steam generators and superheaters.

The invention provides a novel arrangement of steam generating and steam superheating elements which is capable of functioning to readily and efficiently produce superheated steam at various rates, the temperature of which may be varied as desired at each of the various rates. The arrangement is extremely compact and is particularly adaptable to marine installations but it is equally adaptable to land installations of every description.

The nature of 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 more or less diagrammatic illustration, in partial vertical section of a steam generator marine installation embodying the invention.

Referring to the drawing, reference character 10 designates the hull of a ship having a deck 11. In the particular arrangement illustrated, two generating units are disposed transversely of the longitudinal axis of the ship and back to back. Any number of pairs of such units may be utilized in a ship.

The generating unit includes a setting 12 having a steam and water drum 13 in the upper part of the setting, and spaced water drums 14 and 15 in the lower part of the setting. A main bank of steam generating tubes 16 connects the drums 13 and 15 and a screen or bank of suitably spaced water circulating tubes 17 connects the drums 13 and 14. The banks of tubes 16 and 17 and the lower and side walls of the setting 12 form a furnace chamber 18 which is fired by a plurality of fluid burners 19 which may burn pulverized fuel, gas or oil or a combination of such fuels to provide a stream of products of combustion for the furnace chamber. In the arrangement shown, the burners 19 are disposed in a side wall of the setting and fire substantially parallel to the axes of the boiler drums. The burners may be otherwise disposed, if desired.

A superheater furnace 20 is defined by the screen or bank of water tubes 17, the front, side and upper walls of the setting and the drum 13. A superheater having headers 21 and 22 supported on the setting, has a plurality of loop tubes 23 connecting the headers and disposed along the front and upper walls of the setting, adjacent the drum 13 and adjacent the screen or bank of water tubes 17. A steam line 24 connects the upper portion of the steam and water drum 13 with the

superheater inlet header 21. The superheater furnace 20 is fired by a plurality of fluid burners 25 which are disposed, as shown, in the same side wall of the setting as the burners 19. A flue 26 extends from the rear of the setting adjacent the rear wall 27 and connects with a stack 28. An economizer 29 or other heat recovery device is disposed in the flue 26 by may be omitted, if desired.

During operation of the generator, if a low degree of superheat only is desired, one or more of the burners 19 are fired and the burners 25 are not operated. The stream of products of combustion so produced flows through the furnace 18 and over the tubes 16 and out through flue 26 over the economizer 29 to the stack 28. The stream of products of combustion also flows over the screen or bank of water tubes 17 and a comparatively small quantity of the products of combustion passes over those portions 31 of the superheater tubes disposed adjacent the tubes 17 and comparatively little of the heat radiated from the products of combustion reaches the superheater tubes, wherefore the steam passing through the superheater is heated only to a small extent.

The number of burners 19 and burners 25 in operation at one time will depend upon the load on the generator and the required temperature of the steam. If a high degree of superheat at low loads is required, one or more burners 25 is operated and the burners 19 are not operated. Under these circumstances, the stream of products of combustion produced will flow through the superheater furnace 20, over the portions 31 of the superheater tubes, over the water tubes 17, through furnace 18, over the tubes 16 and out through flue 26 and stack 28. In other words, all the gases produced in the superheater furnace flow over all the steam generating tubes and give up heat to produce saturated steam. For other operating conditions, both the steam generating and superheater furnaces 18 and 20 respectively, may be fired at the same time.

Saturated steam may be withdrawn through outlet connection 30, if desired.

With this arrangement, it will be perceived that an extremely compact steam generating and superheating unit has been provided which possesses great flexibility of control of the production of superheated steam of the desired degree of superheat at all rates of steaming. Great economy and efficiency are provided due to the flow of all products of combustion generated in the superheater furnace, over the steam generating elements of the unit.

Although a preferred form of the invention has been disclosed, the principles of the invention may be embodied in other forms of generating and superheating units. For example, a generator having a plurality of upper drums and a single lower drum with a bank of tubes connecting the lower drum with each of the upper drums, may have a screen of water tubes connecting one of the upper drums with the lower drum and a superheater having tubes or portions thereof, disposed adjacent the water screen and on the side opposite the boiler furnace side. The superheater would be separately fired and the gases produced in the superheater furnace would flow over the steam generating tubes, and gases produced in the steam generating furnace would flow in heat exchange relationship with portions of the steam superheating tubes as in the embodiment illustrated. Other embodiments of the invention are also possible.

