United States Patent

O'Sickey

[15] 3,685,741

[45] Aug. 22, 1972

[54] **FUEL INJECTION NOZZLE**

[72] Inventor: **Lawrence B. O'Sickey,** University Heights, Ohio

[73] Assignee: **Parker-Hannifin Corporation,** Cleveland, Ohio

[22] Filed: **July 16, 1970**

[21] Appl. No.: **55,376**

[52] **U.S. Cl.**.....**239/406,** 60/39.74

[51] **Int. Cl.**.....**B05b 7/12**

[58] **Field of Search**.....239/403, 404, 405, 406; 60/39.74

[56] **References Cited**

UNITED STATES PATENTS

3,443,760	5/1969	Simmons	239/403 X
2,701,164	2/1955	Purchas, Jr. et al.	239/404 X
2,703,260	3/1955	Olson et al.	239/404
3,024,045	3/1962	Cleminshaw et al.	239/404 X
3,039,701	6/1962	Carlisle	239/404 X

Primary Examiner—M. Henson Wood, Jr.
Assistant Examiner—Michael Y. May
Attorney—Oberlin, Maky, Donnelly and Renner

[57] **ABSTRACT**

A dual orifice fuel injection nozzle for gas turbines and the like characterized in that a unitary primary nozzle body clamped between the secondary nozzle body and the nozzle housing provides a primary swirl passage and a secondary swirl passage leading respectively to a primary swirl chamber and primary discharge orifice and to a secondary swirl chamber and annular secondary discharge orifice, the secondary orifice and chamber being defined between said primary and secondary bodies with the latter being screw threaded onto the nozzle housing. A further characterizing feature of the invention is that the secondary fuel supply passage is located centrally of the nozzle tip end of the housing with the primary passage disposed radially outward thereof.

1 Claim, 2 Drawing Figures

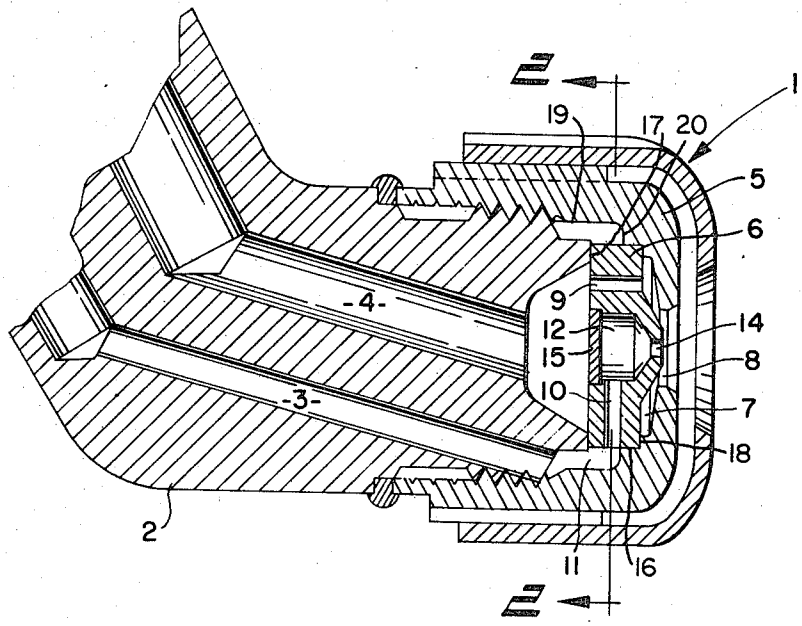
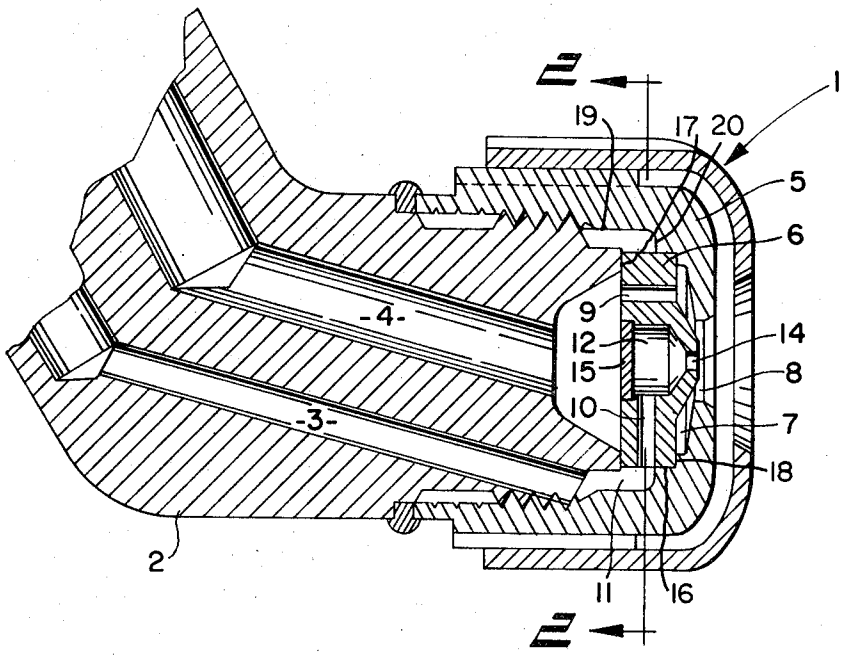


