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JET NOISE SUPPRESSOR NOZZLE

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3 Sheets-Sheet 1

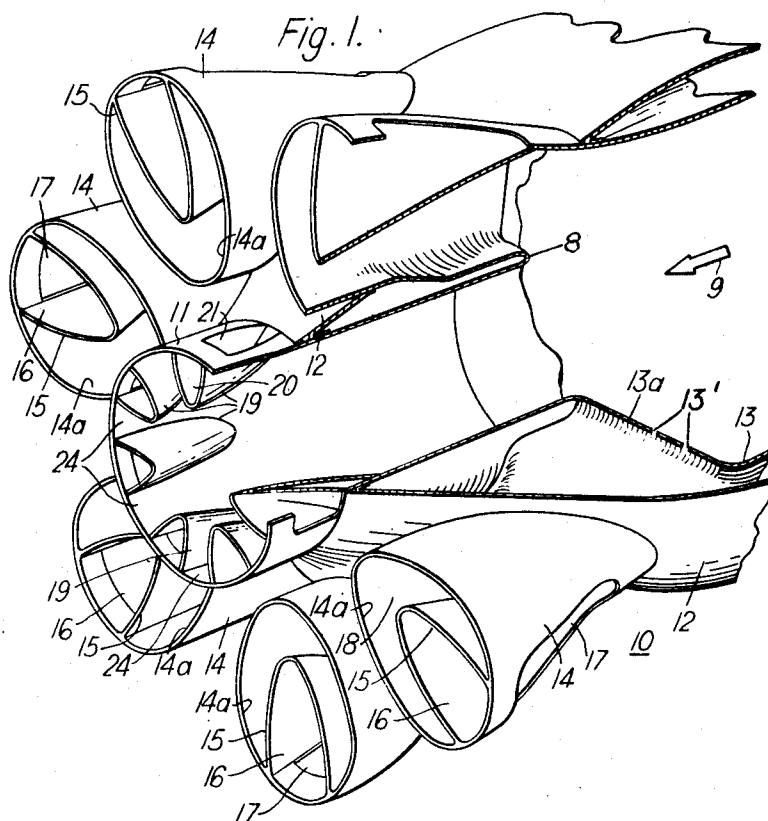
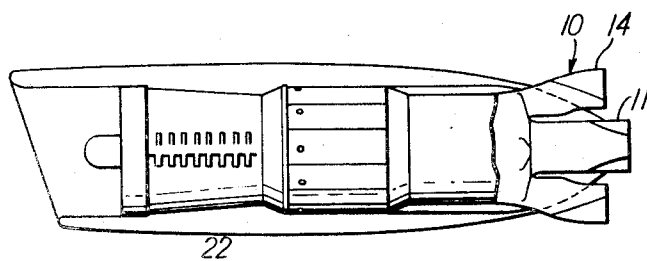


Fig. 2.



