

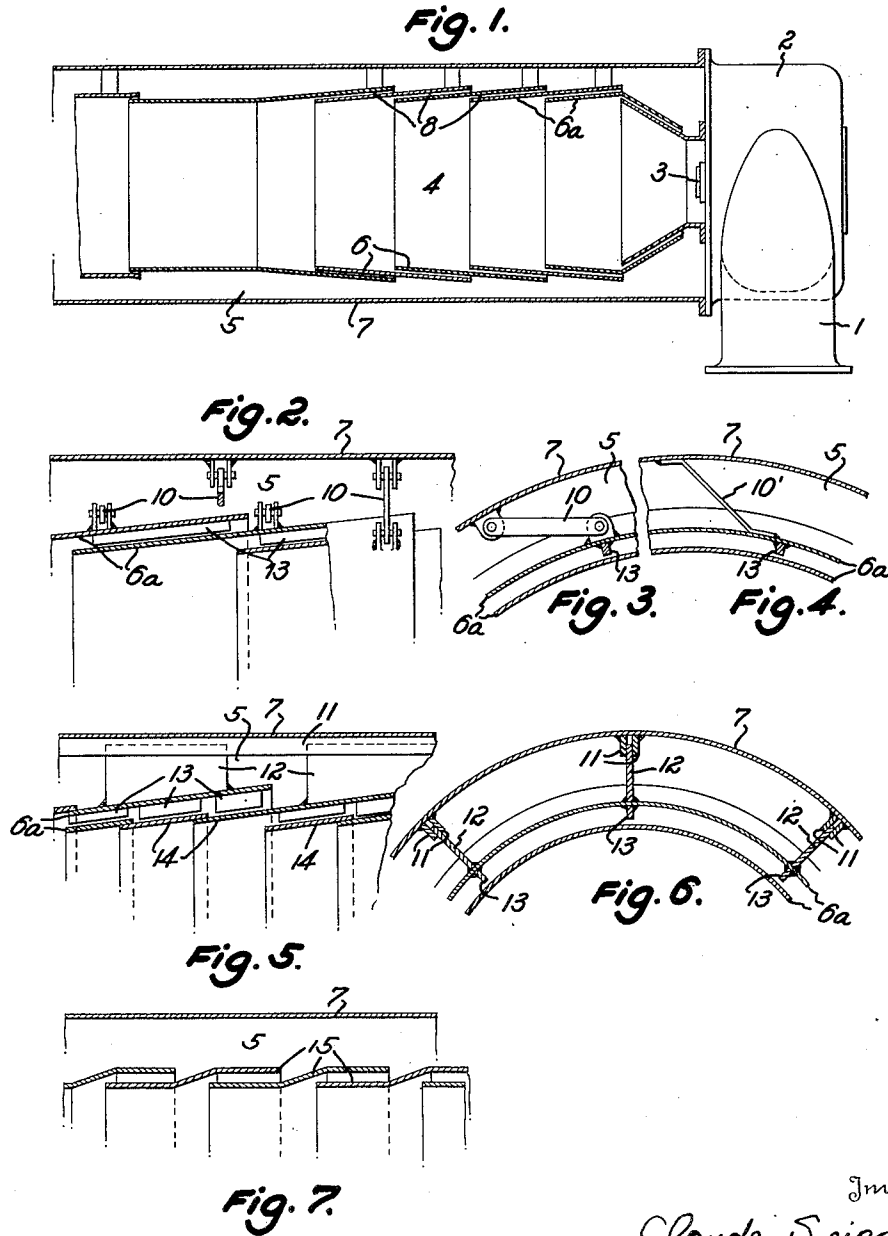
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COMBUSTION CHAMBER

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COMBUSTION CHAMBER

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5 Claims. (Cl. 263—19)

This invention relates to combustion chambers and particularly to metal combustion chambers for the production of heating or power gases at moderate temperatures.

