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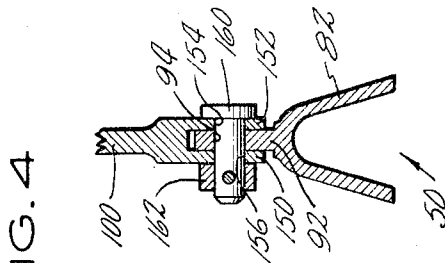
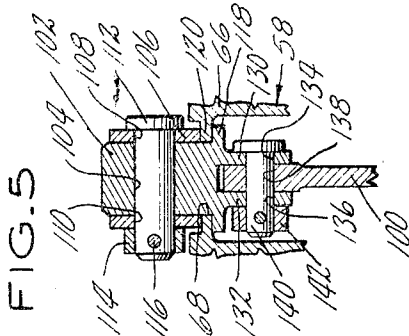
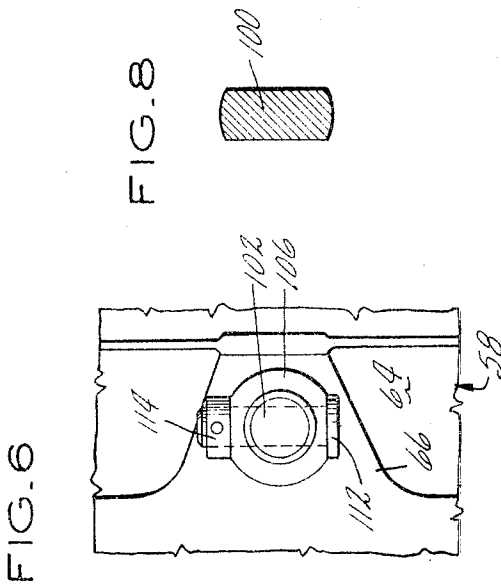
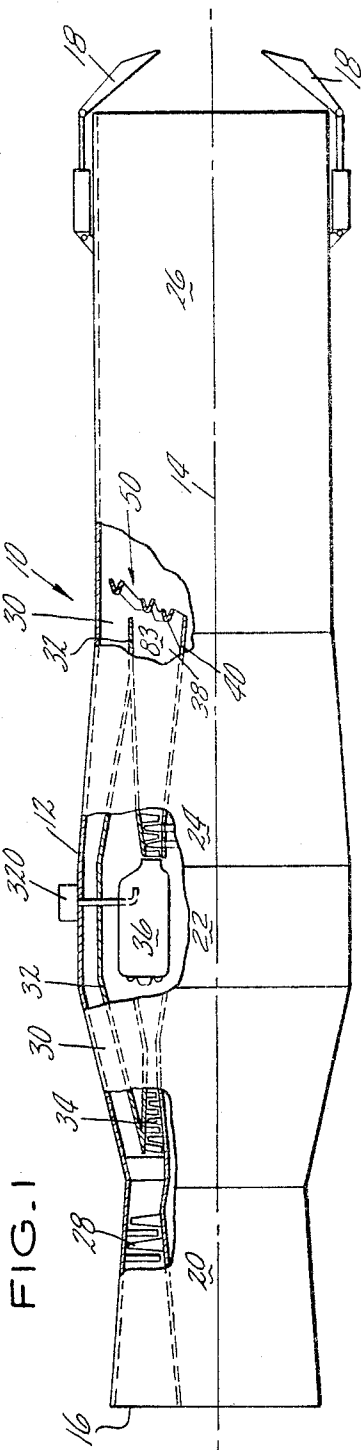
A. W. NELSON, JR

3,269,115

JET ENGINE AFTERBURNER CONTINUOUS SPLASH PLATE

Filed April 29, 1965

6 Sheets-Sheet 1



INVENTOR
ARTHUR W. NELSON, JR.
BY *Vernon F. Hauschild*
ATTORNEY

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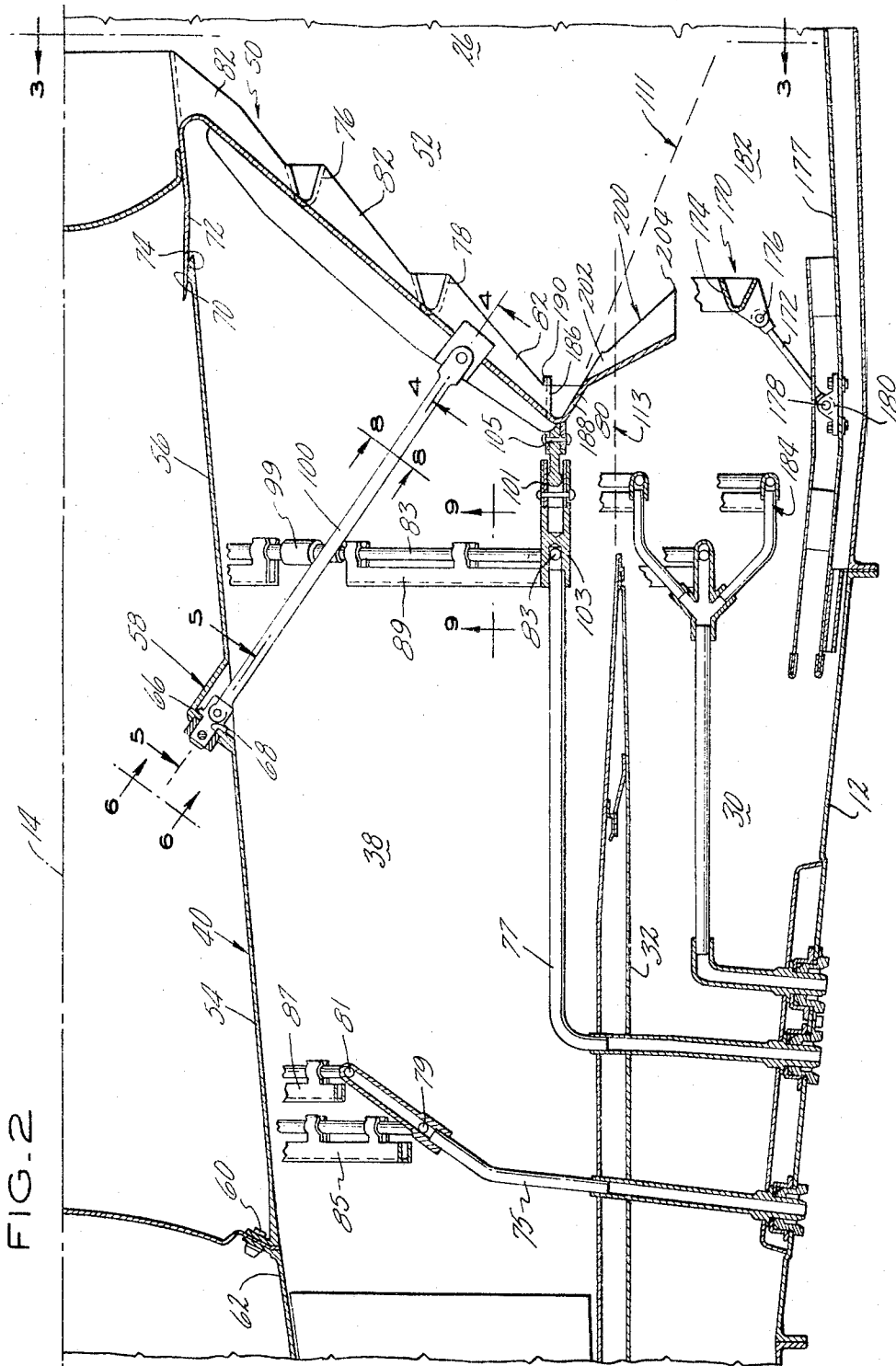
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JET ENGINE AFTERBURNER CONTINUOUS SPLASH PLATE