Changes may be made in the form, location and arrangement of the several elements of the generator disclosed without transcending the principles of the invention. Accordingly, no intention is entertained to limit the invention except by the scope of the appended claims.

What is claimed is:

1. A steam generator comprising a setting, a bank of steam generating tubes in the setting, a screen of water tubes in the setting, a boiler furnace in the setting between the bank of steam generating tubes and the screen of water tubes, means for firing the boiler furnace, a superheater furnace in the setting separated from the boiler furnace by tubes of the screen of water tubes, a superheater in the superheater furnace, means for firing the superheater furnace, and a flue connected with the setting through which the products of combustion produced in both said furnaces flow from the setting, the flue being located so that the products of combustion produced in the superheater furnace, flow at all times in heat exchange relationship with the bank of steam generating tubes before entering the flue.

2. A steam generator comprising a setting, a screen of water circulating tubes in the setting, a bank of boiler tubes in the setting at one side of the screen, a superheater in the setting at the other side of the screen, said screen and bank of boiler tubes defining a boiler furnace, means for firing the boiler furnace, means independent of the means for firing the boiler furnace for firing the superheater, and a flue connected with the setting, the flue being disposed so that products of combustion produced to fire the superheater, flow at all times over the bank of boiler tubes prior to entering the flue.

3. A steam generator comprising a setting, a steam and water drum in the upper part of the setting, spaced water drums in the lower part of the setting, a bank of boiler tubes connecting the steam and water drum and one of the spaced drums, a screen of water tubes connecting the steam and water drum and the other spaced drum, said bank of boiler tubes and screen of water tubes defining a boiler furnace therebetween, means for firing the boiler furnace, a superheater furnace at the side of said screen opposite the boiler furnace, a superheater in the furnace, means for firing the superheater, and a flue for the setting so disposed that the products of combustion produced in the superheater furnace flow at all times over the bank of boiler tubes prior to entering the flue.

4. A steam generator comprising a setting, a steam and water drum in the upper part of the setting, spaced water drums in the lower part of the setting, a bank of boiler tubes connecting the steam and water drum and one of the spaced drums, a screen of water tubes connecting the steam and water drum and the other spaced drum, said bank of boiler tubes and screen of water tubes defining a boiler furnace therebetween, means for firing the boiler furnace, a superheater furnace at the side of said screen opposite the boiler superheater furnace, a superheater in the furnace having tubes disposed adjacent the screen of water tubes, means for firing the superheater, and a flue for the setting so disposed that the products of combustion produced in the superheater furnace flow at all times over the bank of boiler tubes prior to entering the flue.

5. A steam generator comprising a setting, a bank of steam generating tubes in the setting, a screen of water tubes in the setting, said steam generating tubes and water tubes defining in part at least a furnace chamber for the generator, a superheater in the setting disposed outside said furnace chamber and separated therefrom by tubes of said screen of water tubes, and means for firing the superheater, the arrangement being such that the products of combustion so produced flow over the screen of water tubes and the steam generating tubes.

6. A steam generator comprising a setting, spaced banks of steam generating tubes in the setting defining a furnace chamber between them at least in part, means for firing said furnace, a superheater disposed outside of said furnace and separated therefrom by tubes of one of said tube banks and having tubes thereof disposed adjacent tubes of said one bank, means for firing the superheater, and a flue connecting with the setting and having a single inlet into which flow all the products of combustion produced by said firing means, said flue inlet being located so that the products of combustion produced by said superheater firing means flow over tubes of the superheater and each of said tube banks before entering the flue.

7. A steam generator comprising a setting, spaced banks of steam generating tubes in the setting defining a furnace chamber between them at least in part, means for firing said furnace, a superheater disposed outside of said furnace and separated therefrom by tubes of one of said tube banks and having tubes thereof disposed adjacent tubes of said one bank, means for firing the superheater, and an uncontrolled flue connecting with the setting and having a single inlet into which flow all the products of combustion produced by said firing means, said flue inlet being located so that the products of combustion produced by said superheater firing means flow over tubes of the superheater and each of said tube banks before entering the flue.

