Sept. 10, 1963 C. GUARRAIA 3,103,207

WATER-COOLED PANELS FOR REAR PASS ENCLOSURE

Filed May 26, 1961 4 Sheets-Sheet 1

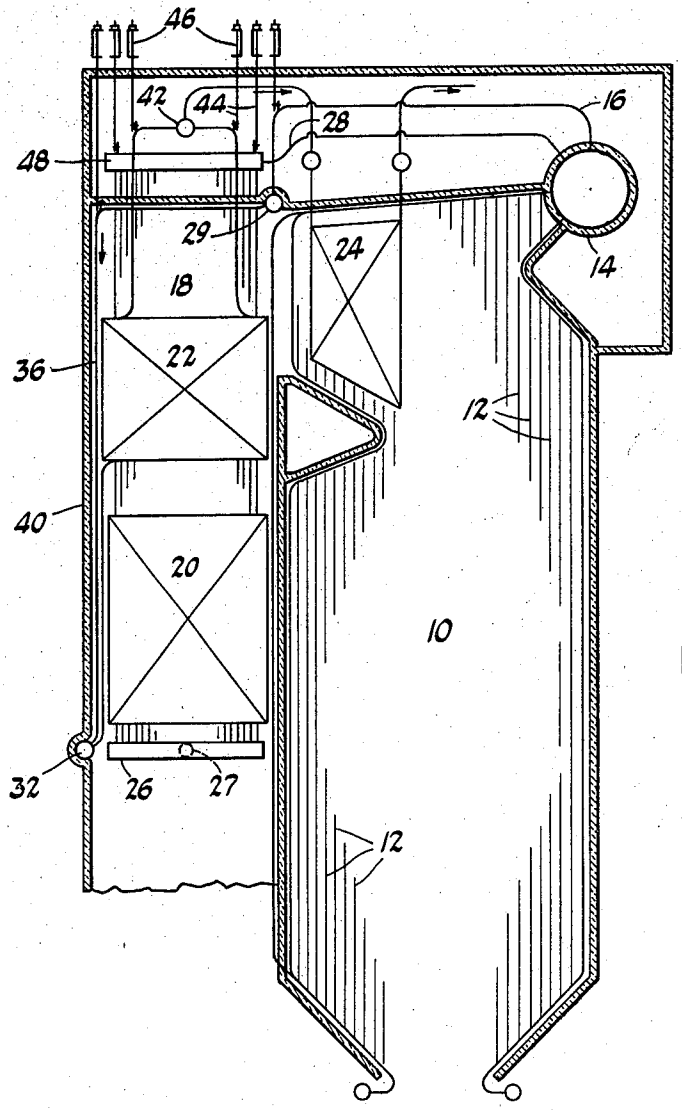

FIG. 1

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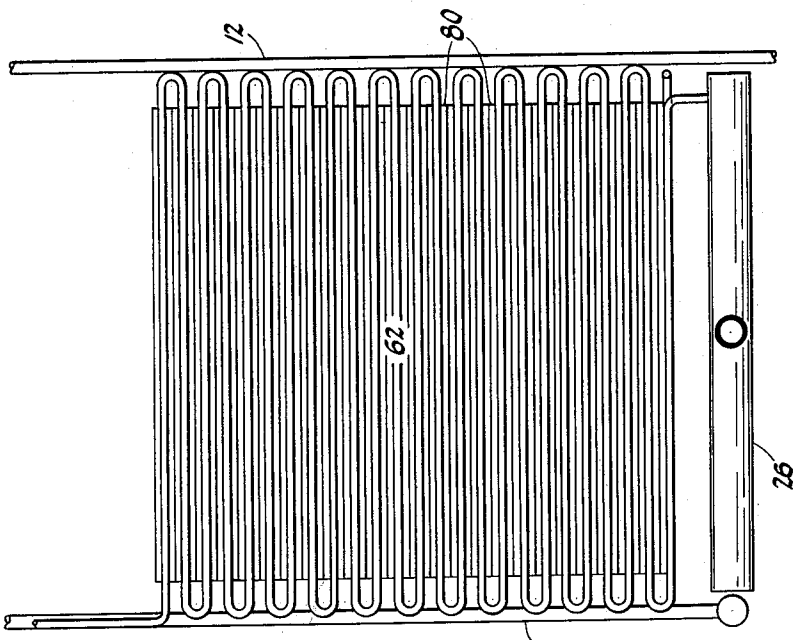