Gases at moderate temperatures are frequently needed for heating and power purposes. With suitable provision such gases can be produced in combustion chambers constructed entirely of metal, that is, without requiring the use of ceramic construction materials. The desired moderate temperatures (about 400–700° C.) are not obtained by burning the fuel with a very large excess of air since too large excesses of air bring about poor combustion, smoking and easy extinguishing of the flame. One must, on the contrary, select the most favorable, that is, a usually quite low, excess of air and mix the combustion gases gradually with so much air that the desired heating or power gas temperature is obtained. In spite of the high temperature which the flame develops with low excess of air, the combustion chamber can be constructed of metal and the use of any special cooling agent, such as water, can be eliminated if one uses for cooling the walls of the combustion chamber the medium which is afterwards used also for cooling the combustion gases.

Such a combustion chamber consists advantageously of an inner wall made of heat-resisting plate and of an outer wall concentrically surrounding the inner wall which gives to the chamber the necessary structural strength. Between the inner and outer walls air or other cooling gas is conducted which cools the inner wall, is thereafter mixed with the combustion gases and forms in admixture with the combustion gases the heating or power means of moderate temperature.

In order to obtain a suitable cooling of the inner wall, it is necessary to pass the cooling medium past the wall with a high velocity so that its heat absorbing capacity becomes large. Moreover, the inner combustion chamber wall which forms one side of the cooling medium passage must be so constructed that even under the effect of heat expansion the uniform distribution of the cooling medium and of its velocity is maintained. While with small combustion chambers the construction of the inner wall as a simple cylinder provided with radial projections is satisfactory, it has been found that with larger combustion chambers, for example, handling more than four million kilogram calories per hour, special precautions must be taken. The principal purpose of the present inven-

tion is the provision of a combustion chamber for the production of heating or power gases of moderate temperatures which comprises an outer supporting wall and an inner wall of heat-resistant metallic plates between which walls cooling air or cooling gases are conducted, the inner wall being formed of a plurality of short channels through which the cooling agent, flowing out of the space between the inner and outer combustion chamber walls, passes with a high velocity.

By the subdivision of the inner wall into a plurality of portions, it becomes possible to compensate for changes in form due to heat expansion so that the required channel cross-section area for a given amount of cooling agent is maintained and also the length of the stream path of each cooling channel is so short that the flow resistance to be overcome is kept at a minimum. Particular care must be taken in certain types of uses, for example, for gas turbine combustion chambers, the pressure drop of the cooling air is only very small in order that too much efficiency is not lost in the wall cooling.

The invention will be more particularly described with reference to the accompanying drawing showing various embodiments of the principles of the invention. In the drawing:

Fig. 1 is an elevation in partial section of the principal portion of a combustion chamber for a gas turbine; and

Figs. 2 to 7 are fragmentary sections showing the details of various constructional modifications of the invention.

In the gas turbine combustion chamber of Fig. 1, the air is introduced at 1 and divides itself in the combustion chamber head 2 into two portions. One portion passes as combustion air to the actual combustion chamber 4, together with the fuel introduced through the fuel nozzle 3. The greater portion of the air, however, is cooling air which flows into space 5 between the inner combustion chamber wall 6 and the outer combustion chamber wall 7. The inner combustion wall 6 comprises a number of cone-shaped rings 6a of metal plate which overlap each other in such a way as to provide between the conical rings annular passages 8 through which the cooling medium flows with high velocity out of space 5.

The individual conical rings are so suspended from the outer wall 7 that they may freely expand. As is shown in Figs. 2 and 3, the rings 6a may be supported by means of pivotally mounted link members 10 or, as in Fig. 4, by means

of flexible metal strips 10' firmly fastened at one end to outer wall 7 and at the other end to ring members 6a. As shown in Figs. 5 and 6, the ring members 6a may be supported for free expansion by means of radially projecting plates 5 riding in guiding slots 11 on the inner surface of the outer wall 7.