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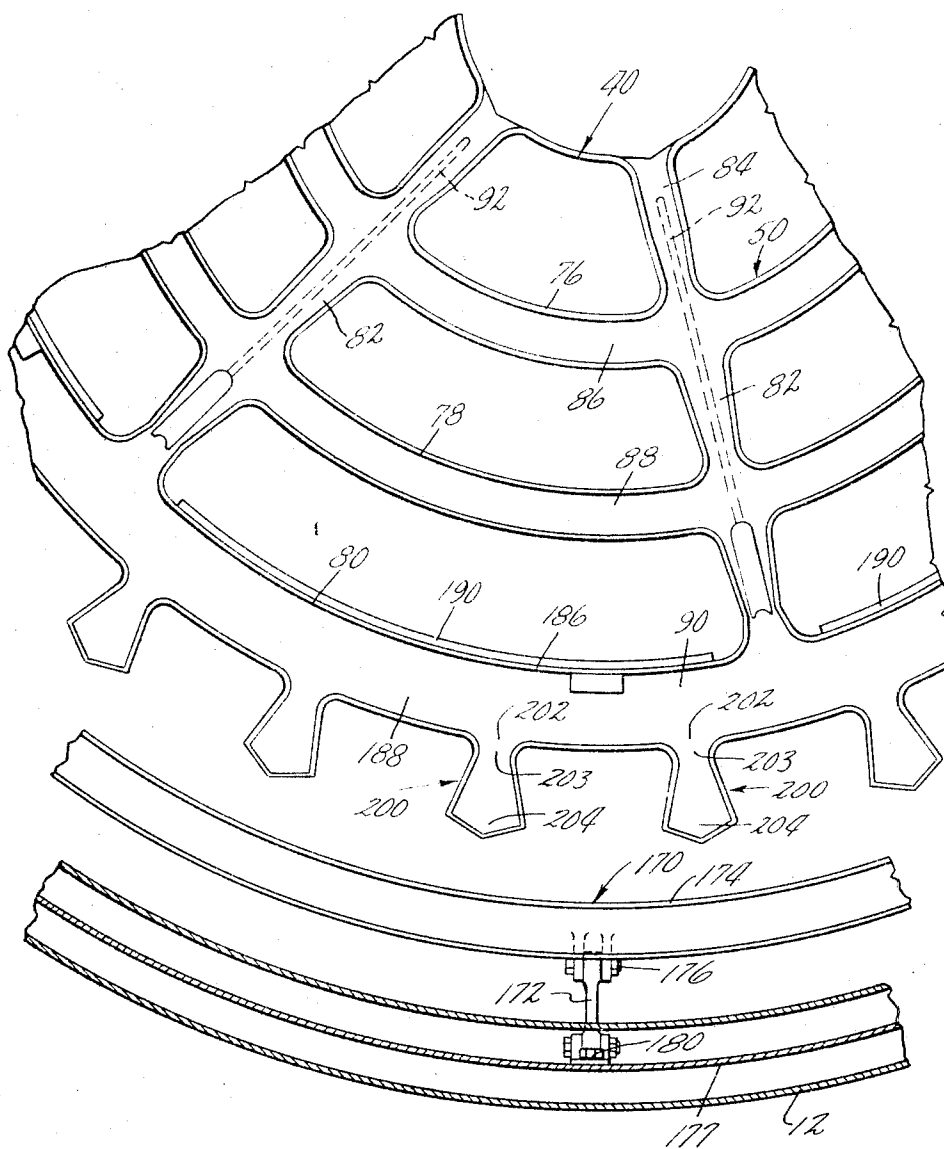
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FIG. 3