8. A steam generator comprising a setting, a steam and water drum in the upper part of the setting, spaced water drums in the lower part of the setting, a bank of boiler tubes connecting the steam and water drum and each of the lower drums, said tube banks defining a furnace chamber between them at least in part, at least one fuel burner for firing the furnace, a superheater disposed outside of said furnace and separated therefrom by tubes of one of said tube banks and having tubes thereof disposed adjacent tubes of said one bank, at least one fuel burner for firing

the superheater, and a flue connecting with the setting and having a single inlet into which flow all the products of combustion produced by said burners, said flue inlet being located so that the products of combustion produced by the at least one burner for firing the superheater flow over tubes of the superheater and each of said tube banks prior to entering the flue.

9. A steam generator comprising a setting, a steam and water drum in the upper part of the setting, spaced water drums in the lower part of the setting, a bank of boiler tubes connecting the steam and water drum and each of the lower drums, said tube banks defining a furnace chamber between them at least in part, at least one fuel burner for firing the furnace, a superheater disposed outside of said furnace and separated therefrom by tubes of one of said tube banks and having tubes thereof disposed adjacent tubes of said one bank, at least one fuel burner for firing the superheater, and a flue connecting with the setting and having a single uncontrolled inlet into which flow all the products of combustion produced by said burners, said flue inlet being located so that the products of combustion produced by the at least one burner for firing the superheater flow over tubes of the superheater and each of said tube banks prior to entering the flue.

10. A steam generator comprising a setting,

two spaced groups of fuel burners in the setting, each group comprising at least one burner, a flue connecting with the setting at a point remote from said burners, a bank of steam generating tubes disposed in the path of the gases produced by one group of burners in flowing to the flue, another bank of steam generating tubes and superheater tubes disposed intermediate said burner groups and in the path of the gases produced by the other group of burners in flowing to the flue, the arrangement being such that the gases produced by said other group of burners flow over said first mentioned tube bank prior to entering the flue.

11. A steam generator comprising a setting, two spaced groups of fuel burners in the setting, each group comprising at least one burner, an uncontrolled gas outlet for the setting at a point remote from said burners, a bank of steam generating tubes disposed in the path of the gases produced by one group of burners in flowing to the flue, another bank of steam generating tubes and superheater tubes disposed intermediate said burner groups and in the path of the gases produced by the other group of burners in flowing to the flue, the arrangement being such that the gases produced by said other group of burners flow over said first mentioned tube bank prior to entering the flue.

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#### CERTIFICATE OF CORRECTION.

Patent No. 2,123,860.

July 12, 1938.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 8, for the word "by" read but; page 2, second column, line 12, claim 4, strike out the word "superheater" and insert the same before "furnace" in line 13, same claim; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of August, A. D. 1938.

Henry Van Arsdale

(Seal)

Acting Commissioner of Patents.

the superheater, and a flue connecting with the setting and having a single inlet into which flow all the products of combustion produced by said burners, said flue inlet being located so that the products of combustion produced by the at least one burner for firing the superheater flow over tubes of the superheater and each of said tube banks prior to entering the flue.

9. A steam generator comprising a setting, a steam and water drum in the upper part of the setting, spaced water drums in the lower part of the setting, a bank of boiler tubes connecting the steam and water drum and each of the lower drums, said tube banks defining a furnace chamber between them at least in part, at least one fuel burner for firing the furnace, a superheater disposed outside of said furnace and separated therefrom by tubes of one of said tube banks and having tubes thereof disposed adjacent tubes of said one bank, at least one fuel burner for firing the superheater, and a flue connecting with the setting and having a single uncontrolled inlet into which flow all the products of combustion produced by said burners, said flue inlet being located so that the products of combustion produced by the at least one burner for firing the superheater flow over tubes of the superheater and each of said tube banks prior to entering the flue.

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two spaced groups of fuel burners in the setting, each group comprising at least one burner, a flue connecting with the setting at a point remote from said burners, a bank of steam generating tubes disposed in the path of the gases produced by one group of burners in flowing to the flue, another bank of steam generating tubes and superheater tubes disposed intermediate said burner groups and in the path of the gases produced by the other group of burners in flowing to the flue, the arrangement being such that the gases produced by said other group of burners flow over said first mentioned tube bank prior to entering the flue.

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