Claims

1. A gas turbine engine comprising:

a static engine structure defining a core inlet and a core outlet;

at least one shaft rotatable relative to the static engine structure about an axis of rotation;

a compressor section driven by the at least one shaft to drive air along a core flowpath that extends from the core inlet to the core outlet;

a speed reduction device driven by the at least one shaft;

a fan including a fan rotor driven by the speed reduction device, wherein the fan drives air along a bypass flowpath located radially outward of the core flowpath; and

at least one inducer stage positioned aft of the fan and coupled for rotation with the fan rotor, wherein the at least one inducer stage comprises a core stator structure fixed to the core inlet of the static engine structure and one or more inducer blades fixed for rotation with the fan rotor for rotation relative to the core stator structure.

2. The gas turbine engine according to claim 1, wherein the core stator structure is supported by at least one strut having a first end fixed to the static engine structure and a second end rotatably supported by a bearing.

3. The gas turbine engine according to claim 1, wherein the core stator structure includes a plurality of vanes positioned axially between the fan and the inducer blades.

4. The gas turbine engine according to claim 1, wherein the core stator structure includes a plurality of vanes positioned aft of the inducer blades.

5. The gas turbine engine according to claim 1, wherein the at least one inducer stage comprises a plurality of inducer stages coupled to the fan rotor.

6. The gas turbine engine according to claim 5, wherein each inducer stage comprises one or more blades fixed for rotation with the fan rotor relative to the core stator structure which is fixed to the core inlet of the static engine structure that surrounds the core flowpath.

7. The gas turbine engine according to claim 1, wherein the core stator structure and the static engine structure are radially inward of the bypass flowpath to surround the core flowpath, and wherein the compressor section comprises a plurality of compressor stages driven by the at least one shaft.

8. The gas turbine engine according to claim 7, wherein the compressor section is positioned immediately aft of the at least one inducer stage.

9. The gas turbine engine according to claim 7, wherein the at least one inducer stage is located within the core flowpath and is positioned forward of the speed reduction device.

10. The gas turbine engine according to claim 7, wherein the at least one shaft comprises at least a first shaft and a second shaft, and wherein the compressor comprises a low pressure compressor driven by the first shaft, and including a high pressure compressor positioned aft of the low pressure compressor and driven by the second shaft positioned radially outwardly relative to the first shaft that drives the low pressure compressor.

11. The gas turbine engine according to claim 1, wherein the core stator structure includes a variable vane positioned at the core inlet.

12. The gas turbine engine according to claim 1, wherein the core stator structure is heated for anti-icing.

13. The gas turbine engine according to claim 1, wherein the one or more inducer blades are heated for anti-icing.

14. The gas turbine engine according to claim 1, wherein the fan rotor turns in the same direction as the at least one shaft.

15. The gas turbine engine according to claim 1, wherein the fan rotor turns in an opposite direction from the at least one shaft.

16. The gas turbine engine according to claim 1 wherein the speed change device comprises a gearbox including a sun gear in meshing engagement with star gears and a ring gear in meshing engagement with the star gears, and wherein the ring gear drives the fan.

17. The gas turbine engine according to claim 1 wherein the speed change device comprises a gearbox including a sun gear in meshing engagement with a plurality of planetary gears supported by a planet carrier and a ring gear in meshing engagement with the planet gears, and wherein the ring gear is fixed and the planet carrier provides input to the fan.

18. A gas turbine engine comprising:

a static engine structure surrounding a core flowpath extending from a core inlet to a core outlet;

at least one shaft rotatable relative to the static engine structure about an axis of rotation;

a speed change device driven by the at least one shaft;

a fan section including at least one fan blade coupled to a fan rotor wherein the fan rotor is driven by the speed change device, and wherein the fan section drives air along a bypass flowpath located radially outward of the core flowpath;

a compressor comprising a plurality of compressor stages driven by the at least one shaft, the compressor surrounded by the static engine structure at a location downstream of the core inlet; and

at least one inducer stage positioned within the core flowpath aft of the fan blade and coupled for rotation with the fan rotor about the axis of rotation.