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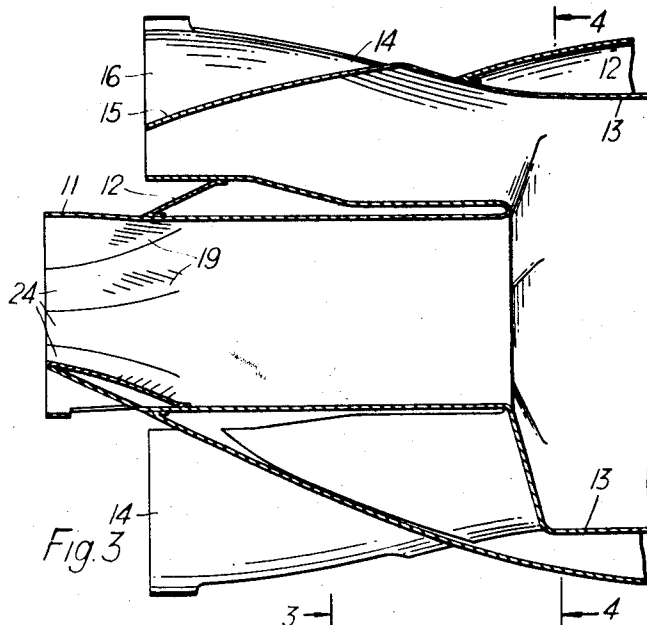
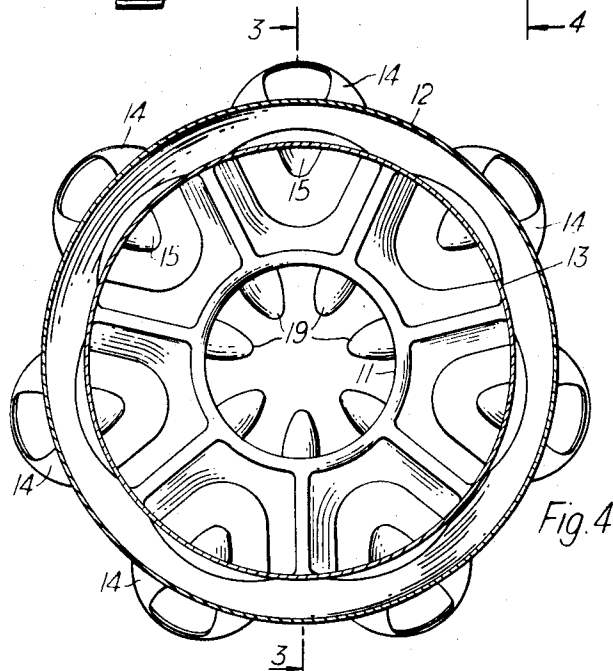
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3 Sheets-Sheet 2



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JET NOISE SUPPRESSOR NOZZLE

3 Sheets-Sheet 3

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1

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JET NOISE SUPPRESSOR NOZZLE

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11 Claims. (Cl. 181—51)

This invention relates to a jet noise suppressor nozzle.

According to the present invention there is provided a jet noise suppressor nozzle comprising a plurality of individual nozzle members in a spaced arrangement around a central nozzle member, each nozzle member having within it an internal wall member forming a chamber open at its downstream end, the chambers being closed at their upstream ends and having provision for flow of atmospheric air therethrough in a downstream direction, each internal wall member being positioned relatively to the inner wall of its nozzle member to provide a longitudinal channel for flow of hot gases therethrough from a jet pipe.

Preferably a dividing wall member divides each chamber into an inner compartment surrounded by an outer compartment, the flow of atmospheric air being arranged to occur through the inner compartment. Pressure balance means are preferably provided for ensuring that the pressure in the outer compartment is substantially the same as that in the said longitudinal channel.

The provision for the flow of atmospheric air into the chambers can be in the form of apertures provided in the walls of the individual nozzle members.

The individual nozzle members can be substantially cylindrical and can be spaced at equal angular intervals in a circular arrangement around a central substantially cylindrical nozzle member.

The internal wall members can be situated at the downstream ends of the nozzle members and the chambers formed thereby can increase in radial extent in a downstream direction.

The invention is illustrated, merely by way of example, in the accompanying drawings in which:

Figure 1 is a perspective view of a nozzle embodying the invention, part of the nozzle being broken away to show the construction more clearly;

Figure 2 shows diagrammatically a gas turbine engine embodying a nozzle according to the invention;

Figure 3 is a section through the nozzle on line 3—3 of Figure 4;

Figure 4 is a section through the nozzle on line 4—4 of Figure 3; and

Figure 5 is a perspective view partly broken away, of a modified embodiment of a nozzle according to the invention.

Referring first to the embodiment of Figures 1—4, the arrow 9 indicates the direction of gaseous flow through a nozzle 10, the nozzle 10 comprising a central substantially cylindrical nozzle member 11 supported by an external nozzle wall member 12 and an internal nozzle wall member 13. The wall members 12 and 13 also support a number (e.g. seven) of substantially cylindrical nozzle members 14 disposed at equal angular intervals in a circular arrangement around the central nozzle member 11 (Figures 1, 3 and 4). Each nozzle member 14 includes an internal wall member 15 forming a chamber 16 open at its downstream end and closed at its upstream

2

end. An aperture 17 is provided in the external wall of each nozzle member 14, the aperture 17 extending throughout the major proportion of the length of the nozzle member and being situated so as to allow air to pass into the interior of chamber 16 and to pass out through the open end of the chamber.