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FIG. 7

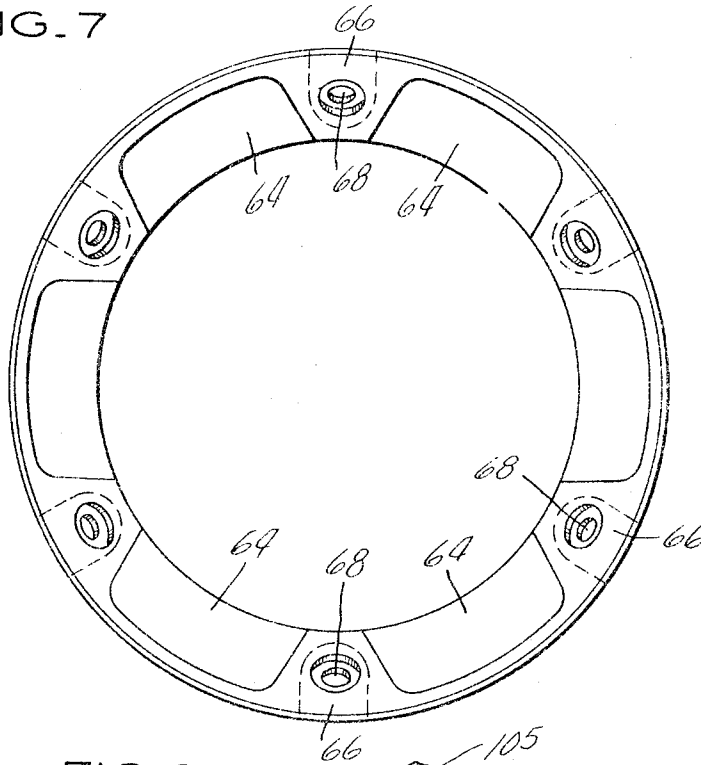
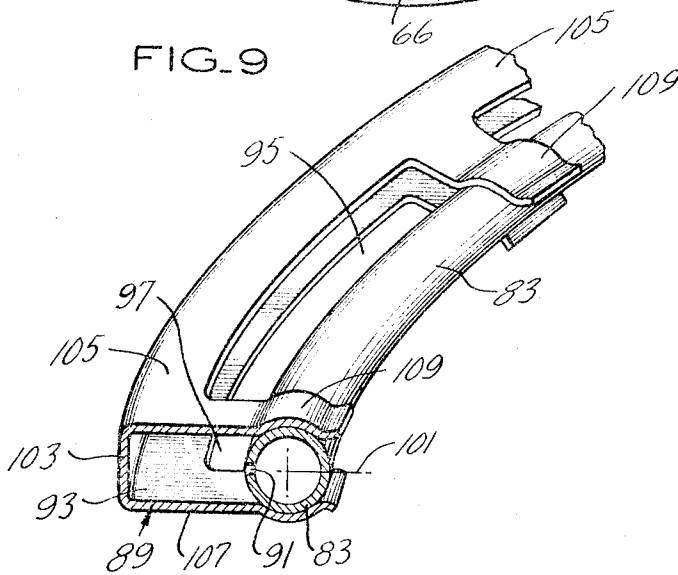


FIG. 9



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FIG. 10

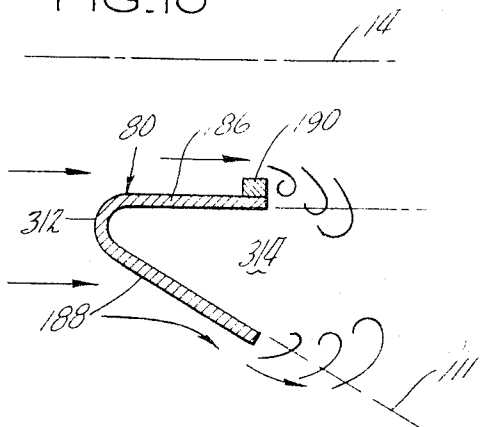


FIG. 13

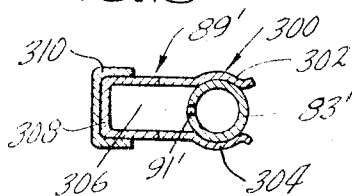
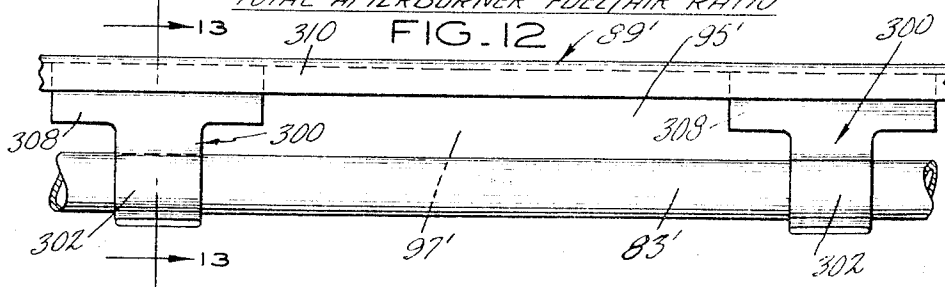
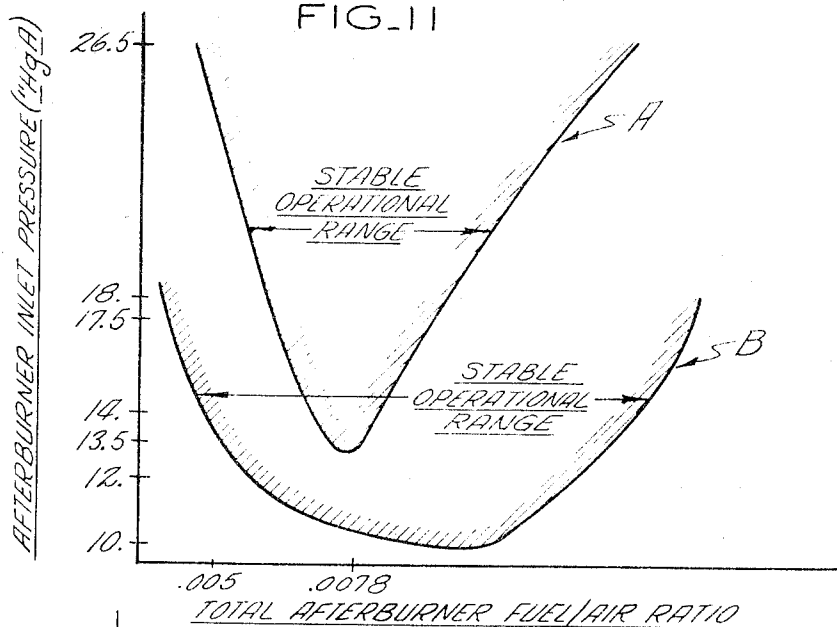


