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(54) Lobe Mixer for Gas Turbine Engine

(57) The mixer 10 has alternate inner lobes 14A extended axially and radially inwardly downstream of outer lobes 16 permitting the use of a smaller conically shaped centre body 24. The arrangement improves mixing by increasing the total flow area at the mixer discharge end to thereby improve engine performance and noise suppression.

FIG. 1

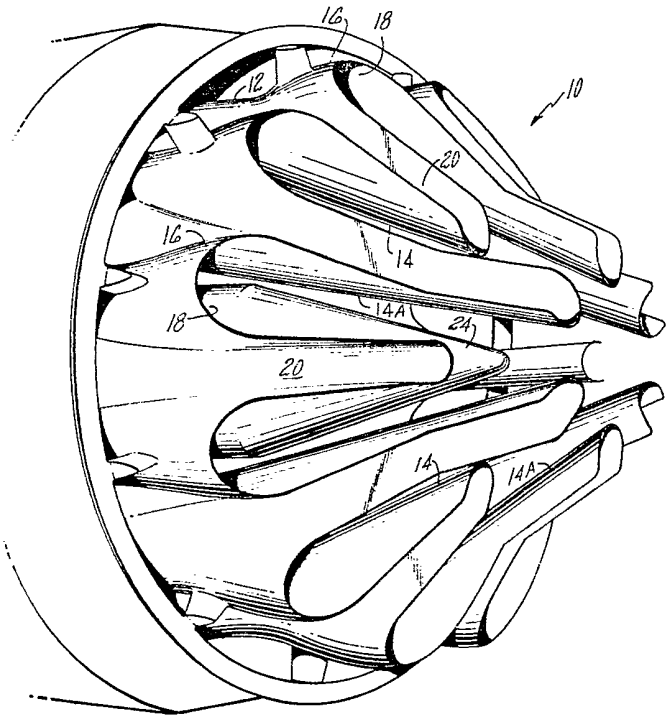

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FIG. 1

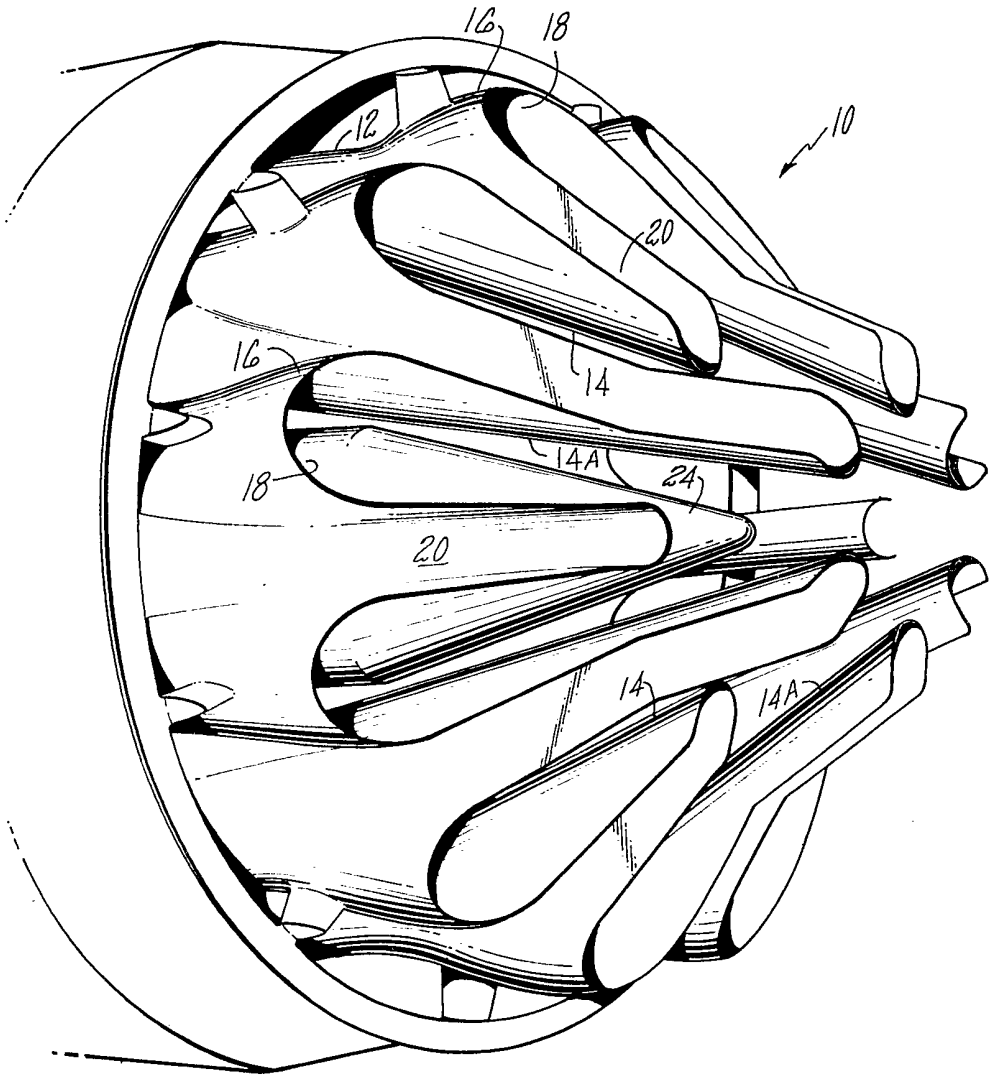
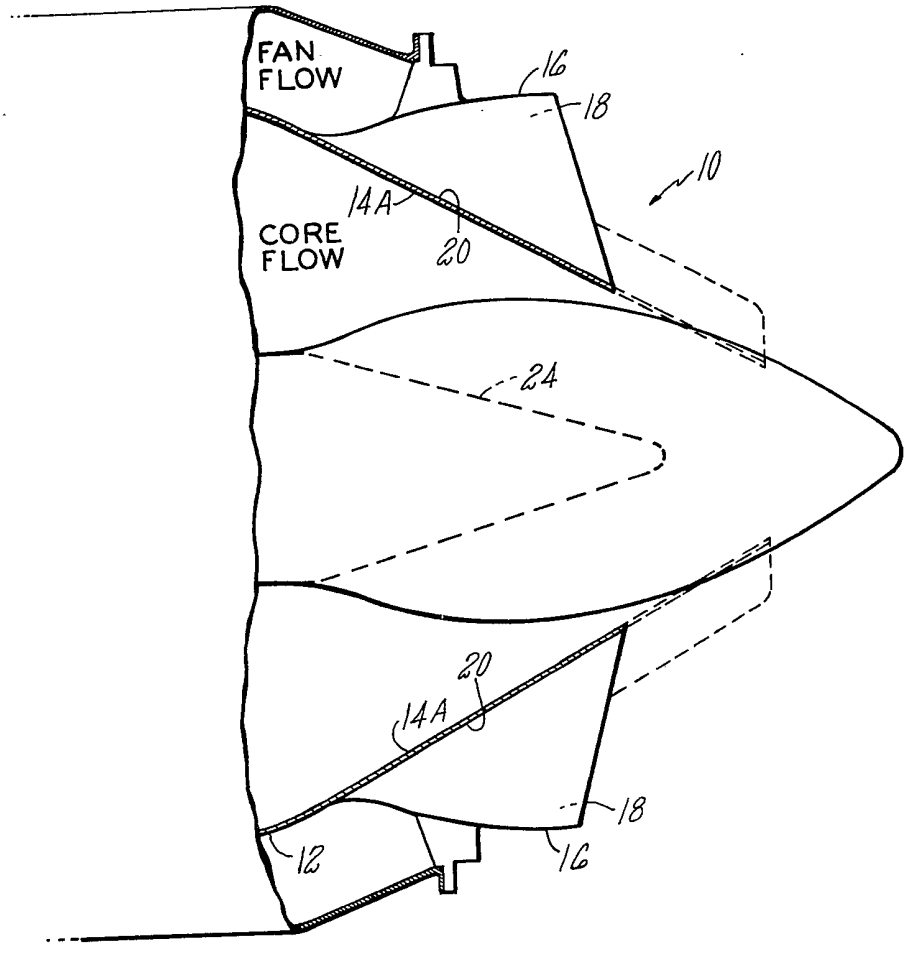


FIG. 2



SPECIFICATION

Lobe Mixer for Gas Turbine Engine

Technical Field

This invention relates to gas turbine engines and particularly lobe mixers therefore.

Background Art

This invention constitutes an improvement of the lobe mixer disclosed and claimed in U.S. Patent No. 4,149,375 granted to T. A. Wynosky, R.A Streib and C. A. Campbell on April 17, 1979 and assigned to the same assignee as this patent application. The lobed mixer described in the above-mentioned patent scalloped adjacent side walls to effectuate premature mixing in comparison to the well known lobed mixer. While this proved efficacious in certain aircraft installations, we have found that we can improve on not only the engine performance and acoustics but also this innovation results in a reduction in weight, cost and complexity.

