

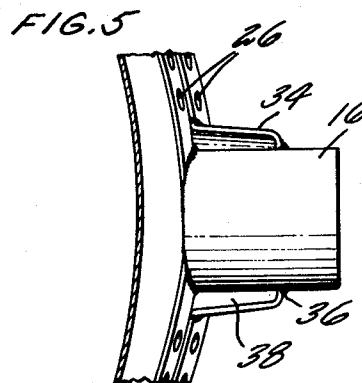
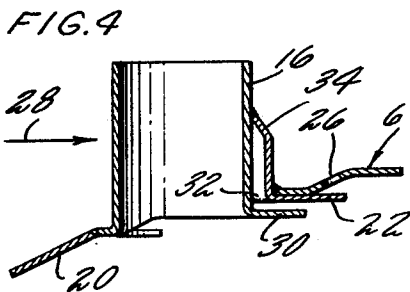
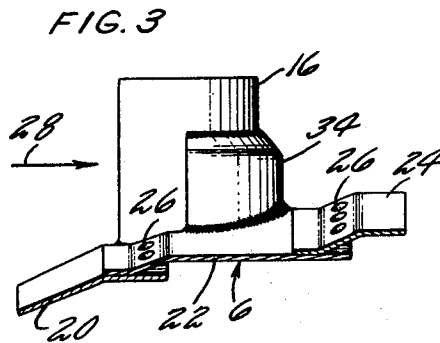
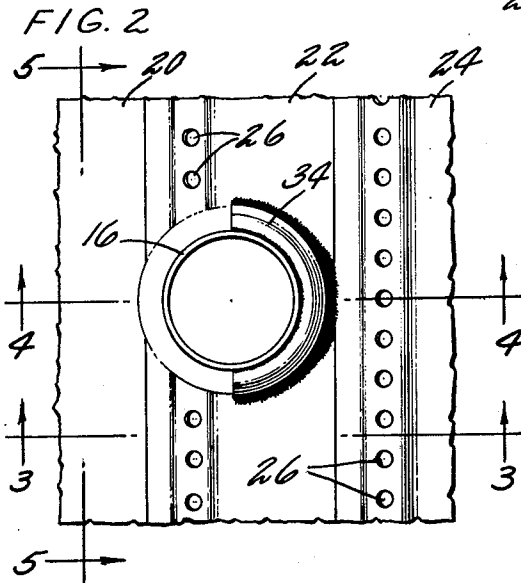
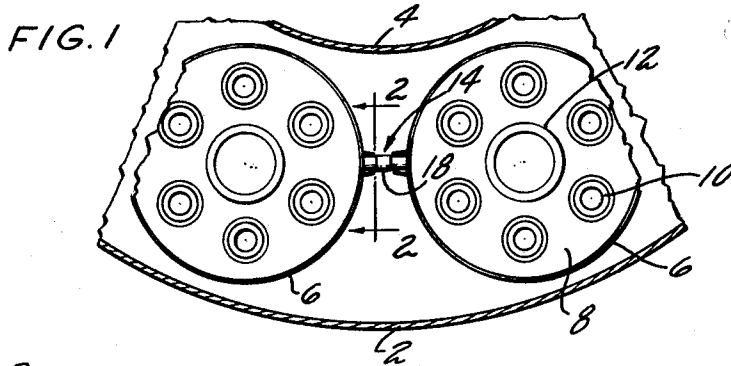
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3,184,918

COOLING ARRANGEMENT FOR CROSSOVER TUBES

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3,184,918 COOLING ARRANGEMENT FOR CROSSOVER TUBES

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This invention relates to an arrangement by which to provide for cooling of the crossover tubes in a combustion chamber construction to prevent burnout of the crossover tubes and the flametube wall adjacent thereto.

In combustion chamber constructions for gas turbine engines the gas from the compressor passes either through a plurality of separate combustion chambers or through a single annular combustion chamber within which are located a plurality of flametubes. In either of these constructions there are crossover tubes provided between adjacent flametubes to equalize the pressures within the tubes and also to provide for ignition of the combustible mixture in adjacent flametubes after ignition has been initiated in one of them. The crossover tubes interfere with the flow of air over the surface of the flametube and as a result the crossover tube or the flametube adjacent thereto frequently is overheated with resultant breakdown of the tube wall. One feature of the present invention is an arrangement by which to eliminate this destructive overheating.

One arrangement by which to control the wall temperature adjacent the crossover tube is shown in the patent to Ward 2,979,898. This arrangement has been satisfactory in certain installations. However, under certain conditions it has been found that even more effective wall cooling is necessary and, accordingly, one of the principal features of the present invention is a modification or revision of the cooling arrangement of the Ward patent which more effectively reduces the flametube wall temperature.

Other features and advantages will be apparent from the specification and claims, and from the accompanying drawing which illustrates an embodiment of the invention.

FIG. 1 is a transverse sectional view through a semiannular combustion chamber showing the flametubes in elevation.

FIG. 2 is a view substantially along the line 2—2 of FIG. 1.

FIG. 3 is a view substantially along the line 3—3 of FIG. 2.

FIG. 4 is a sectional view substantially along the line 4—4 of FIG. 2.

FIG. 5 is a sectional view substantially along the line 5—5 of FIG. 2.