FIG. 11



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FIG. 14

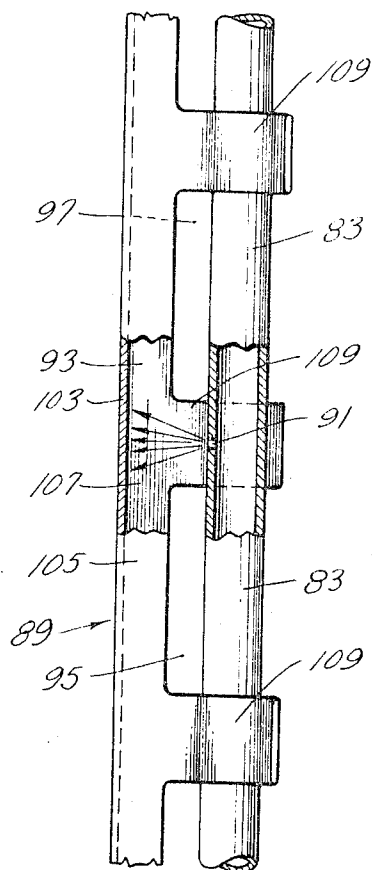
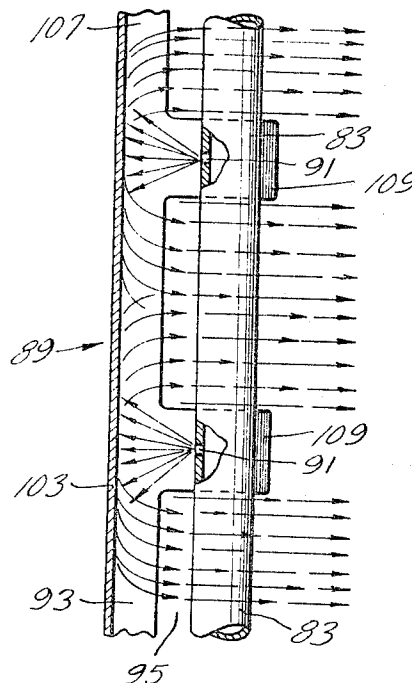


FIG. 15



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3,269,115

JET ENGINE AFTERBURNER CONTINUOUS
SPLASH PLATE

Arthur W. Nelson, Jr., Glastonbury, Conn., assignor to
United Aircraft Corporation, East Hartford, Conn., a
corporation of Delaware
Filed Apr. 29, 1965, Ser. No. 451,860
9 Claims. (Cl. 60—35.6)

This invention relates to combustion apparatus and more particularly to such apparatus when adapted for use in jet engine afterburners.

In modern jet engine afterburners, the engine exhaust gases and in some instances also the cold air from the engine ducted fan passage, are passed through the afterburner at high velocity. It is extremely difficult to support combustion in this high velocity gas flow and it is therefore necessary to provide flameholders to establish stagnation zones within the afterburner, wherein combustion can be supported. These flameholders produce a stagnation zone wherein a fuel-air mixture may be burned within the afterburner. Since there is insufficient unburned fuel in the engine exhaust gases to support combustion, it is necessary to introduce fuel into the afterburner upstream or forward of the flameholder. It is essential to control the introduction of this fuel so that the fuel is atomized and is capable of forming a stoichiometric mixture with the gases within the afterburner and also such that the fuel is uniformly and symmetrically passed over or axially across the flameholder so that all the fuel will be introduced into and burned in the stagnation zone formed by the flameholder.

In the past, it has been conventional practice to introduce fuel into the afterburner through fuel spray bars of the type taught in U.S. Patent 3,044,264, which are circumferentially located and radially extending bars located upstream of the flameholder. This fuel spray bar system proved unsatisfactory because such a system produced fuel downstream of spray bar only and left fuel void between the spray bars.

The fuel spray bar was eventually replaced by a fuel spray ring which had apertures in the walls thereof and through which fuel is projected to be passed over the flameholder. The fuel ring system of injection was not satisfactory because there was insufficient control of the radial and the circumferential distribution of the fuel after it was projected through the apertures and into the afterburner gas stream.

The number and size of the fuel injection apertures is fixed for a given range of fuel flow requirements by the pressure limit of the fuel supply pump for high mach number, low altitude conditions (i.e. maximum fuel flow requirement) and by the fuel boiling point (the condition where the fuel vapor pressure exceeds the supply pressure) at high altitude conditions (i.e. the minimum fuel flow requirement). Should fuel boiling (vaporization) occur within the fuel rings or supply pipes, vapor locking could occur. This is particularly true of afterburners which require a variation of augmentation over a wide range of altitude and mach numbers and for fixed augmentation afterburners which have similar requirements. Hence it is not possible to provide an unlimited number of fuel injection apertures to improve fuel distribution.

To obtain better atomization and better radial control of the fuel distribution when a fuel dispensing ring is used, individual splash plates were positioned forward of each forwardly directed fuel dispensing aperture in the fuel tube as illustrated in U.S. Patent 3,176,465. This system provided a reasonable control of the radial distribution of the fuel, but proved disappointing in practice from a performance standpoint.

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It is accordingly the main object of this invention to overcome the disappointing performance of the individual splash plate system of fuel injection. After studying the problem, it occurred to me that the short-coming of the individual splash plate system might be caused because the fuel being introduced into the individual splash plates by the single fuel aperture therewithin is carried axially downstream by the afterburner high velocity gas so that circumferential distribution of the fuel was not being accomplished. Motion pictures of the fuel distribution pattern from the individual splash plate system confirmed this suspicion. I realized that it would not be feasible to improve the circumferential distribution of fuel by introducing more fuel dispersing apertures in the fuel dispensing tube and/or more individually controlled splash plates without exceeding practical fuel pump pressure supply limits, or exceeding the practical aperture size necessary to pass the known contaminants of commercially available fuels and/or the danger of vapor locking the fuel dispensing feedlines by the reduction of the fuel supply pressure below the fuel vapor pressure at high altitude conditions (low fuel flows).