Fig. 1



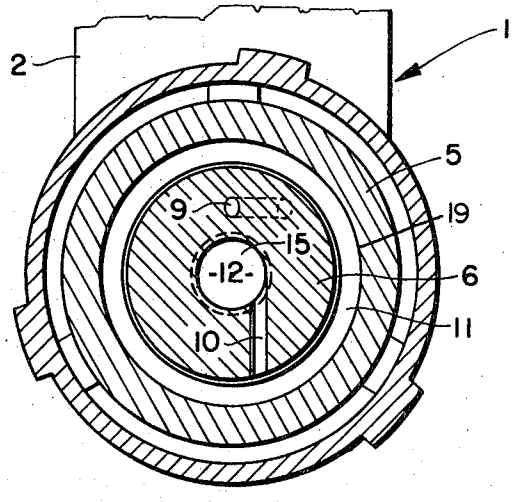


Fig. 2

INVENTOR.
LAWRENCE B. O'SICKEY
BY
Oberlin, Maky, Donnelly & Renner
ATTORNEYS

FUEL INJECTION NOZZLE

BACKGROUND OF THE INVENTION

In dual orifice fuel injection nozzles it is a prevalent practice as shown for example in the patents to Webster et al. U.S. Pat. No. 3,013,732, and Moebius et al. U.S. Pat. No. 3,159,971, to provide a nozzle housing having at the nozzle end thereof coaxial primary and secondary fuel supply passages of which the primary passage is the center one and the secondary passage is an annular passage around the primary passage. In such known constructions the primary orifice body has swirl slots on its periphery which define with the secondary body which is screwed onto or into the nozzle housing, swirl passages which lead to a secondary swirl chamber and secondary orifice which is defined between the primary and secondary bodies. Furthermore, to provide the primary swirl slots and primary swirl chamber leading to the primary discharge orifice the primary body is provided with a swirl plug disposed therewithin. In Webster et al. U.S. Pat. No. 3,013,732 the housing has screwed thereinto a bushing onto which the primary nozzle body is screwed and between the busing and the primary body is a primary swirl plug and has screwed thereonto the secondary body which forms with the primary body the secondary swirl slots, the secondary swirl chamber, and the secondary annular discharge orifice. In Moebius et al. U.S. Pat. No. 3,159,971 the primary swirl plug has screw threaded engagement in the housing and in turn, the primary body is screw threaded on said swirl plug and finally, the secondary body has screw threaded engagement with the housing to form the aforesaid secondary swirl slots, chamber, and discharge orifice while the primary body and swirl plug form therebetween the primary swirl slots, chamber, and discharge orifice.

SUMMARY OF THE INVENTION

Contrary to the foregoing, in the present invention the secondary fuel supply passage is located centrally at the end of the nozzle housing with the primary passage being disposed radially outward to one side thereof, whereby when the secondary body is screwed onto the housing it clamps therebetween a unitary primary body which contains not only the primary swirl slots, primary swirl chamber, and primary discharge orifice, but in addition, the secondary swirl slots which communicate the secondary fuel supply passage with the secondary swirl chamber and secondary discharge orifice which is defined between the primary and secondary bodies.

