Aug. 8, 1961 G. BRANDSTETTER 2,995,118

TUBULAR LINING FOR THE COMBUSTION CHAMBER OF A RADIANT HEAT TUBULAR HEAT EXCHANGER

Filed Oct. 9, 1959

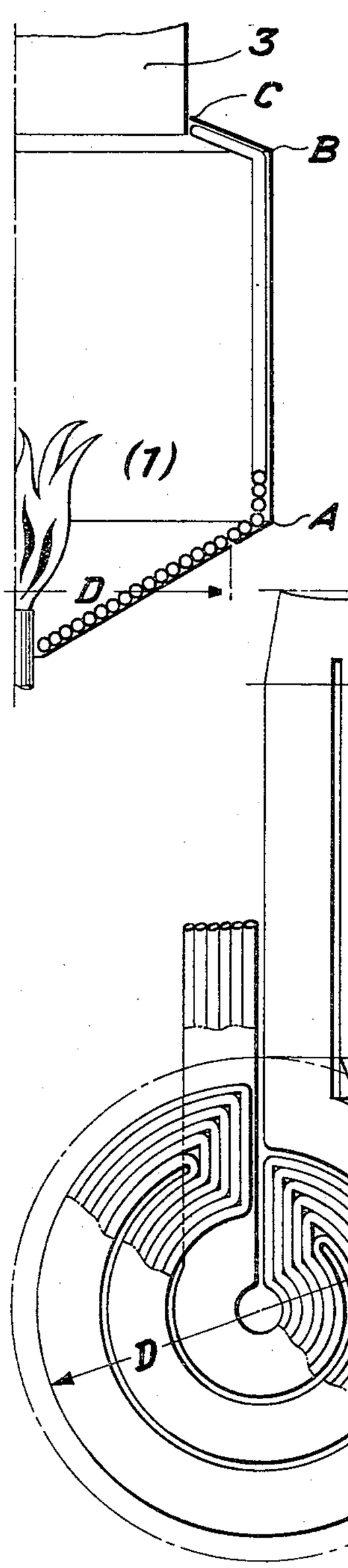
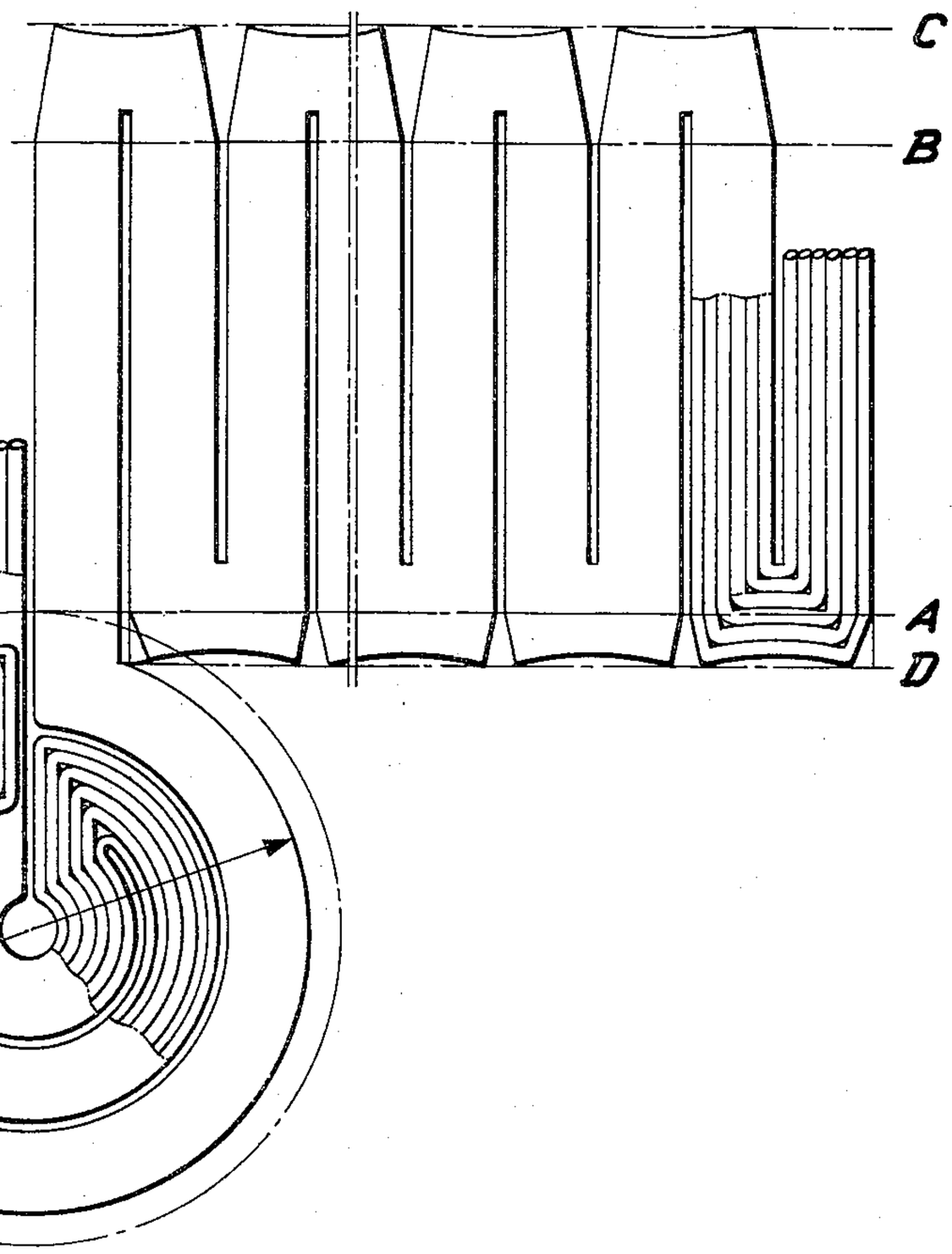