FIG. 4

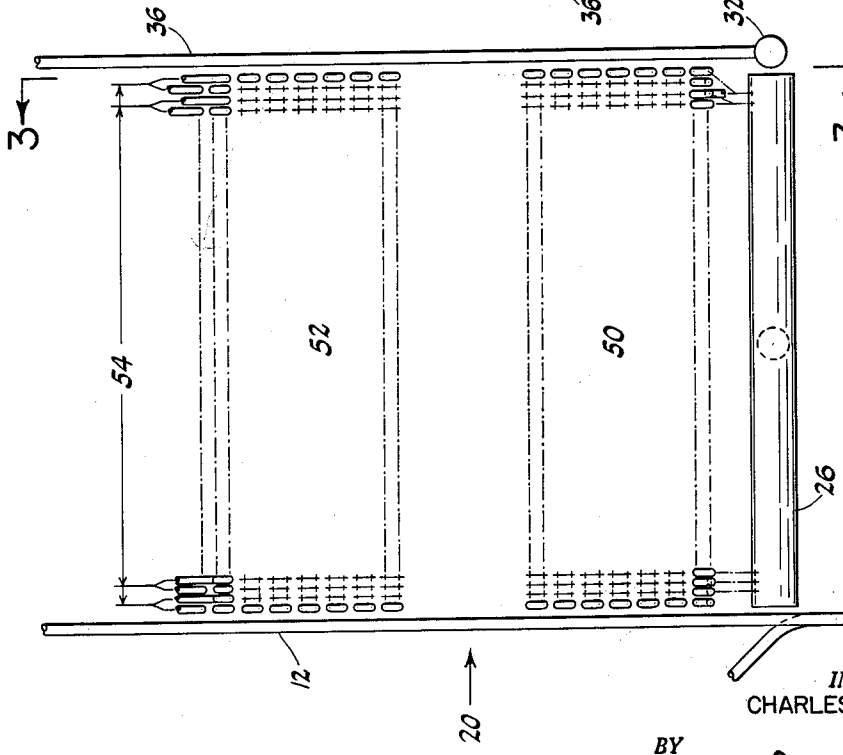

FIG. 2

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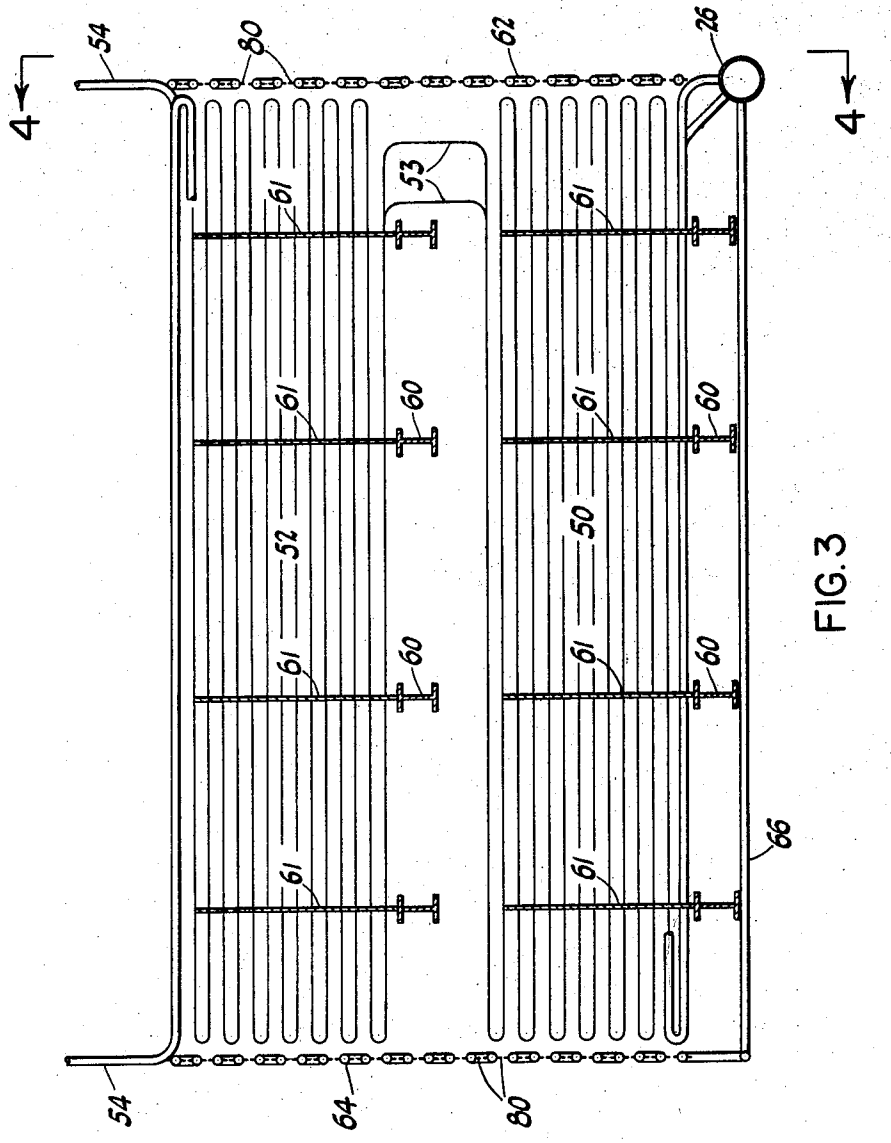