The invention is shown in connection with a semiannular combustion chamber for use in gas turbine powerplants of the type shown, for example, in the Savin Patent 2,747,367. Air from the compressor passes through an annular combustion chamber defined by an outer wall 2 and a concentric inner wall 4. Within this annular duct are located a plurality of substantially cylindrical flametubes 6 having at their upstream ends an end cap 8 with a plurality of openings 10 therein to receive fuel nozzles, not shown, for the injection of combustible fluid into the flametube. The end cap may also have a central opening 12 for the admission of air into a central tube within the flametube although this is not a feature of or involved in the present invention.

Adjacent flametubes 6 are interconnected by crossover connectors 14 extending between adjacent flametubes. Each crossover connector consists of a crossover tube 16 projecting from and suitably attached as by brazing or welding to the flametube, as best shown in FIG. 4. Op-

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posed crossover tube elements 16 from adjacent tubes are in alignment as shown in FIG. 1 and a connector sleeve 18 establishes the remainder of the crossover connector 14.

Referring now to FIGS. 2 to 5, inclusive, the flametube 6 normally consists of a plurality of annular rings 20, 22 and 24 which are overlapping and welded together as best shown in FIG. 3. Each ring has a plurality of openings 26 therein for the admission of air into the flametube for cooling purposes. The crossover tube element 16 is positioned in the sleeve 22 and in a position to interrupt the row of holes 26 in this sleeve. The tube 16 for the upstream half of its periphery is blended into and welded into the sleeve 20 and sleeve 22. At the downstream side of the tube 16, the flow of air being in the direction of the arrow 28, FIG. 4, it carries a downwardly projecting flange 30 positioned inside of the sleeve 22 and spaced therefrom to direct flow of cooling air between the sleeve 22 and the flange 30. The sleeve 22 is spaced from the wall of the tube 16 over the area where the flange 30 is located to provide a passage 32 for the flow of cooling air into the flametube at this point.

To assist in directing the cooling air around the tube 16 and through the opening 32 the downstream side of the tube 16 has a semiannular shield 34 mounted thereon. The shield 34 is suitably welded or brazed to the sleeve 22 at its inner end and at its outer end carries an inwardly projecting flange 36 engaged with and suitably secured to the tube 16. The diametral edges of the shield are spaced from the tube 16 and, in this way, the shield 34 defines an opening 38 on opposite sides of the tube 16 which faces in an upstream direction and which receives cooling air to guide it around the downstream side of the tube 16 and thence through the opening 32 to flow between the flange 30 and the adjacent wall of the sleeve 22.

Prior to the application of this device to the crossover tube the downstream side of the tube 16 and the wall of the sleeve 22 adjacent thereto would frequently be extensively heated to result in destructive damage to the tube and sleeve. With the arrangement shown it has been found possible to operate the gas turbine powerplant in which this invention is incorporated at maximum power over long periods of time without damage by overheating.

It is to be understood that the invention is not limited to the specific embodiment herein illustrated and described, but may be used in other ways without departure from its spirit as defined by the following claims.

I claim:

1. A flametube for a combustion chamber, said tube having an annular wall with openings therein for the flow of air into the tube, said tube having a partially closed upstream end, a laterally extending crossover tube mounted in a side opening in the annular wall and projecting outwardly therefrom with the inner end of the lateral tube substantially in alignment with the annular wall, said lateral tube being welded to the flametube over substantially the upstream half of the lateral tube and having an outwardly projecting flange on the downstream half thereof located within and extending parallel to the adjacent flametube wall, the lateral tube being spaced from the edge of the opening in the flametube wall over substantially the downstream half of the lateral tube to form a passage for air between the lateral tube and the flametube wall and a substantially semicylindrical shield extending around and located in spaced concentric relation to the lateral tube in the downstream side thereof, said shield being secured along its outer edge to the crossover tube at a point spaced from the flametube wall and being secured at its inner edge to the edge of the opening in the flametube within which the lateral tube is positioned for directing air entering the space between the shield and

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the lateral tube into the passage between the lateral tube and the flametube wall.

2. In a combustion chamber a plurality of flametubes each having a substantially cylindrical wall and arranged in substantially parallel relation to each other for a flow of air around the flametube in substantially parallel relation to the longitudinal axes of the tubes, said tubes having upstream and downstream ends, a crossover tube projecting laterally from each flametube with the crossover tubes of adjacent flametubes positioned in alignment and interconnected and a semicylindrical shield positioned around and in spaced concentric relation to the crossover tube and located on the downstream side of the crossover tube, said shield extending outwardly from the flametube and being attached at its inner end, said shield being attached to the crossover tube at its outer end in spaced relation to the flametube wall, said shield between its ends, at its diametral edges being spaced from the crossover tube on opposite ends thereof to form openings for the entrance of cooling air into the shield, the flametube being spaced from the crossover tube at the downstream side

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of the crossover tube to provide a passage for a flow of cooling air entering the shield into the interior of the flametube.

3. A combustion chamber as in claim 2 in which the crossover tube has a flange thereon on the end adjacent the flametube, said flange projecting in a downstream direction and being positioned within and in spaced relation to the wall of the flametube for directing air entering the passage to flow along the inner wall of the flametube at the downstream side of the crossover tube.

References Cited by the Examiner

UNITED STATES PATENTS

2,699,648	1/55	Berkey	60—39.65
2,851,859	9/58	Foure	60—39.65
2,979,898	4/61	Ward	60—39.37 X

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