etc. Wash fluid can be temperature regulated for more efficient washing processes by using a heater (not shown) to increase the temperature, isopropyl alcohol to keep wash liquid from freezing in cold weather or other means depending on system requirements. Wash fluid can be delivered from a hose (not shown) connected to a wash unit (not shown) or from another source.

Wash liquid travels through feeder body 18 to nozzles 26a, 26b, 26c and 26d. Nozzles 26a, 26b, 26c and 26d direct the wash liquid into inlet ducts 16 to remove contaminants and buildup in engine 12. During a wash operation, engine can be cranked to assist in flowing wash liquid through engine 12 in the same manner that air and contaminants flow through engine 12. For washing operations, it may be desirable to motor engine 12 with a starter or auxiliary power unit (not shown).

As mentioned above, many engines are washed by connecting a manifold to an inlet near the fan and spraying wash fluid into the engine inlet. Due to the architecture of certain engines, like typical turboprop engines, use of prior art manifolds that connect to the engine inlet cowling to axially direct wash fluid are not possible. Thus for cleaning of engines with radial passageways, due to the unique architecture and the use of inlet screen 14, some aircraft have integrated wash components. Integrated components add weight to an associated aircraft and therefore additional fuel expense for a component that is not necessary during flight. Other washing is done by simply using a hose to try to spray into different sections of the engine, but such use of a hose is usually at relatively low pressures and without consistent positioning, which may not provide desired cleaning efficacy. Other washing is also done by using a tube formed to fit the inlet screen, the tube of which contains drilled holes to inject streams of wash fluid inward at relatively low pressures (below 100 psi). This method does not atomize or control droplet size and thus does not provide desired cleaning efficacy. However, the present invention improves upon such other washing.

Manifold 10 can effectively wash turboprop engine 12 by being able to attach quickly, easily and securely to engine 12 inlet screen 14, allowing for the delivery of high-pressure wash fluid through nozzles 26a, 26b, 26c and 26d. The unique design of manifold 10 with feeder body 18 and clamps 24a, 24b allow nozzles 26a, 26b, 26c and 26d to deliver wash liquid into inlet ducts 16 to clean compressor, turbine and other engine 12 components, resulting in improved penetration of the engine core gas path over past engine cleaning systems, particularly for engines having radial passageways at or near an inlet. Feeder body 18 can be specifically shaped and sized to follow the unique

CLAIMS

1. An engine wash manifold assembly for delivering wash liquid to an engine with a radial air passage, the manifold assembly comprising:

a feeder body;

an inlet on the feeder body to receive wash fluid;

a first nozzle in fluid communication with the feeder body and configured to direct wash fluid in a radial direction such that the wash fluid can pass into the radial air passage; and

a spring-loaded clamping mechanism configured to support the feeder body relative to a mounting location, the spring-loaded clamping mechanism including a first clamping member and a second clamping member pivotally secured to each other at a pivot location, wherein the first and second clamping members are compressible relative to the pivot location and expand relative to the pivot location as a function of a spring bias force.

2. The manifold assembly of claim 1, wherein the spring-loaded clamping mechanism is configured to selectively engage an inlet screen of the engine by insertion into one or more inlet screen openings.

3. The manifold assembly of claim 1, wherein the spring-loaded clamping mechanism further comprises:

tabs that protrude from the first clamping member at a location spaced from the pivot location.

4. The manifold assembly of claim 1, and further comprising:

an additional nozzle in fluid communication with the feeder body and configured to spray the wash fluid radially.

5. The manifold assembly of claim 1, wherein the feeder body is arcuate.

6. The manifold assembly of claim 5, wherein the feeder body has opposite ends and is continuously curved between the opposite ends.

7. The manifold assembly of claim 1, and further comprising a centering feature.

8. A method of washing an engine having a radial passageway, the method comprising:

securing a manifold with one or more nozzles relative to the engine so that at least one of the one or more nozzles are oriented to spray into the radial passageway, wherein the step of securing a manifold with one or more nozzles relative to the engine comprises engaging one or more clamping devices and includes:

squeezing a spring mounted clamping device;

inserting tabs on the spring mounted clamping device into an inlet screen of the engine; and

releasing the spring mounted clamping device so that the tabs engage the inlet screen radially and either axially or circumferentially;

delivering wash fluid to an inlet on the manifold;

flowing the wash fluid from the inlet through a feeder body of the manifold to the one or more nozzles; and

directing the wash fluid through the one or more nozzles in a generally radial direction into the radial passageway.

9. An engine wash manifold assembly for delivering wash liquid to an engine with a radial air passage, the manifold assembly comprising:

a feeder body;

an inlet on the feeder body to receive wash fluid;

a first nozzle in fluid communication with the feeder body and configured to direct wash fluid in a radial direction such that the wash fluid can pass into the radial air passage, wherein the first nozzle is configured to atomize the wash fluid;

one or more additional nozzles in fluid communication with the feeder body and configured to spray the wash fluid radially, wherein the first nozzle and the one or more additional nozzles are convergent, such that the wash fluid from the first nozzle and the one or more additional nozzles converges inwardly toward a common axis; and

a securing device configured to support the feeder body relative to a mounting location, wherein the securing device comprises a spring-loaded clamping mechanism that includes a first clamping member and a second clamping member pivotally secured to each other at a pivot location, wherein the first and second clamping members are compressible relative to the pivot location and expand relative to the pivot location as a function of a spring bias force.

10. The method of claim 8 and further comprising:

squeezing the engaged spring mounted clamping device; and

removing tabs on the spring mounted clamping device from the inlet screen of the engine.

11. The manifold assembly of claim 9, wherein the securing device is positioned in between the first nozzle and any of the one or more additional nozzles along the feeder body, and wherein the feed body is arcuate.

12. The manifold assembly of claim 4, wherein the spring-loaded clamping mechanism is positioned in between the first nozzle and the additional nozzle along the feeder body.

13. The manifold assembly of claim 4, wherein the additional nozzle is configured to atomize the wash fluid.

14. The manifold assembly of claim 1, wherein the feeder body is an arcuate pipe, and wherein the arcuate pipe has a central angle of approximately 84°.

15. The manifold assembly of claim 2, wherein the spring-loaded clamping device is configured to selectively engage a wire mesh inlet screen of the engine by insertion into one or more openings located between wires of the wire mesh inlet screen.

16. The manifold assembly of claim 3, wherein at least one of the tabs protrudes axially.

17. The manifold assembly of claim 3, wherein at least one of the tabs protrudes circumferentially.

18. The manifold assembly of claim 1, wherein the first nozzle is configured to atomize the wash fluid.

19. The method of claim 8, wherein the step of directing the wash fluid through the one or more nozzles in a generally radial direction into the radial passageway atomizes the wash fluid.

20. The manifold assembly of claim 9, wherein the spring-loaded clamping device is positioned in between the first nozzle and any of the one or more additional nozzles along the feeder body.

21. The manifold assembly of claim 9, wherein the feeder body is arcuate.