Each wall member 15 is spaced from the internal wall 18 of each nozzle member 14 so as to provide a longitudinal channel 14a for flow of gases from the jet pipe.

The control cylindrical nozzle member 11 also has a number of flow-dividing wall members 19 forming chambers 20 and there are a plurality of apertures 21 adapted to allow air to enter the chambers 20 and flow out of the open downstream ends. The wall members 19 are positioned relatively to each other and to the inner wall of the nozzle member 11 so as to provide a plurality of channels 24 for flow of gases from the jet pipe.

The nozzle can be applied to a gas turbine engine 22, as shown diagrammatically in Figure 2.

In use jet gases pass out of the jet pipe in the direction of the arrow 9 and are divided by baffle means 8 so as to flow through the channels 14a and the channels 24 out of the downstream end of the nozzle members. Atmospheric air enters the chambers 16 through the apertures 17 and also enters the chambers 20 through the apertures 21 to pass out of the downstream ends of chambers 20, and to mix with gases from the jet pipe at the boundaries formed by the downstream edges of the wall members 19.

Jet gases flow through holes 13' in the wall member 13 into the space between wall members 12 and 13 as well as through the jet pipe within the wall member 13. Accordingly the inwardly bent portion 13a of the wall member 13 will be pressure balanced and need not be of great strength as it does not have to withstand high gas loads.

The modified embodiment of the invention illustrated in Figure 5 is generally similar to that of Figures 1—4 in that it comprises a central cylindrical nozzle member 11 surrounded by seven nozzle members 14 spaced from each other at equal angular intervals, the nozzle members 11, 14 being respectively provided with internal wall members 19, 15. In the Figure 5 construction, however, the chambers 16 formed by the internal wall members 15 are divided by a wall member 25 into an inner compartment 26 and an outer compartment 27 surrounding the inner compartment.

The inner compartment 26 is disposed adjacent the inner wall of the nozzle member 14 and is provided with the apertures 17. The wall members 15 and 25 are welded to each other along lines of welding 28. The internal wall member 15 is provided with a number (e.g. 4) of pressure balance holes 29 which ensure that the pressure within the outer compartment 27 is substantially the same as that of the gases flowing through the longitudinal channels 14a in the nozzle member. For this reason the wall member 15 need not be a heavy one.

It will be appreciated that in the Figure 5 construction the hot gases from the jet pipe will not impinge on the dividing wall member 25 which may therefore also be of light construction. Thus the provision of the dividing wall member 25 enables the structure of the noise suppressor nozzle of the present invention to be lightened.

Similarly each of the chambers 20 of the central nozzle member 11 is divided into an inner and an outer compartment by a wall member 30, the outer compartment being pressure balanced with respect to the pressure of the hot gases flowing through the channels 24 in the central nozzle member 11 by holes 30' extending through the wall member 19. Here again, the provision of the wall member 30 enables a lighter structure to be employed.

The wall members 15 and 25 of each nozzle member

3

14 are respectively shaped to suit the gas flow and the air flow through the nozzle member 14. Similarly the wall members 19, 30 and the central nozzle member 11 are respectively shaped to suit the gas flow and air flow through the nozzle member 11 although as will be seen from Figure 5, the flow lines of the wall members 19, 30 differ somewhat from those of the wall members 15, 25.

The dividing wall member 25 may be secured to the inner surface of its nozzle member 14 by argon welding while the wall member 15 is flanged at 15' and may be stitch welded to the inner surface of its nozzle member.

Each nozzle member 14 has a rear section 31 and a forward section 32 which are butt welded to each other along a line 33. The aperture 17 is provided wholly within the rear section 31 and is surrounded by a reinforced plate 34 which is welded to the outer surface of the nozzle member.

A baffle structure 35 is provided at the junction of each nozzle member 14 with the central cylindrical member 11 so as to ensure that the hot gases are directed positively either into the central nozzle member 11 or into the nozzle member 14.

The chamber 36 formed by the wall members 12, 13 and bounded by the nozzle members 14 and the central nozzle member 11 is pressure balanced by holes 37 in the wall member 13.