I accordingly decided that circumferential distribution of the fuel might be improved if a continuous splash plate projected across several or all of the fuel dispensing apertures forward of the fuel dispensing tube. Quite unexpectedly, motion pictures of the fuel distribution pattern using my continuous splash plate showed that substantial improvement in circumferential distribution of the fuel can be obtained thereby, while radial distribution control is maintained.

It is accordingly a teaching of this invention that secondary fuel be introduced into a jet engine afterburner through a hollow fuel dispensing ring positioned concentrically about the afterburner axis and forward of a flameholder ring of substantially the identical diameter and wherein the fuel is dispensed from the tube through a plurality of circumferentially spaced apertures in the forward or upstream wall of the tube and projected there-through against a continuous splash plate which projects across the apertures.

It is still a further object of this invention to teach such a continuous splash plate which is supported in spaced relation from the fuel dispensing tube and forward thereof by clips which are in radial alignment with the fuel dispensing apertures and which support the splash plate so as to form top and bottom circumferential apertures between the splash plate and the fuel dispensing tube.

It is still a further object of this invention to teach such a continuous splash plate which is of U-shaped cross section or a U channel and which is preferably of integral construction with the aforementioned clip support means.

It is still a further object of this invention to provide a continuous splash plate which extends across a plurality of forwardly directed fuel dispensing apertures and which is so shaped to produce controlled radial distribution and controlled circumferential distribution of the fuel directed through the apertures and against the splash plate.

FIG. 1 is an exterior showing, partially broken away, of a turbofan engine showing the flameholder in its environment.

FIG. 2 is partial cross-sectional showing through the flameholder and its support mechanism.

FIG. 3 is a partial rear view of the flameholder taken along line 3—3 of FIG. 2.

FIG. 4 is a view taken along line 4—4 of FIG. 2.

FIG. 5 is a view taken along line 5—5 of FIG. 2.

FIG. 6 is a view taken along line 6—6 of FIG. 2.

FIG. 7 is a view of the afterburner flameholder support ring.

FIG. 8 is a view taken along line 8—8 of FIG. 2.

FIG. 9 is a view taken along line 9—9 of FIG. 2.

FIG. 10 is an enlarged cross-sectional view thru my flameholder ring.

FIG. 11 is a graph showing the performance of my flameholder ring as compared to a conventional, symmetric V-gutter flameholder ring.

FIG. 12 is a showing of an alternate construction of the continuous splash plate.

FIG. 13 is a view taken along line 13—13 of FIG. 12.

FIG. 14 is a plan view, partly broken away of continuous splash plate construction.

FIG. 15 is a broken away showing of the continuous splash plate to illustrate fuel dispersion pattern.

Referring to FIG. 1 we see engine 10, which may be of the conventional turbojet type but which is preferable of the turbofan or fan jet type. Engine 10 includes engine outer case 12 which is of circular cross section and concentric about axis 14 and which includes air inlet section 16 at its forward end and variable area exhaust nozzle 18 at its after or rearward end. The components of engine 10 include compressor section 20, burner section 22, turbine section 24 and afterburner section 26. In operation, air enters inlet section 16 and is compressed in the fan portion 28 of compressor section 20. Fan portion 28 includes a plurality of alternately positioned stationary vanes and rotating blades. After passing through fan portion 28, a portion of the compressed air then passes into annular bypass air passage 30, defined between engine case 12 and splitter duct 32, and is discharged therefrom into afterburner section 26. The remainder of the air from fan portion 28 passes through high pressure compressor section 34, which comprises a plurality of alternately positioned stationary vanes and rotating blades, for further compression therein. After leaving high pressure compressor 34, the compressed air is heated in burner section 22 due to combustion which takes place in combustion chambers 36, which may be either of the conventional can or annular type, and the heated gas is then passed through turbine section 24, where sufficient energy is extracted therefrom to drive fan portion 28 and high pressure compressor 34, and then is discharged through annular gas passage 38 formed between splitter duct 32 and afterburner central support member 40 and then into afterburner 26 for eventual discharge to atmosphere through variable area exhaust nozzle 18. Variable area exhaust nozzle 18 is of conventional design and may be of the type more fully disclosed in U.S. Patents Nos. 3,032,974, 3,057,150, 3,062,003, 2,910,829, 2,974,480 or 2,846,841 while engine 10 may be of the type shown in U.S. Patents Nos. 2,929,203, 2,978,865 and 2,979,900 to which reference may be had.

A reheat process takes place in afterburner 26 and this requires the injection of additional fuel into afterburner 26 and the establishment of a flow stabilization zone in the afterburner so that combustion may take place therein. Flameholder 50 performs the flame stabilization zone creating function.

Referring to FIGS. 2 and 3 we see flameholder 50 and its support mechanism in greater particularity. Flameholder 50 is supported entirely from afterburner central support member of cone 40 and serves to form flow stabilization zone 52 downstream thereof as the exhaust gases from turbine 24 are passed thereover. Central support member 40 which serves to support flameholder 50, is of circular cross-section and concentric about axis 14 and includes forward conical portion 54 and after conical portion 56, which are axially separated to receive flameholder support ring 58 therebetween, which support ring is welded or in other fashion attached to forward cone portion 54 and after or rearward cone portion 56 to cooperate therewith to form a conical structure. Central support member 40 is attached by bolts 60 to turbine rear bearing support housing 62, which is in turn supported in conventional fashion by a plurality of struts (not shown) projecting between support housing 62 and engine case 12 in conventional fashion.

Support ring 58 is shown in greater particularity in FIG. 7 and includes radially extending support rib or ring 64 and a plurality of V-cross sectioned bosses 66, which include substantially rearwardly directed apertures 68 therein.