19. The gas turbine engine according to claim 18, wherein the at least one inducer stage is positioned in the core flowpath at a position axially forward of the compressor.

20. The gas turbine engine according to claim 19, wherein the at least one shaft comprises at least a first shaft and a second shaft, and wherein the compressor comprises a low pressure compressor driven by the first shaft, and including a high pressure compressor positioned aft of the low pressure compressor and driven by the second shaft positioned radially outwardly relative to the first shaft that drives the low pressure compressor.

21. The gas turbine engine according to claim 20, wherein the low pressure compressor is positioned aft of the speed change device.

22. The gas turbine engine according to claim 18, wherein the at least one inducer stage comprises one or more inducer blades fixed for rotation with the fan rotor and a core stator structure fixed to the core inlet of the static engine structure such that the core stator structure and the static engine structure are radially inward of the bypass flowpath.

23. The gas turbine engine according to claim 22, wherein the core stator structure includes a plurality of vanes positioned axially between the fan blades and the inducer blades.

24. The gas turbine engine according to claim 22, wherein the core stator structure includes a plurality of vanes positioned aft of the inducer blades.

25. The gas turbine engine according to claim 18, wherein the at least one inducer stage comprises a plurality of inducer stages coupled to the fan rotor and a core stator structure fixed to the core inlet of the static engine structure, and wherein each inducer stage

comprises one or more inducer blades fixed for rotation with the fan rotor and one or more vanes fixed to the core stator structure.

26. The gas turbine engine according to claim 18, wherein the core stator structure is supported by at least one strut having a first end fixed to the static engine structure and a second end rotatably supported by at least one bearing, and wherein the compressor is positioned aft of the at least one bearing.

27. The gas turbine engine according to claim 26, wherein the at least one inducer stage is positioned forward of the speed change device which is positioned in the core flowpath.

Claims

1. A gas turbine engine comprising:

a static engine structure defining a core inlet and a core outlet;

at least one shaft rotatable relative to the static engine structure about an axis of rotation;

a compressor section driven by the at least one shaft to drive air along a core flowpath that extends from the core inlet to the core outlet;

a speed reduction device driven by the at least one shaft;

a fan including a fan rotor driven by the speed reduction device, wherein the fan drives air along a bypass flowpath located radially outward of the core flowpath; and

at least one inducer stage positioned aft of the fan and coupled for rotation with the fan rotor, wherein the at least one inducer stage comprises a core stator structure fixed to the core inlet of the static engine structure and one or more inducer blades fixed for rotation with the fan rotor for rotation relative to the core stator structure.

2. The gas turbine engine according to claim 1, wherein the core stator structure is supported by at least one strut having a first end fixed to the static engine structure and a second end rotatably supported by a bearing.

3. The gas turbine engine according to claim 1, wherein the core stator structure includes a plurality of vanes positioned axially between the fan and the inducer blades.

4. The gas turbine engine according to claim 1, wherein the core stator structure includes a plurality of vanes positioned aft of the inducer blades.

5. The gas turbine engine according to claim 1, wherein the at least one inducer stage comprises a plurality of inducer stages coupled to the fan rotor.

6. The gas turbine engine according to claim 5, wherein each inducer stage comprises one or more blades fixed for rotation with the fan rotor relative to the core stator structure which is fixed to the core inlet of the static engine structure that surrounds the core flowpath.

7. The gas turbine engine according to claim 1, wherein the core stator structure and the static engine structure are radially inward of the bypass flowpath to surround the core flowpath, and wherein the compressor section comprises a plurality of compressor stages driven by the at least one shaft.

8. The gas turbine engine according to claim 7, wherein the compressor section is positioned immediately aft of the at least one inducer stage.

9. The gas turbine engine according to claim 7, wherein the at least one inducer stage is located within the core flowpath and is positioned forward of the speed reduction device.