It will be noted that the jet noise suppressor nozzle shown in the drawings comprises nozzle members 11, 14 which are substantially circular in cross section. The entry of the hot gases into the nozzle members 11, 14 and their passage therethrough is, as a result, such that the propulsive efficiency of the construction shown in the drawings is superior to that of silencers employing conventional corrugated nozzles. The form of the nozzle members 11, 14, moreover, makes for ease and rigidity of construction and, since it makes more efficient use of space, it also enables the overall size of the silencer to be reduced in comparison with silencers employing corrugated nozzles.

I claim:

1. A noise suppressor nozzle for use on a jet engine comprising a central nozzle member, a plurality of individual nozzle members in a spaced arrangement around said central nozzle member, an internal wall member in and extending to the downstream end of each of said nozzle members, each said internal wall member being disposed to provide a longitudinal channel in its nozzle member for the flow therethrough of hot gases from a jet pipe, each said internal wall member forming with the inner wall of its nozzle member a chamber which is open at its downstream end and closed at its upstream end, and means providing for flow of atmospheric air through each of said chambers in a downstream direction.

2. A noise suppressor nozzle for use on a jet engine comprising a central nozzle member, a plurality of individual nozzle members in a spaced arrangement around said central nozzle member, an internal wall member in and extending to the downstream end of each of said nozzle members, each said internal wall member being disposed to provide a longitudinal channel in its nozzle member for the flow therethrough of hot gases from a jet pipe, each said internal wall member forming with the inner wall of its nozzle member a chamber which is open at its downstream end, and closed at its upstream end, a dividing wall member dividing each said chamber into an inner compartment surrounded by an outer compartment, and means providing for flow of atmospheric air through each of said inner compartments in a downstream direction.

3. A noise suppressor nozzle for use on a jet engine comprising a central nozzle member, a plurality of individual nozzle members in a spaced arrangement around said central nozzle member, an internal wall member in and extending to the downstream end of each of said nozzle members, each said internal wall member being

4

disposed to provide a longitudinal channel in its nozzle member for the flow therethrough of hot gases from a jet pipe, each said internal wall member forming with the inner wall of its nozzle member a chamber which is open at its downstream end and closed at its upstream end, a dividing wall member dividing each said chamber into an inner compartment surrounded by an outer compartment, pressure balance means maintaining the pressure of the outer compartment substantially the same as that in a said longitudinal channel, and means providing for flow of atmospheric air through each of said inner compartments in a downstream direction.

4. A noise suppressor nozzle for use on a jet engine comprising a central nozzle member, a plurality of individual nozzle members in a spaced arrangement around said central nozzle member, an internal wall member in and extending to the downstream end of each of said nozzle members, each said internal wall member being disposed to provide a longitudinal channel in its nozzle member for the flow therethrough of hot gases from a jet pipe, each said internal wall member forming with the inner wall of its nozzle member a chamber which is open at its downstream end and closed at its upstream end, and means providing apertures in the walls of the nozzle members for flow of atmospheric air through each of said chambers in a downstream direction.

5. A noise suppressor nozzle for use on a jet engine comprising a central nozzle member, a plurality of individual nozzle members in a spaced arrangement around said central nozzle member, an internal wall member in and extending to the downstream end of each of said nozzle members, each said internal wall member being disposed to provide a longitudinal channel in its nozzle member for the flow therethrough of hot gases from a jet pipe, each said internal wall member forming with the inner wall of its nozzle member a chamber which is open at its downstream end and closed at its upstream end, a dividing wall member dividing each said chamber into an inner compartment surrounded by an outer compartment, and means providing apertures in the walls of the nozzle members for flow of atmospheric air through each of said inner compartments in a downstream direction.

6. A noise suppressor nozzle for use on a jet engine comprising a central nozzle member, a plurality of individual nozzle members in a spaced arrangement around said central nozzle member, means supporting the individual nozzle members from the central nozzle member and forming enclosures between the individual nozzle members and the central nozzle member, an internal wall member in and extending to the downstream end of each of said nozzle members, each said internal wall member being disposed to provide a longitudinal channel in its nozzle member for the flow therethrough of hot gases from a jet pipe, each said internal wall member forming with the inner wall of its nozzle member a chamber which is open at its downstream end and closed at its upstream end, pressure balance means maintaining the pressure in the enclosures substantially the same as the pressure in the said longitudinal channels, and means providing for flow of atmospheric air through each of said chambers in a downstream direction.