As shown in FIG. 2, rearward portion 56 of central support member 54 terminates at its after end in inner diameter, cylindrical support surface 70.

Flameholder 50 includes sleeve member 72 which includes substantially cylindrical, outer diameter support surface 74 at the forward end thereof which engages surface 70 of support 40 in a slip fit, i.e. .005—.015 inch loose. Flameholder 50 further includes a plurality of trough or gutter-shaped flame stabilizing rings 76, 78 and 80 which are positioned concentrically about axis 14 and which have their open ends projecting in a rearward or after direction. Rings 76-80 are spaced axially from one another such that the larger ring 80 is farthest forward or upstream and such that the smallest ring 76 is farthest rearward or downstream. Substantially radially directed connectors 82 project from central member 40, from which they project in flared and faired fashion as best shown in FIG. 3, and are connected to flame stabilizing rings 76-80 to support these rings from support member 40. Connectors 82 are positioned circumferentially about axis 14 and are also of trough-shaped cross section opening in a downstream direction, similar to rings 76-80, and are connected to rings 76-80 so that their interiors are in communication, as best shown in FIG. 3. Referring to FIG. 3 we see that the interior 84 of connector 82 is in communication with the interiors 86, 88 and 90 of rings 76, 78 and 80 so that, once combustion is established in combustion support zone 52, connectors 82 serve as flame-spreaders between flame stabilization rings 76-80. Aero-dynamic support web 92 extends along the forward or upstream edge of connector 82 and serves as a stiffener therefor and includes an aperture 94 therein (FIG. 4) to be utilized in a fashion to be described hereinafter.

A plurality of support rods 100 extend between flameholder 50 and central support member 40 to assist in supporting flameholder 50 from central support member 40. Support rods 100 are pivotally attached to both flameholder 50 and central support member 40 so that the flameholder and support member are free to move and grow thermally with respect to one another.

The pivot connection between support rod 100 and central support member 40 is best shown in FIG. 5 with further details shown in FIG. 6. It will be noted by observing FIG. 5 that support rod 100 is actually of two-piece construction and includes a cylindrical end 102 including aperture 104 therethrough and having boss 106 thereover, which boss has apertures 108 and 110 in the opposite walls thereof which align with aperture 104 of cylindrical end 102 to receive pin 112 which is held in place by nut 114, which may be pinned or wire-locked in position through aperture 116. Cylinder 102, it will be noted, passes through aperture 68 of boss 66 of support ring 58 and includes flange 118, which abuts boss flange 120 so that the coaction of sleeve 106 and pin 112 serve to position cylinder 102 and hence connecting rod 100 with respect to boss 66 of connecting ring 58. Yoke arms 130 and 132 project from cylinder 102 and include apertures 134 and 136, which align with aperture 138 in support rod 100 to receive pin 140, which is held in position by nut 142 so that support rod 100 is accordingly pivotally connected to support ring 58 and hence central support member 40.

As best shown in FIG. 4, the opposite end of support rod 100 is pivotally attached to flameholder 50. At its opposite end, support rod 100 includes yoke arms 150 and 152 which have aligned apertures 154 and 156 therein, which apertures align with aperture 94 of flameholder support web 92 to receive pivot pin 160 therethrough and pivot pin 160 is held in position by nut 162.

It will accordingly be seen by viewing FIGS. 4 and 5 that connecting rods 100 are pivotally attached to the central support member 40 and flameholder 50. Accordingly, rings 76-80 may thermally expand with respect to central support member 40.

To permit reheating in afterburner 26, it is necessary to inject fuel into the afterburner to be mixed therein with the engine exhaust gases and to burn as a stoichiometric fuel-air mixture within the combustion stabilization zone 52 downstream of flameholder 50. Fuel is injected through tubes 75 and 77, shown in FIG. 2, and passes therefrom into hollow, apertured fuel dispensing rings 79, 81 and 83 and through apertures in the walls of these fuel dispensing rings into splash plates 85, 87 and 89. Fuel rings 81, 79 and 83 are concentric about axis 14 and are of substantially the same diameter as flameholder rings 76, 78 and 80, respectively.

For optimum efficiency and performance, it is important that the fuel which is injected into afterburner 26 by the fuel rings, such as 83, be controlled in radial dispersion and circumferential dispersion so that a symmetrical and continuous fuel-air pattern is passed axially across each flameholder ring such as 80. It is essential that the radial dispersion of the fuel from the fuel rings such as 83 be controlled so that fuel does not pass by flameholder rings 76-80 and through afterburner 26 unburned. It is also highly desirable that the splash plate, such as 89, serve to circumferentially disperse the fuel injected thereinto from the fuel ring 83 such that a circumferentially continuous pattern of fuel is passed axially over the flameholder ring 80.

The construction of the fuel dispensing rings and the continuous splash plates will be considered, as shown in FIGS. 9, 14 and 15 to describe fuel dispersing ring 83 and continuous splash plate 89.

As shown in FIGS. 9 and 14, the fuel in the fuel tube 83 passes substantially forwardly or upstream therefrom through circumferentially spaced apertures 91 into the hollow interior 93 of circumferential, U-shaped splash plate 89 from whence the fuel is distributed uniformly in a circumferential direction and controlled in flow in a radial direction through circumferential apertures 95 and 97 formed top and bottom between splash plate 89 and fuel tube 83. It will be noted that splash plate 89 is continuous and extends circumferentially to cover several apertures and is broken only where required at places such as fuel tube joint 99 (FIG. 2). The axes 101 of apertures 90 are substantially parallel to afterburner case axis 14. Continuous splash plate 89 includes radial plate 103 spaced from and in axial alignment with apertures 91 and also includes axial, ring-segmented plates 105 and 107, which cooperate to form channel shaped or U-shaped continuous splash plate 89. Clip support members 109 attach to fuel dispensing tube 83 and to splash plate 89 so as to position flameholder 89 in spaced relation axially forward of fuel ring 83 to establish top and bottom circumferential apertures 95 and 97 therebetween. Clip members 109 and splash plate 89 are preferably of integral construction and clip members 109 may be brazed or welded to tube 83.