FIG. 3

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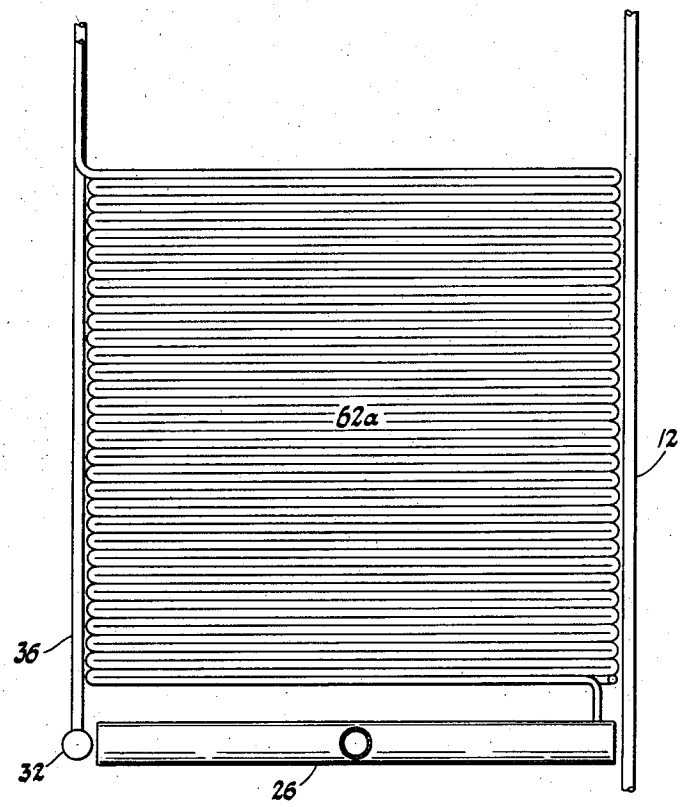

FIG. 5

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WATER-COOLED PANELS FOR REAR PASS ENCLOSURE

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This invention relates generally to modern high capacity steam generators and is particularly concerned with the construction of the gas pass of such a steam generator and within which is disposed heat exchange surface generally in the form of the economizer section of the steam generator and a steam heater.

The gas pass to which reference is being made is in the form of a large upright duct that receives hot combustion gases at its upper end from the furnace with these gases passing down through the gas pass over heat exchange surface located therewithin and discharging from the lower end of the gas pass. Prior to applicant's improved construction of this invention it was the general practice to provide large plates adjacent the economizer which is located within the gas pass at the lower end, with this region being generally referred to as the low temperature zone. These plates form the wall of the gas pass at this zone and in addition to these plates various amounts of refractory and/or insulation was required to protect the casing of the gas pass. This construction was extremely difficult to maintain in order because of differential expansion problems and it was also difficult to assemble.