In accordance with this invention, the inside diameter "chutes" or valleys are extended radially inward toward the engine centerline and axially downstream from the inner lobes. This enables the conventional large bulbous or cylindrical centerbody to be replaced by a smaller conical centerbody. As a result, the centerbody of the heretofore know lobe mixers forces the core engine gases radially outward to meet with the fan gases that were being guided radially inwardly by the "chutes" of the inner diameter lobes where both gases at the discharge end intersperse to accomplish mixing.

By extending the chutes in this manner and reducing the diameter and length of the centerbody, penetration of the fan air into the core gas is accomplished. Additionally, elimination of the larger centerbody increases the total flow area at the discharge end of this mixer. Owing to this fact, flow area velocities are decreased with a consequential reduction in skin friction resulting in an improvement in performance. The residence time of the gases in the tailpipe are also increased enhancing the mixing and hence, improving performance and acoustics over and above the heretofore known mixers.

Disclosure of Invention

An object of this invention is to provide for a gas turbine engine an improved lobed mixer.

A feature of the invention is to extend radially and inwardly judiciously selected chutes of the lobe to penetrate the fan air into the core gases. The size of the centerbody is reduced resulting in a mixer that is characterized as being less complicated, less expensive and lighter than heretofore known mixers for the same engine characteristics, resulting in an improvement in performance and acoustics.

Other features and advantages will be apparent from the specification and claims and from the accompanying drawings which illustrate an embodiment of the invention.

Brief Description of Drawings

Fig. 1 is a perspective view of the invention.

Fig. 2 is a view in schematic showing the improvement over the prior art.

Best Mode for Carrying Out the Invention

Lobe mixers are described in U.S. Patent No. 4,149,375, supra and the description thereof is incorporated herein by reference. This invention has found utility in the JT-8D engine manufactured by Pratt & Whitney Aircraft Group, division of United Technologies Corporation (the assignee). The mixer serves to direct the fan air discharging from the fan of the fan jet engine with the core gases discharging from the turbine. Until the fan air is interspersed with the core gases both are in the form of coannular streams. As noted in Figs. 1 and 2, the mixer generally illustrated by reference numeral 10 is a cylindrical member 12 having a sinusoidal portion on the downstream end defining inner and outer lobes 14 and 16 respectively. These lobes define open ended channels or chutes and the outer lobes form inner chutes 18 for leading the core gases radially outwardly and the inner lobes define outer chutes 20 for leading the fan air radially inwardly. As noted the outer chutes 20 are in a decreasing diameter from an upstream to the downstream end and the inner chutes 18 are in an increasing diameter in the same direction.

In accordance with this invention, certain inner lobes are extended radially inwardly and axially downstream relative to the unextended lobes. In its preferred embodiment alternate inner lobes 14A were extended at the 60° intervals. As would be understood by one skilled in the art, other intervals, say extending all of the inner lobes, could be employed without departing from the scope of the invention.

Fig. 2 shows the improvement of the mixer over the prior art lobe mixer. The dash line shows the improvement over the heretofore known mixers. As noted certain inner lobes 14A are extended radially inwardly and axially downstream of the outer lobe. Also, this allows a new configuration of the centerbody illustrated by the dash lines 24. The prior art centerbody was a larger bulbous shaped mass as compared with the generally conical shaped centerbody 24.

It should be understood that the invention is not limited to the particular embodiments shown and described herein, but that various changes and modifications may be made without departing from the spirit and scope of this novel concept as defined by the following claims.

Claims

1. A lobe mixer for a fan jet engine having coannular streams one of which flows from the fan and the other flows from the core of the engine, said mixer having a generally cylindrically shaped body disposed parallel to said coannular streams and having a sinusoidal portion of the

rearward end with respect to the direction of flow of said coannular streams, the sinusoidal portion defining open ended chutes in alternate increasing diameter and decreasing diameter in the axial extending direction relative to the centerline of said cylindrically shaped body, the increasing diameter chutes adapted to direct the core stream and the decreasing diameter chutes adapted to direct the fan stream, both fan stream and core stream mixing at the discharge end of said mixer, at least some of said decreasing diameter chutes extending axially from the increasing diameter chutes.

2. A lobe mixer as claimed in claim 1 wherein some of said decreasing diameter chutes extend further radially inwardly toward the centerline relative to the other of said decreasing diameter chutes.

3. A lobe mixer as in claim 2 wherein alternate ones of said decreasing diameter chutes extend both axially from the downstream end of and radially inwardly toward the centerline relative to the adjacent decreasing diameter chutes.

4. A lobe mixer as claimed in claims 2 or 3 including a conically shaped plug disposed centrally of said sinusoidal portion of said mixer.

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