We have found that for fuel rings of 30 to 40" diameter, fuel dispensing apertures 91 should be spaced about 2½ inches apart and should be about .025 inch in diameter. The splash plate 89 should be spaced about ¼ of an inch forward of ring 93.

As best shown in FIG. 15, the fuel sprayed from apertures 91 sprays forwardly to strike splash plate 89 and ricochets or flows rearwardly and circumferentially therefrom into the high velocity gas stream through afterburner 26 and is carried axially therewith in a uniform circumferential pattern.

Continuous splash plate 89 serves the additional function of raising the natural frequency of tube 83 and thereby improving its vibration withstanding qualities. The fuel injected through rings 79, 81 and 83 is pref-

erably liquid, such as kerosene or other similar liquid hydrocarbon compounds.

Test results and motion pictures show that such a splash plate construction provides fuel of uniform circumferential distribution and of controlled radial distribution to an afterburner flame stabilization ring, such as 80, downstream thereof. The fuel so injected will be burned in flow stabilization zone 52 downstream of the flameholder 50.

An alternate embodiment of the continuous splash plate is shown in FIGS. 12 and 13. Referring to these two figures we see hollow fuel dispensing tube 83' which has forwardly oriented and circumferentially spaced fuel dispensing apertures 91' therein. Continuous splash plate 89' comprises support clip members such as 300 which include radially outer clip legs such as 302 and radially inner clip legs such as 304 attached by either a clipping or pinching action or by brazing to tube 83' in radial alignment with each aperture 91' and defining an axially forwardly directed passage 306 forward of each aperture 91'. Clip legs 302 and 304 attach to U-shaped bracket 308, which is of U-shaped cross-section opening toward tube 83' and axially spaced therefrom and in axial alignment with apertures 91' and extending circumferentially thereof. Continuous channel member 310 attaches to U-shaped clips 300 and bridges the circumferential gap therebetween to cooperate therewith in defining a continuous, circumferential channel aligned with and bridging the circumferential gap between fuel dispensing apertures 91'. U-channel member 310 is arcuate in shape to follow the circumferential curvature of tube 83' and is of U-shaped cross-section opening toward tube 83.

Flameholder 50 has a plurality of circumferentially spaced ball ended pins 161 extending forwardly therefrom and received into sleeved bosses 103, which projects rearwardly from fuel ring 83. Support pin 105 pivotally connects pin 161 to flameholder 50 so that pin 101 and sleeve 103 serve to keep flameholder ring 80 and fuel spray tube 83 in axial alignment, while permitting relative motion therebetween.

While flameholder 50 serves to establish combustion stabilization zone 52 downstream thereof to permit the reheating of the exhaust gases being discharged through annular passage 38, combustion or reheating must also take place in afterburner 26 downstream of the bypass annular passage 30 defined between engine or afterburner case or duct 12 and splitter duct 32. Flameholder 170, (see FIG. 2) which is of trough-shaped cross-section and in the form of a ring concentric about axis 14 is positioned downstream of annular bypass gas passage 30 by a plurality of support rods 172, which are pivotally attached to flameholder ring 174 at pivot points 176 and which are also attached to engine or afterburner duct 12 or afterburner liner 177 at pivot points 178 through boss arrangement 180. Bypass air flameholder ring 170 has cold air from passage 30 passed thereover and serves to form flow stabilization zone 182 downstream thereof in which the fuel which is injected through fuel injection means 184 may be ignited and burned. It is a very difficult problem to ignite and sustain combustion in a cold gas stream such as the one in which flameholder 170 is located and it is accordingly an important teaching of this invention that flameholder 50 be made as best shown in FIGS. 2 and 10 so that it consists of inner wall 186, which is substantially cylindrical and concentric about axis 14, and outer wall 188 which diverges in a downstream direction with respect to axis 14 such that it projects toward cold air flameholder 170 to define an included angle of about 30° with inner wall 186 and is smoothly joined to inner wall at leading edge 312. Further, a circumferentially extending aerodynamic trip in the form of circumferentially extending and inwardly projecting lip or flange 190 (FIGS. 2, 3 and 10) is attached to the after or downstream end of cylindrical wall 186 of flameholder ring 80 and serves to cause the air

flowing therearound to recirculate, as shown in FIG. 10, toward the interior 314 of flameholder ring 80. Similar recirculation is caused by the air flowing over outer wall 188 as shown in FIG. 10. The specific shape of ring 80 shown in FIG. 10 establishes a hot gas-cold gas interface or flamefront to project along line 111 and out into the cold air stream downstream of passage 30 and into combustion zone 182 formed downstream of flameholder 170. The flamefront or interface 111 intercepts cold air-hot gas interface 113 defined by splitter duct 132 so as to force hot air or flame into combustion zone 182.

By referring to FIG. 11 we can see the improvement in performance obtained by the use of flameholder ring shaped as shown in FIG. 10 as opposed to a conventional and symmetrical trough-shaped ring of the type illustrated for flameholder rings 76 and 78. Curve A represents the performance curve for the conventional ring such as 76 or 78 when used in the flameholder 80 position, whereas curve B represents the performance curve for flameholder 80 of the type shown in FIG. 10. It will be noted that for any given afterburner inlet pressure level (i.e. altitude), the stable operational range from lean to rich fuel air ratios is vastly greater for the flameholder ring shaped as shown in FIG. 10 (curve B) as compared for the conventional ring (curve A). It should also be noted that the capability for operation to higher altitudes, as represented by reduction in afterburner inlet pressure, is significantly improved for the flameholder ring shown in FIG. 10 (curve B) as compared to the conventional ring (curve A).