Accordingly, a constant search has been conducted to provide an improved construction which will overcome the difficulties and shortcomings of that heretofore employed. It is desirable to have this upright gas pass fully cooled from its upper region to a location below the economizer, i.e., have heat exchange tubes extend along and line the inner surface of the gas pass. It is also desirable to have complete backing of the fluid-cooled inner surface of the gas pass with a gas tight casing and to provide full support for the economizer elements and the gas pass walls from the fluid cooling tubes.

It is an object of this invention to provide an improved construction for use in vapor generators and particularly with relation to the gas pass through which combustion gases from the furnace of the generator pass and traverse heat exchange surface located therewithin by covering all the inner walls of the gas pass with heat exchange tubes.

It is a further object to support the outer wall structure of the gas pass, which includes insulation, sheet or plate type casing sections, stiffener members and the like, from the tubes that extend along the inner surface of the walls of the gas pass.

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 the illustrative embodiments, said embodiments being shown by the accompanying drawings wherein:

FIGURE 1 is a vertical sectional view of a steam generator incorporating the present invention;

FIGURE 2 is an enlarged vertical sectional view of the economizer portion of the gas pass that receives the combustion gases issuing from the furnace;

FIGURE 3 is a vertical sectional view taken along line 3—3 of FIGURE 2;

FIGURE 4 is a vertical view showing the serpentine tube arrangement formed on the wall of the gas pass adjacent the economizer, taken on line 4—4 of FIGURE 3;

FIGURE 5 is a vertical view similar to FIGURE 4 showing another modification of a serpentine tube arrangement formed on the wall of the gas pass adjacent the economizer.

Referring now to the drawings, wherein like reference characters are used throughout to designate like elements, the illustrative and preferred embodiment of the invention depicted therein, includes a furnace 10 in which fuel is burned for the generation of steam as in water tubes 12 lining the walls of the furnace. The mixture of steam and water is discharged into a separator drum 14 with the steam here being separated and passing from the drum to conduit 16. Combustion gases generated in furnace 10 pass upwardly through the furnace and into the upper end of gas pass 18 with the gases passing down through this gas pass and out the lower end thereof. Located within this gas pass 18 is the economizer 20 and the superheater section 22 with this superheater section generally being termed the low temperature superheater and with there being provided at the upper end of furnace 10 a high temperature superheater section 24 as is common practice.

Feed water is supplied to the economizer 20 through inlet header 26. Water enters header 26 by means of supply pipe 27. Water passes upwardly from header 26 into and through the tubes of the economizer 20, then into outlet headers 48. From here the fluid flows by means of tubes 28 into drum 14.

Steam to be superheated passes from drum 14 through tubes 16 into distribution header 29. The steam passes down along tubes 36 to supply header 32, which tubes 36 are adjacent to and line outer wall 40 of the gas pass. From header 32, the steam flows up into superheater section 22 where the steam is superheated, and then into header 42, from which point it passes on to the high temperature superheater section 24. The steam leaving superheater 24 then passes on to its ultimate point of use, such as in driving a turbine to generate electricity.

The tubes lining the four walls of the gas pass 18 are supported from their upper end by suitable structural supports, such as tube hangers 44 that are supported from structural members 46. Thus the gas pass or the walls thereof are supported from above and expand downwardly. The support for the economizer sections 50 and 52 (FIGURE 3) is derived from the I beams 60 that extend between walls of the gas pass. Extending up from these I beams are support members 61 that are formed to receive the laterally extending tube runs and are secured to these runs. The inner surface of the four walls of the gas pass 18 is lined with fluid cooled tubes, as later more fully described, and the outer structure of the wall is supported therefrom. The construction of this outer wall portion may be in accordance with that shown and described in Walter et al. Patent 2,773,487 issued December 11, 1956, with this being a desirable construction since it provides for the necessary differential expansion of the duct walls, although a variety of possible constructions of the outer wall components may equally as well be employed, so long as a pressure tight casing is formed.

