

[54] **COMBUSTOR WING VORTEX GENERATORS**
[75] Inventors: **Patrick H. Hall; David W. Oliver,**
both of China Lake, Calif.
[73] Assignee: **The United States of America as**
represented by the Secretary of the
Navy, Washington, D.C.
[22] Filed: **Apr. 13, 1972**
[21] Appl. No.: **243,720**

[52] **U.S. Cl.**..... **60/39.72 R; 60/39.74 R; 60/270 R**
[51] **Int. Cl.²**..... **F02K 7/10; F02G 3/00**
[58] **Field of Search**..... **60/39.72 R, 39.74 R, 261,**
60/270

[56] **References Cited**
UNITED STATES PATENTS
2,558,816 7/1951 Bruynes 60/39.72 R

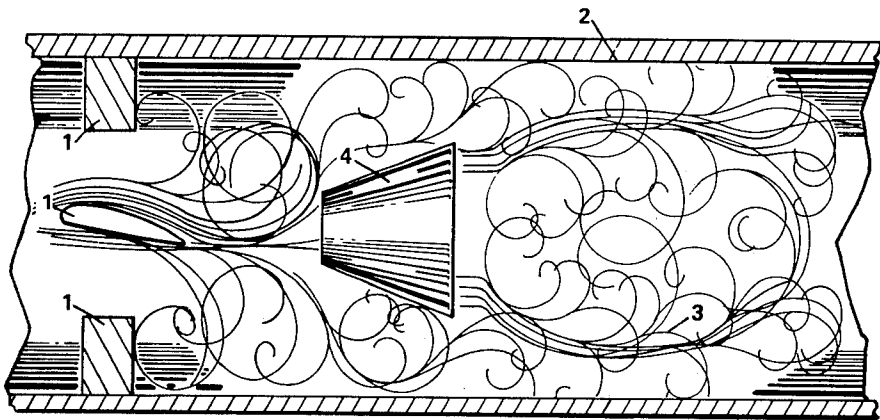
2,607,191	8/1952	Lee	60/39.72 R
2,844,001	7/1958	Alford.....	60/39.5 X
2,930,195	3/1960	Blackman et al.....	60/39.72 P X
2,981,065	4/1961	Sloan	60/39.72

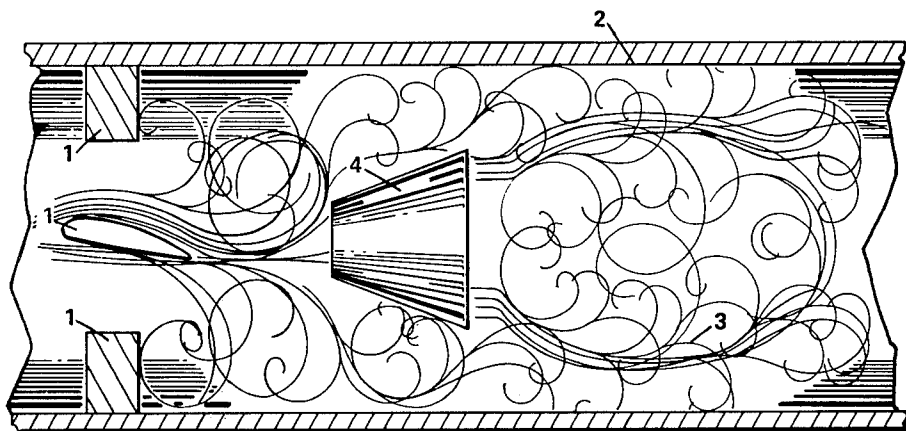
FOREIGN PATENTS OR APPLICATIONS
228,976 5/1959 Australia..... 60/39.72

Primary Examiner—Carlton R. Croyle
Assistant Examiner—Robert E. Garrett
Attorney, Agent, or Firm—R. S. Sciascia; Roy Miller;
Robert F. Beers

[57] **ABSTRACT**
A combustor of a ramjet engine having a plurality of wings of aerofoil cross-section extending inwardly from the combustor wall at the air inlet and in advance of the pilot flame. The wings are of finite aspect ratio and are pitched to an angle of attack to generate a vortex downstream of the pilot flame.

