FUEL INJECTION NOZZLE

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UNITED STATES PATENTS
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2,592,111 4/1952 Bischof..............................239/533
3,029,029 4/1962 Webster..............................239/404
3,131,866 5/1964 Cummins et al..........................239/533
3,154,095 10/1964 Cleminshaw et al.....................239/410 X

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ABSTRACT

A fuel injection nozzle of the dual orifice type characterized in that the elongated primary fuel passage in the nozzle housing is constituted by a length of tube which is thermally isolated from the housing whereby the flow of fuel through the tube maintains the interior wall thereof at a temperature below that at which carbonizing of the fuel would occur.

5 Claims, 3 Drawing Figures
FUEL INJECTION NOZZLE

BACKGROUND OF THE INVENTION

Dual orifice fuel injection nozzles for gas turbines and the like generally comprise an elongated housing having a fuel inlet port and flow divider at one end and a spray nozzle at the other end, said one end being flanged for mounting as on the wall of the combustion chamber. Between the fuel inlet port and flow divider and the spray nozzle the housing is provided with elongated primary and secondary passages which respectively communicate with the fuel injector port upstream and downstream of the flow divider and lead to the primary and secondary discharge orifices of the nozzle. As shown, for example, in the U.S. Pat. to Cleminshaw et al. No. 3,154,095, granted Oct. 27, 1964, the intermediate portion of the housing is defined by elongated primary and secondary tubes which extend alongside each other and which are brazed at their ends to the flow divider body and to the nozzle body. Furthermore, in some cases as shown for example in the U.S. Pat. to Webster et al. No. 3,013,732, granted Dec. 19, 1961, and Moebius et al. No. 3,159,971, granted Dec. 8, 1964, there may be a heat shield around the aforementioned primary and secondary tubes. In another known construction (Webster U.S. Pat. No. 3,029,029, granted Apr. 10, 1962), the nozzle housing is of unitary form, a forging for example, in which the elongated secondary passage is in the form of a drilled hole, and the primary passage is the bore of a primary tube which extends in spaced relation through the secondary passage and which has its ends brazed in place to communicate with a fuel inlet port which is upstream of the secondary flow control valve and with the primary discharge orifice.

In the known constructions wherein the primary and secondary tubes are exposed, the interior wall of the primary tube may become overheated owing to the limited cooling rate of the low primary flow rate thus preventing carbonization of the fuel with consequent flaking or breaking off of such carbon deposits and resultant plugging of the primary discharge orifice and/or the primary swirl passages. Even when a heat shield is disposed around the primary and secondary tubes, as foreseen, the air space around said tubes may become highly heated so that the low primary fuel flow rate may not be able to maintain the wall of the primary passage below fuel carbonizing temperature. Moreover, the tubes are in good heat conducting relation with the nozzle housing where their ends are brazed in place.

From an operational standpoint, the nozzle of U.S. Pat. No. 3,029,029 may be satisfactory insofar as maintaining the temperature of the wall of the passage in the primary tube at less than fuel carbonizing temperature because of the cooling effect of the secondary fuel flow therearound, and the cooling effect of the primary fuel flow through the primary tube. However, the location and shape of the primary tube entails difficult and expensive assembly operations in view of the angular construction of the nozzle end of the housing with insertion thereof, prior to brazing of the primary tube, of a nozzle insert containing both the primary and secondary passages whereby brazing of that end of the primary tube to the insert is difficult, and moreover, the other end of the primary tube is bent to fit into an angular passage in the housing.

SUMMARY OF THE INVENTION

Contrary to the foregoing, the elongated primary passage in the nozzle housing is in the form of a straight tube which loosely fits in a drilled hole in the housing without any brazed or like connections which would form good heat transfer points between the housing and the primary tube, whereby the flow of fuel through the primary passage from the fuel inlet port to the primary orifice has sufficient cooling effect on the interior wall of the primary tube which is thermally insulated from the housing. This prevents overheating of the wall of the primary tube to the point where carbonizing of the fuel would occur.

Other objects and advantages of the present invention will appear hereinafter.
In summary, it can be seen that the primary tube 16 or 19 is loosely disposed in a bore 14 in the housing 3 so that it is thermally isolated from the housing. Furthermore, it is preferred that the upper end of the primary tube 16 or 19 be axially spaced from the hold-down spring 9 or 21 to avoid firm contact of the lower end of tube 16 with the stop shoulder 15 or of the flange 20 of tube 19 with the housing 3. In the example herein, (tube 16 or 19 of 0.001 to 0.006 in. diameter smaller than bore 16) the tube 16 or 19 is effectively thermally insulated from the housing 3 and substantially the entire primary fuel flow contacts the interior wall of the tube 16 or 19 to cool it below fuel carbonizing temperature.

I, therefore, particularly point out and distinctly claim as my invention:
1. In a dual orifice fuel injection nozzle assembly wherein an elongated housing has primary and secondary fuel supply passages therein leading to the respective primary and secondary discharge orifices of a dual orifice nozzle at one end of said housing operative to spray fuel into the combustion chamber of a gas turbine or the like, the improvement which comprises an elongated open ended metallic tube loosely disposed in a bore in said housing and constituting a substantial portion of the length of the primary fuel supply passage; said tube being thus thermally isolated from said housing whereby primary fuel flowing through said tube cools the interior wall thereof to prevent carbonizing of the fuel flowing in contact therewith.

2. The fuel injection nozzle assembly of claim 1, wherein said housing has a flow divider therein for flow of fuel therethrough into said secondary fuel supply passage.

3. The fuel injection nozzle assembly of claim 1, wherein said housing has means radially overlapping one end of said tube to limit axial movement thereof in said bore.

4. The fuel injection nozzle assembly of claim 3, wherein said bore has a stop shoulder adjacent the other end of said tube.

5. The fuel injection nozzle assembly of claim 3, wherein said one end of said tube, adjacent to the end of said bore, is enlarged to a diameter greater than that of said bore.

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