The spacing of the adjacent cones 6a from each other, and thereby their centering and maintenance of the channel section, is provided by ribs 13. It is desirable to have the individual conical rings overlap to such an extent that the inner combustion chamber wall consists over its entire length of channels closed on both sides so that the opposite sides of the portions of the rings in contact with the flame are everywhere washed by rapidly flowing cooling medium. With combustion chambers which are only moderately burdened, particularly with fuels of low radiation value, the overlapping may be less extensive as it may be assumed that the heat conductivity of the metal plate will be sufficient to keep cool also those portions of the wall past which the cooling agent flows at a moderate velocity. In every case the cooling medium has only a low velocity in space 5 in order to avoid too large pressure drops. A particular advantage of the method of construction of the invention consists in the possibility of supplying the cooling medium at low velocity and only accelerating it for the short distance where it is required to exert its cooling action.

In order to better avoid warping of the inner wall by high heat, the ring members 6a can themselves be formed of a plurality of overlapping conical rings 14, as shown in Fig. 5. Also a subdivision of the individual conical rings is possible wherein the shingle-like overlapping is provided not only from ring to ring but also from ring segment to ring segment. Instead of the strictly conical form the ring members may be given the equivalent step-down cylindrical form, as is shown by members 15 in Fig. 7.

I claim:

1. A combustion chamber for the production of heating and combustion gases at moderate temperatures comprising a metallic cylindrical outer wall, and a metallic inner wall supported from the outer wall in concentric spaced relation thereto and providing an annular gas space between the outer wall and the inner wall and a combustion space within the inner wall, said inner wall comprising a plurality of annular channels for the passage of cooling gas from said annular gas space through said inner wall into said combustion space, said channels being substantially coextensive with the area of said inner wall exposed to the combustion flame in said combustion space.

2. A combustion chamber for the production of heating and combustion gases at moderate temperatures comprising a metallic cylindrical outer wall, and a metallic inner wall supported from

the outer wall in concentric spaced relation thereto by means of flexible link members permitting thermal expansion of the inner wall and providing an annular gas space between the outer wall and the inner wall and a combustion space within the inner wall, said inner wall comprising a plurality of annular channels for the passage of cooling gas from said annular gas space through said inner wall into said combustion space, said channels being substantially coextensive with the area of said inner wall exposed to the combustion flame in said combustion space.

3. A combustion chamber for the production of heating and combustion gases at moderate temperatures comprising a metallic cylindrical outer wall, and a metallic inner wall supported from the outer wall in concentric spaced relation thereto by means of radial rib members horizontally movable in guideways to permit thermal expansion of the inner wall and providing an annular gas space between the outer wall and the inner wall, said inner wall comprising a plurality of annular channels for the passage of cooling gas from said annular gas space through said inner wall into said combustion space, said channels being substantially coextensive with the area of said inner wall exposed to the combustion flame in said combustion space.

4. A combustion chamber for the production of heating and combustion gases at moderate temperatures comprising a metallic cylindrical outer wall, and a metallic inner wall supported from the outer wall in concentric spaced relation thereto and providing an annular gas space between the outer wall and the inner wall and a combustion space within the inner wall, said inner wall comprising a plurality of overlapping conical rings spaced to provide between said rings a plurality of annular channels for the passage of cooling gas from said annular gas space through said inner wall into said combustion space, said channels being substantially coextensive with the area of said inner wall exposed to the combustion flame in said combustion space.

5. A combustion chamber for the production of heating and combustion gases at moderate temperatures comprising a metallic cylindrical outer wall, and a metallic inner wall supported from the outer wall in concentric spaced relation thereto and providing an annular gas space between the outer wall and the inner wall and a combustion space within the inner wall, said inner wall comprising a plurality of overlapping stepped cylindrical rings spaced to provide between said rings a plurality of annular channels for the passage of cooling gas from said annular gas space through said inner wall into said combustion space, said channels being substantially coextensive with the area of said inner wall exposed to the combustion flame in said combustion space.

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