Fig. 1

Fig. 2



United States Patent Office

2,995,118

Patented Aug. 8, 1961

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TUBULAR LINING FOR THE COMBUSTION CHAMBER OF A RADIANT HEAT TUBULAR HEAT EXCHANGER

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Filed Oct. 9, 1959, Ser. No. 845,471
Claims priority, application Germany Oct. 9, 1958
2 Claims. (Cl. 122—235)

The present invention relates to tubular linings of the combustion chamber of a radiant heat tubular heat exchanger, particularly of a radiant heat steam generator having a substantially cylindrical combustion chamber provided with a substantially circular outlet for the combustion gases whose diameter is smaller than the diameter of the combustion chamber. The combustion chamber is lined by a plurality of tubes arranged in parallel with respect to the flow of the medium through the tubes which medium is heated by heat developed in the combustion chamber, the tubes being placed parallel to each other and forming one or a plurality of ribbons arranged in meandering fashion to cover or form the inside walls of the combustion chamber.

Linings of the kind with which the invention is concerned are used in combustion chambers of steam generators of the forced circulation or forced flow type. Particularly in forced flow steam generators it is of great importance that the individual tubes forming a tube ribbon have the same length and offer the same flow resistance to the fluid inside the tubes so that the individual tubes absorb substantially the same amount of heat. Conventional combustion chamber linings do not fully satisfy this requirement.

It is an object of the present invention to provide a lining for a substantially cylindrical combustion chamber, particularly for forced flow steam generators, whereby a plurality of tubes are arranged in parallel with respect to a flow of water and steam therethrough and form a ribbon, the ribbon entering the combustion chamber substantially at the center of the bottom of the combustion chamber and being placed in a plurality of concentric circles covering the bottom of the combustion chamber. Thereupon the tube ribbon is arranged in parallel relation to the longitudinal axis of the combustion chamber and covers the inside wall of the combustion chamber in a meandering fashion. The individual tubes and the ribbon formed thereby and covering the cylindrical wall of the combustion chamber have U-bends located at the annular marginal part of the bottom of the combustion chamber and at the annular marginal part around the circular outlet opening in the ceiling of the combustion chamber which opening has a diameter smaller than that of the combustion chamber. With the arrangement according to the invention the entire combustion chamber is lined by one or a plurality of continuous tube ribbons whose tubes are arranged in parallel relation with respect to the flow of heat absorbing medium flowing therethrough and are placed parallel to each other, whereby all tubes have the same length and the same bends so that the internal flow resistance of the individual tubes is equal. The arrangement according to the invention has the additional advantage that the entire combustion chamber lining can be produced by a small number of differently shaped groups of tubes. The last mentioned advantage is particularly marked, if the diameter of the annular marginal part surrounding the outlet opening in the ceiling of the combustion chamber is alike the diameter of the annular marginal part surrounding the outermost circular tube lining the combustion chamber bottom so that the U-bends at the ends of the tubes which

are parallel to the longitudinal axis of the combustion chamber are alike.