Looking now to the manner in which the walls of the gas pass are lined, as seen in FIGS. 1 and 2, the tubes 36 which extend down from header 29 to supply header 32 line the outer wall of the gas pass. These tubes can be positioned right next to each other so as to form a solid wall of tubes, or they can be finned, whereby not as many tubes will be required. The inner wall of the gas pass adjacent to the furnace 10 is lined with tubes 12. These tubes 12 form a common wall both for the gas

pass and the furnace, and thus perform a double function. Again these may be plain or finned tubes.

The other two walls of the gas pass are lined with tubes as illustrated in FIGS. 3 and 4. The economizer sections 50 and 52 are formed by a plurality of tubes which extend from header 26 and zig zag back and forth across the width of the gas pass, the two sections being joined serially by tubes 53, there being a sufficient number of economizer tubes that they cover completely the area of the gas pass, as seen in FIGURE 2. The economizer is shown as made up of two tube bundles so that soot blowers can be mounted therebetween. The tubes 54 leaving the tube bundle of the economizer extend up along the walls of the gas pass, and are connected at their upper ends to outlet headers 48, every other tube extending up along and lining the left hand wall as seen in FIGURE 3, and the remaining tubes lining the right hand wall. These tubes should be finned, so as to substantially cover the entire wall area above the economizer.

Below these tubes 54, directly adjacent the economizer, the two walls are lined by means of a single tube extending out of header 26 up along each wall, as shown at 62 and 64 in FIGURE 3. Each of these tubes is of a serpentine configuration, zig zagging back and forth upon itself upwardly along the wall. The left hand wall tube, as seen in FIG. 3, is connected to header 26 by means of tube 66, which extends across the gas pass below the economizer section. FIGURE 4 shows the serpentine configuration of tube 62, which lines the wall of the gas pass adjacent the economizer. The tubes 62 and 64 have fins 80 thereon.

As seen in FIGURE 5, a second embodiment of the invention would be to omit the fins 80. If this were done, the tubes would have to have sharper bends than when the tubes are finned, so that the tube doubles back directly upon itself, so as to line the entire area of the wall, as shown at 62*a*.

It is obvious that two, three, or more tubes could be used to line each wall adjacent the economizer, as shown at 62 and 64 in the illustrated embodiment. These tubes again would be of a serpentine configuration. However, the simplest and most economical method is to use just one tube for each wall, as illustrated.

With the present invention full cooling of the gas pass 18 at the economizer is had with the cooling surface being completely backed by a pressure tight skin casing and with the entire gas pass and economizer being supported from the cooling tubes which are, in turn, supported at the upper end of the gas pass.

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 is claimed is:

1. In a vapor generator an upright gas passageway of rectangular transverse section and adapted to have a stream of hot combustion gases pass downwardly therethrough, a superheater heat exchanger in said passageway as well as an economizer heat exchanger below said superheater, longitudinally extending tube means carrying steam for superheating lining a first one of the walls of the passageway and extending from the upper end thereof to a location below the economizer heat exchanger, means effectively connecting these tube means to the superheater heat exchanger, longitudinally extending tube means which line the wall of said passageway opposite said first wall, an inlet header for said economizer heat exchanger located below said economizer heat exchanger, said economizer heat exchanger being made up of a plurality of tubes extending out of said inlet header, each tube having a first portion bent and formed in serpentine configuration to extend back and forth across the passageway thereby forming a group of first tube bundles, a second substantially vertical portion, and a third portion bent and formed in serpentine configuration to extend back and forth across the passageway thereby forming a group of second tube bundles, the first tube bundles being connected in series flow relationship with the second bundles and spaced a substantial distance vertically therefrom, with these tubes leaving the third portions returning to the other two opposed walls of the passageway and extending therealong above said economizer heat exchanger, a first tube means extending out of said inlet header extending along one of the other said opposed walls, said first tube means being of a serpentine configuration so as to cover the entire wall adjacent the economizer heat exchanger, a second tube means extending out of said inlet header along the wall opposite that lined by said first tube means, said second tube means being of a serpentine configuration so as to cover the entire wall adjacent the economizer heat exchanger.

2. The vapor generator of claim 1, said first and second tube means extending out of said inlet header being finned, such that said first and second tube means and their corresponding fins cover the entire two other opposed walls adjacent the economizer heat exchanger.

References Cited in the file of this patent

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2,469,487 Woodward et al. ---------- May 10, 1949
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