10. The gas turbine engine according to claim 7, wherein the at least one shaft comprises at least a first shaft and a second shaft, and wherein the compressor comprises a low pressure compressor driven by the first shaft, and including a high pressure compressor positioned aft of the low pressure compressor and driven by the second shaft positioned radially outwardly relative to the first shaft that drives the low pressure compressor.

11. The gas turbine engine according to claim 1, wherein the core stator structure includes a variable vane positioned at the core inlet.

12. The gas turbine engine according to claim 1, wherein the core stator structure is heated for anti-icing.

13. The gas turbine engine according to claim 1, wherein the one or more inducer blades are heated for anti-icing.

14. The gas turbine engine according to claim 1, wherein the fan rotor turns in the same direction as the at least one shaft.

15. The gas turbine engine according to claim 1, wherein the fan rotor turns in an opposite direction from the at least one shaft.

16. The gas turbine engine according to claim 1 wherein the speed reduction device comprises a gearbox including a sun gear in meshing engagement with star gears and a ring gear in meshing engagement with the star gears, and wherein the ring gear at drives the fan.

17. The gas turbine engine according to claim 1 wherein the speed reduction device comprises a gearbox including a sun gear in meshing engagement with a plurality of planetary gears supported by a planet carrier and a ring gear in meshing engagement with the planet gears, and wherein the ring gear is fixed and the planet carrier provides input to the fan.

18. A gas turbine engine comprising:

a static engine structure surrounding a core flowpath extending from a core inlet to a core outlet;

at least one shaft rotatable relative to the static engine structure about an axis of rotation;

a speed change device driven by the at least one shaft;

a fan section including at least one fan blade coupled to a fan rotor wherein the fan rotor is driven by the speed change device, and wherein the fan section drives air along a bypass flowpath located radially outward of the core flowpath;

a compressor comprising a plurality of compressor stages driven by the at least one shaft, the compressor surrounded by the static engine structure at a location downstream of the core inlet; and

at least one inducer stage positioned within the core flowpath aft of the fan blade and coupled for rotation with the fan rotor about the axis of rotation.

19. The gas turbine engine according to claim 18, wherein the at least one inducer stage is positioned in the core flowpath at a position axially forward of the compressor.

20. The gas turbine engine according to claim 19, wherein the at least one shaft comprises at least a first shaft and a second shaft, and wherein the compressor comprises a low pressure compressor driven by the first shaft, and including a high pressure compressor positioned aft of the low pressure compressor and driven by the second shaft positioned radially outwardly relative to the first shaft that drives the low pressure compressor.

21. The gas turbine engine according to claim 20, wherein the low pressure compressor is positioned aft of the speed change device.

22. The gas turbine engine according to claim 18, wherein the at least one inducer stage comprises one or more inducer blades fixed for rotation with the fan rotor and a core stator structure fixed to the core inlet of the static engine structure such that the core stator structure and the static engine structure are radially inward of the bypass flowpath.

23. The gas turbine engine according to claim 22, wherein the core stator structure includes a plurality of vanes positioned axially between the fan blades and the inducer blades.

24. The gas turbine engine according to claim 22, wherein the core stator structure includes a plurality of vanes positioned aft of the inducer blades.

25. The gas turbine engine according to claim 18, wherein the at least one inducer stage comprises a plurality of inducer stages coupled to the fan rotor and a core stator structure fixed to the core inlet of the static engine structure, and wherein each inducer stage comprises one or more inducer blades fixed for rotation with the fan rotor and one or more vanes fixed to the core stator structure.

26. The gas turbine engine according to claim 18, wherein the core stator structure is supported by at least one strut having a first end fixed to the static engine structure and a second end rotatably supported by at least one bearing, and wherein the compressor is positioned aft of the at least one bearing.

27. The gas turbine engine according to claim 26, wherein the at least one inducer stage is positioned forward of the speed change device which is positioned in the core flowpath.