Other objects and advantages of the present invention will appear hereinafter.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a cross-section view of a preferred embodiment of the present invention; and

FIG. 2 is a cross-section view taken substantially along the line 2—2, FIG. 1.

DETAILED DESCRIPTION OF THE DRAWING

The dual orifice injection nozzle 1 herein illustrated comprises a housing 2 provided with primary and secondary fuel supply passages 3 and 4 which, as well known, communicate at their upstream ends with a fuel inlet port and with the downstream end of a flow divider or variable area valve, not shown herein, the secondary fuel supply passage 4 terminating in a flare mouth opening centrally located at the nozzle end of the housing 2, and the primary passage 2 terminating in an opening which is radially outwardly spaced from the secondary opening.

The secondary nozzle body and air shroud 5 is screwed onto the end of the housing 2 and may be welded thereto as shown, and the unitary primary body 6 is clamped between the secondary body 5 and the end of the housing 2 to form with the secondary body 5 a secondary swirl chamber 7 and an annular secondary discharge orifice 8, the primary body 6 being provided with one or more helical swirl passages 9 therethrough which intercommunicate the secondary passage 4 with the secondary swirl chamber 7.

The primary body 6 also has therein one or more tangential swirl passages 10 which lead from an annular chamber 11 communicating with the primary passage 3 into the primary swirl chamber 12 which has a central primary discharge orifice 14. The end of the primary swirl chamber 12 opposite the orifice 14 is closed by a plug 15 in said body 6.

Thus, when the gas turbine or the like is operating, the fuel passing through the primary passage 3 enters the annular chamber 11 and flows through the tangential swirl passage or passages 10 into the primary swirl chamber 12 for discharge from the primary orifice 14 in finely divided hollow conical spray form.

As the fuel pressure increases, and as the flow divider (not shown) opens, fuel also flows through the secondary passage 4 and the secondary swirl passage or passages 9 into the secondary swirl chamber 7 from whence the fuel issues in finely divided hollow conical form through the secondary annular discharge orifice 8.

From the foregoing it can be seen that the present invention provides a very simple form of dual orifice fuel injection nozzle 1 involving basically only two parts, namely, a secondary body 5 and a primary body 6 of which the secondary body 5 is screw threaded and welded onto the nozzle housing 2. The secondary body 5 has a first counterbore 16 of substantially the same diameter as the primary body 6, said secondary body 5 being effective to clamp the primary body 6 between the axially spaced apart annular end face 17 of the nozzle housing 2 and the bottom 18 of the first counterbore 16. The unitary primary body 6 contains not only the primary swirl passage 10, but also the secondary swirl passage 9 respectively leading to the primary swirl chamber 12 and to the secondary swirl chamber 7. The primary swirl chamber 12 is, as aforesaid, closed as by means of the plug 15 which is press fitted or otherwise secured into the end of the primary body 6 to isolate the primary discharge orifice 14 and primary swirl chamber 12 from the centrally located secondary fuel supply passage 4. The secondary body has a second counterbore 19 with a bottom 20 axially spaced from the end face 17 and from the bottom 18 of the first counterbore 16 to form the annular chamber 11 around the primary body 6 and radially outward of the end face 17, said chamber 11 communicating the primary fuel supply passage 3 in the nozzle housing 2 with the primary swirl passage 10 in the primary body 6.

I, therefore, particularly point out and distinctly claim as my invention:

1. A dual orifice fuel injection nozzle comprising a housing having at one end an annular end face and having primary and secondary fuel supply passages which are open at said one end respectively radially outward and inward of such end face; a secondary body secured to said housing and having a secondary fuel discharge orifice and first and second counterbores with their bottoms axially spaced from each other and from such end face; a cylindrical primary body of diameter less than said second counterbore and substantially equal to said first counterbore clamped between such end face and the bottom of said first counterbore and defining with said secondary body a secondary swirl chamber upstream of said secondary orifice and defining with said second counterbore an annular chamber around

said primary body and radially outward of such end face which communicates with said primary fuel supply passage; said primary body having a primary discharge orifice coaxial with said secondary orifice and a primary swirl chamber upstream of said primary orifice; said primary body further having circumferentially offset primary and secondary swirl passages respectively communicating said annular chamber with said primary swirl chamber and said secondary fuel supply passage radially within such end face with said secondary swirl chamber whereby fuel is discharged in conical spray form from the respective primary and secondary orifice.

* * * * *