7. A noise suppressor nozzle for use on a jet engine comprising a central nozzle member, a plurality of individual nozzle members in a spaced arrangement around said central nozzle member, means supporting the individual nozzle members from the central nozzle member and forming enclosures between the individual nozzle members and the central nozzle member, an internal wall member in and extending to the downstream end of each of said nozzle members, each said internal wall member being disposed to provide a longitudinal channel in its nozzle member for the flow therethrough of hot gases from a jet pipe, each said internal wall member forming with the inner wall of its nozzle member a

5

chamber which is open at its downstream end and closed at its upstream end, pressure balance means maintaining the pressure in the enclosures substantially the same as the pressure in the said longitudinal channels, a dividing wall member dividing each said chamber into an inner compartment surrounded by an outer compartment, pressure balance means maintaining the pressure in the outer compartment substantially the same as that in a said longitudinal channel, and means providing for flow of atmospheric air through each of said inner compartments in a downstream direction.

8. A noise suppressor nozzle for use on a jet engine comprising a central nozzle member, a plurality of individual nozzle members in a spaced arrangement around said central nozzle member, an internal wall member in and extending to the downstream end of each of said nozzle members, each said internal wall member being disposed to provide a longitudinal channel in its nozzle member for the flow therethrough of hot gases from a jet pipe, each said internal wall member forming with the inner wall of its nozzle member a chamber which increases in radial extent in a downstream direction and which is open at its downstream end and closed at its upstream end, and means providing for flow of atmospheric air through each of said chambers in a downstream direction.

9. A noise suppressor nozzle for use on a jet engine comprising a central nozzle member, a plurality of individual nozzle members in a spaced arrangement around said central nozzle member, an internal wall member in and extending to the downstream end of each of said nozzle members, each said internal wall member being disposed to provide a longitudinal channel in its nozzle member for the flow therethrough of hot gases from a jet pipe, each said internal wall member forming with the inner wall of its nozzle member a chamber which is open at its downstream end and closed at its upstream end, baffle means for directing hot gases from a jet pipe selectively into the central nozzle member and into one of said individual nozzle members, and means providing for flow of atmospheric air through each of said chambers in a downstream direction.

10. A noise suppressor nozzle for use on a jet engine comprising a central nozzle member, a plurality of individual nozzle members disposed at equal angular intervals in a circular arrangement around said central nozzle member, an internal wall member in and extending to the downstream end of each of said nozzle members

6

disposed to provide a longitudinal channel in its nozzle member for the flow therethrough of hot gases from a jet pipe, each said internal wall member forming with the inner wall of its nozzle member a chamber which is open at its downstream end and closed at its upstream end, and means providing for flow of atmospheric air through each of said chambers in a downstream direction.

11. A noise suppressor nozzle for use on a jet engine comprising a central nozzle member, a plurality of individual nozzle members disposed at equal angular intervals in a circular arrangement around said central nozzle member, means supporting the individual nozzle members from the central nozzle member and forming enclosures between the individual nozzle members and the central nozzle member, an internal wall member situated in and at the downstream end of each of said nozzle members and disposed to provide a longitudinal channel in the nozzle member for the flow therethrough of hot gases from a jet pipe, each said internal wall member forming with the inner wall of its nozzle member a chamber which increases in radial extent in a downstream direction and which is open at its downstream end and closed at its upstream end, pressure balance means maintaining the pressure in the enclosures substantially the same as the pressure in the said longitudinal channels, baffle means for directing the hot gases from the jet pipe selectively into the central nozzle member and into one of said individual nozzle members, a dividing wall member dividing each said chamber into an inner compartment surrounded by an outer compartment, pressure balance means maintaining the pressure in the outer compartments substantially the same as that in said longitudinal channels, and means providing apertures in the walls of the nozzle members for flow of atmospheric air through each of said inner compartments in a downstream direction.

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