1 Claim, 1 Drawing Figure





COMBUSTOR WING VORTEX GENERATORS

BACKGROUND OF THE INVENTION

A flameholder in a ramjet combustor generally has two basic components, namely a sheltered region where a small amount of a fuel is mixed with a small amount of air to yield a small flame or pilot and a device for spreading the flame to the remainder of the fuel air mixture effecting complete combustion of the fuel. A gutter is commonly used to accomplish this.

A gutter provides a sheltered region for the flame to spread from the pilot. Mixing of the burned gases with the unburned fuel-air mixture then occurs in the gutter wake. This allows combustion of the remaining fuel-air mixture.

A gutter does not actively mix the burned and unburned gases, but merely provides a large flameholding region. Of course some turbulence is introduced due to the wakes caused by the gutters. A large number of gutters (on the order of six) is required to spread the flame to all of the fuel-air mixture within a reasonable length of the combustor. This causes an increase in drag with a resultant loss in total pressure which decreases the performance of the combustor. Because the gutters are in contact with the flame they must be fabricated from high temperature materials and coated to survive the thermal environment.

A more advantageous method of affecting a fuel-air mixture employs wing vortex generators as shown in the patent to Lee U.S. Pat. No. 2,607,191 dated Aug. 19, 1952. There are several advantages to the wing vortex generator concept:

The action of the vortex is very effective in mixing the burned and unburned gases and can therefore allow the use of very short combustion chambers which still operate at high efficiency. This allows a significant saving in ramjet weight and volume. The wing vortex generators need be at only a small angle of attack to accomplish efficient mixing and therefore have low drag. They are simple to fabricate. Because they are located upstream of the pilot flame and thus do not touch the flame, they can be fabricated from conventional, non-thermal-coated materials and are therefore inexpensive. The vortex generators are small wings of finite aspect ratio as opposed to turning vanes, which would span the duct thus having infinite aspect ratio. Turning vanes, also, cause an overall swirl of the flow. Vortex generators could easily be mechanized to vary the angle of attack during flight so that maximum mixing would be accomplished only during those periods of flight when efficient combustion is difficult to achieve, e.g., high altitude.

SUMMARY OF THE INVENTION

A combustor of a ramjet engine having a plurality of wings of aerofoil cross-section extending inwardly from the combustor wall or outwardly from a fuel injector or the like at the air inlet end and upstream of the pilot flame. The wings are of finite aspect ratio and are pitched to an angle of attack to generate a vortex downstream of the pilot flame.

BRIEF DESCRIPTION OF THE DRAWING

The FIGURE shows an elevation view of the invention with a portion of the combustor wall cut away.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Wing vortex generators 1 in the configuration of an aerofoil and extending from combustor wall 2 create trailing vortices 3. Whenever a wing of finite aspect ratio is pitched to an angle of attack it generates a trailing vortex because of the pressure difference between the bottom and top of the wing. This vortex causes rapid mixing of the burned and unburned gases resulting in flamespreading.

Vortices 3 extend past flameholder 4 and into the flame front created by the flameholder.

What is claimed is:

1. A vortex generator in a combustor for a ramjet type engine comprising:

a hollow cylindrical chamber of substantial wall thickness having an opening completely across its inner diameter for allowing airflow in an axial direction through said chamber;

a flame front;

flameholder means positioned within said chamber a substantial distance from said opening for creating said flame front;

a plurality of spaced solid wings of airfoil cross section positioned upstream of said flameholder, each of said wings projecting from said chamber wall at right angles to the longitudinal axis of said chamber with the free ends of each of said wings extending to a position adjacent each other near the center of said chamber and having the cordwise dimension of each of said wings slanted with respect to axial airflow through said chamber;

whereby airflow through said chamber is caused to eddy downstream of the trailing edges of the wings to actively and rapidly mix the air with the area of said flameholder.

* * * * *

55

60

65