It is also an important teaching of this invention that a plurality of circumferentially positioned and trough-shaped flame spreaders 200 (FIGS. 2 and 3) project outwardly from flame stabilizing ring 80 and project downstream therefrom toward flameholder ring 170 in such a fashion that they increase in cross-sectional area in a downstream and radial outward direction to form a venturi as shown in FIG. 3. To be more specific, the inner end 202 of each flamespreader 200 is of intermediate cross-sectional area and tapers down to throat 203, which is of minimum cross-sectional area, then increases in cross-sectional area so that outer end 204 thereof is of maximum cross-sectional area. It will be noted that the after or outer end 204 of flamespreader 200 is substantially in radial alignment with cold stream flameholder 170 and serves to carry flame from flame stabilization ring 80 to flame stabilization ring 174 of flameholder 170 both to provide ignition of flameholder 170 in the case of a zoned afterburner and to provide added assistance for proper combustion of flameholder 170 located in the cold bypass airstream by providing added heat in the recirculation zone of this flameholder. By providing a large cross-sectional area in flamespreader 200 at its outer end 204 we are establishing a low pressure region at 204 with respect to the pressure at the inner end 202 of the flameholder. This pressure differential causes a heat or flame pumping action from flameholder ring 80 to flameholder ring 170 in the cold air stream.

In afterburner operation, fuel is injected through fuel line 77 (FIG. 2) into flamehold ring 83 and passes therefrom against continuous splash plate 89 and is then carried by the engine exhaust gases in passage 38 symmetrically around flame stabilizing ring 80 to be ignited downstream thereof and in the interior thereof by a conventional hotstreak igniter shown as element 320 in FIG. 1 and of the type taught and fully described in U.S. Patent No. 2,913,875 to which reference is hereby made. Fuel from fuel rings 79, 81 and 184 is then caused to pass around flameholder rings 78, 76 and 170 respectively. The flame established in the interior of flame stabilization ring 80 will flow through the interior of flame spreader connectors 82 and 200 to establish combustion in and downstream of flame support rings 76 and 78 and in and downstream of cold path flameholder 170.

It is to be understood that the invention is not limited

to the specific embodiment herein illustrated and described but may be used in other ways without departure from its spirit as defined by the following claims.

I claim:

1. A jet engine afterburner comprising an afterburner case of circular cross-section and concentric about an axis and having a forward end and an after end, a flame-holder ring positioned within said case and concentric about said axis, a hollow fuel dispensing ring positioned within said case and concentric about said axis and being of substantially the same diameter as said flameholder ring, said fuel dispensing ring being spaced forward of said flameholder ring and having a plurality of apertures in the forward wall thereof, and an arcuate splash plate having the contour of the diameter or said fuel dispensing ring and positioned adjacent said fuel dispensing ring and located forward of said apertures and being of U-shaped cross-section and having a first radially extending plate forming the base of said U-shape and extending across said apertures and further having two cylindrically shaped plates attached to and extending along said case axis from said radially extending plate to form the legs of said U-shape and still further including means to support said attached U-shaped plates in spaced relation to said fuel dispensing ring to form top and bottom circumferential apertures therewith, and means to provide pressurized fuel into said fuel dispensing ring to be projected therefrom through said apertures against said splash plate.

2. Apparatus according to claim 1 and including means to pass high velocity gas axially through said case from said forward end to said after end and across said splash plate, fuel dispensing ring and flameholder so that said fuel which projects from said apertures and against said splash plate will radiate circumferentially within said splash plate and be carried therefrom as atomized fuel through said circumferential apertures between said splash plate and said fuel dispensing ring and substantially symmetrically across said flameholder.

3. Apparatus according to claim 2 and wherein said fuel dispensing ring apertures are circumferentially positioned and have an axis substantially parallel to said case axis.

4. Apparatus according to claim 3 and wherein said splash plate is of one-piece construction.

5. Apparatus according to claim 4 and wherein said support means are clip means extending between said U-shaped plates and said fuel dispensing ring and are in circumferential alignment with said fuel dispensing ring apertures.

6. Combustion equipment including an afterburner case concentric about an axis, a hollow fuel dispensing ring positioned within said case concentrically about said axis and having a forward and an after end, a plurality of circumferentially spaced fuel dispensing apertures in the forward wall of said fuel dispensing tube oriented toward said forward end, a continuous splash plate including support arms attached to the radial top and radial bottom of said tube in radial alignment with each of said apertures and projecting axially forward thereof to define an axial forwardly extending passage therebetween projecting forwardly from each of said apertures, a circumferentially extending, U-channeled, arcuate member attached to and supported by said support arms in spaced relation to said fuel dispensing tube and located thereby to be positioned axially forward of said apertures and in spaced relation thereto and extending across said apertures and bridging the circumferential gap therebetween to form a continuous, circumferential, U-shaped trough positioned axially forward and extending circumferentially between said apertures and forming top and bottom circumferential apertures with said fuel dispensing tube.

7. Apparatus according to claim 6 wherein said U-channel includes a radially extending plate positioned axially forward of said apertures and two axially extending plates projecting toward said ring from the outer and inner ends

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of said radially extending plate to form a channel of U-shaped cross-section therewith.

8. Apparatus according to claim 7 and including means to pass gas from the forward end to the after end of said case and over said splash plate and tube, and means to provide pressurized fuel to the interior of said fuel dispensing tube to be projected forwardly therefrom through said apertures and against said U-channel to be dispersed circumferentially therealong and then through said top and bottom circumferential apertures around said tube.

9. An afterburner case having an axis and a forward and after end, a hollow fuel dispensing tube located within said case and concentric about said axis, a plurality of circumferentially spaced fuel dispensing apertures in the forward wall of said tube, U-shaped clip support means clipped onto said tube radially outward of and radially inward of each of said apertures and extending forwardly

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thereof to provide an axially extending passage forward of each of said apertures, an arcuate, U-channel engaging and attached to the forward end of each of said clip support means and bridging the circumferential gap between said clips to define therewith a U-shaped channel opening toward said apertures and presenting a continuous, circumferentially extending trough in axially spaced relation thereto.

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MARK NEWMAN, *Primary Examiner.*

RALPH D. BLAKESLEE, *Assistant Examiners.*