The novel features which are considered characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, and additional objects and advantages thereof will best be understood from the following description of an embodiment thereof when read in connection with the accompanying drawing, in which:

FIG. 1 is a portion of a diagrammatic longitudinal section of a cyclone burner type combustion chamber of a forced flow steam generator.

FIG. 2 is a diagrammatic top view of the tubular lining of the bottom of the combustion chamber shown in FIG. 1 and of the tube band, lining the cylindrical wall of the combustion chamber, in spread-out position.

Referring more particularly to the drawing, numeral 1 designates a combustion chamber having a cylindrical part between planes A and B which are at a right angle to the longitudinal axis of the combustion chamber. The lower end of the combustion chamber is provided with a frusto-conical bottom and the upper end of the combustion chamber is provided with a substantially concentric outlet opening 3 of smaller cross section than the combustion chamber. The upper end of the combustion chamber has, therefore, an annular wall portion C opposite the bottom of the combustion chamber. The bottom of the combustion chamber, the cylindrical part of the combustion chamber between the planes A and B and the annular part C at the upper end of the combustion chamber are lined by a ribbon formed by a plurality of tubes arranged in parallel with respect to the flow of the operating medium therethrough and placed in parallel relation.

As seen in FIG. 2, the tube ribbon enters the combustion chamber at the center of the bottom of the combustion chamber and covers the bottom in concentric circles up to an outer diameter D, the individual tubes and the ribbon formed thereby having a U-bend at the end of each concentric circle and at the beginning of the subsequent circle of larger diameter. The portion of the tube ribbon forming the outermost circle at the bottom of the combustion chamber continues in a vertical direction parallel to the longitudinal axis of the combustion chamber to line the longitudinal wall of the latter in a meandering fashion. The individual vertical tubes and the part of the ribbon formed thereby have U-bends or return bends located at the outermost part of the bottom of the combustion chamber in the region between the circle of the diameter D and the circle formed by the combustion chamber wall at the plane A. The individual vertical tubes and the ribbons formed thereby have U-bends or return bends located at the annular part C at the outlet of the combustion chamber adjacent to the circular opening 3.

Though in the illustrated example only one tube ribbon is used for lining the entire combustion chamber, a plurality of ribbons arranged in parallel with respect to each other and with respect to the flow of operating medium therethrough may be provided. If two ribbons are used, the combustion chamber may be split by a diametrical plane into two halves and each ribbon may line the interior wall of one longitudinal half of the combustion chamber.

What is claimed is:

1. In a tubular steam generator, a substantially cylindrical combustion chamber having a substantially closed bottom, a ceiling opposite said bottom, said ceiling having a substantially circular opening substantially coaxial of said combustion chamber and having a diameter which is smaller than the diameter of said combustion chamber and leaving an annular ceiling portion, said combustion

chamber being lined by tubes conducting a medium receiving heat from said combustion chamber, a plurality of said tubes being arranged in parallel relation with respect to the medium flowing through the tubes and being placed parallel and adjacent to each other to form a continuous ribbon entering the combustion chamber at the center of said bottom and being placed for covering said bottom excepting the outer annular marginal portion thereof in concentric circles beginning in the center of said bottom, the individual tubes and the ribbon formed thereby having a U-bend at the end of each circle and at the beginning of the subsequent circle of larger diameter, the portion of the ribbon forming the outermost circle at the bottom of the combustion chamber continuing through a substantially radial portion into a portion which is parallel to the longitudinal axis of the combustion chamber and lines a part of the longitudinal interior wall thereof, said last mentioned portion continuing into a meandering portion having relatively long straight portions parallel to the longitudinal axis of and lining the balance of the longitudinal interior wall of the combustion chamber, said meandering portion having return

bends connecting said straight portions, said return bends at one end of said straight portions covering the annular marginal portion of said bottom, and the return bends at the opposite end of said straight portions covering said annular ceiling portion.

2. In a tubular steam generator according to claim 1 and wherein the diameter of the marginal annular portion of said bottom is substantially the same as the diameter of said annular ceiling portion whereby the return bends covering the marginal annular portion of the bottom of the combustion chamber are alike the return bends covering the annular ceiling portion of the combustion chamber.

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