CLAIMS

What is claimed is:

1. A gas turbine engine comprising:

a fan rotatable about an axis;

a compressor section;

a combustor in fluid communication with the compressor section;

a turbine section in fluid communication with the combustor, the turbine section including a fan drive turbine and a second turbine, wherein the second turbine is disposed forward of the fan drive turbine, wherein the fan drive turbine includes at least one rotor having a bore radius (R) and a live rim radius (r), and a ratio of r/R is between about 2.00 and about 2.30; and

a speed change system driven by the fan drive turbine for rotating the fan about the axis.

2. The engine as set forth in claim 1, wherein the bore radius (R) includes at least one bore width (W) in a direction parallel to the axis of rotation and a ratio of the bore width (W) to the live rim radius (r) is between about 4.65 and about 5.55.

3. The engine as set forth in claim 1, wherein the bore radius (R) includes at least one bore width (W) in a direction parallel to the axis of rotation and the bore width (W) is between about 1.20 inches and about 2.00 inches where said bore width (W) is an unattached disk bore.

4. The engine as recited in claim 1, wherein the fan drive turbine section has a first exit area and rotates at a first speed, the second turbine section has a second exit area and rotates at a second speed, which is faster than the first speed, wherein a first performance quantity is defined as the product of the first speed squared and the first area, a second performance quantity is defined as the product of the second speed squared and the second area, and a performance ratio of the first performance quantity to the second performance quantity is between about 0.5 and about 1.5.

5. The engine as recited in claim 4, wherein the performance ratio is above or equal to about 0.8.

6. The engine as recited in claim 4, wherein the first performance quantity is above or equal to about 4.

7. The engine as recited in claim 1, wherein the speed change system comprises a gearbox, and wherein the fan and the fan drive turbine both rotate in a first direction about the axis and the second turbine section rotates in a second direction opposite the first direction.

8. The engine as recited in claim 1, wherein the speed change system comprises a gearbox, and wherein the fan, the fan drive turbine, and the second turbine section all rotate in a first direction about the axis.

9. The engine as recited in claim 1, wherein the speed change system comprises a gearbox, and wherein the fan and the second turbine both rotate in a first direction about the axis and the fan drive turbine rotates in a second direction opposite the first direction.

10. The engine as recited in claim 1, wherein the speed change system comprises a gearbox, and wherein the fan is rotatable in a first direction and the fan drive turbine, and the second turbine section rotate in a second direction opposite the first direction about the axis.

11. The engine as recited in claim 1, wherein the speed change system comprises a gear reduction having a gear ratio greater than about 2.3.

12. The engine as set forth in claim 1, wherein said fan delivers a portion of air into a bypass duct, and a bypass ratio being defined as the portion of air delivered into the bypass duct divided by the amount of air delivered into the compressor section, with the bypass ratio being greater than about 6.0.

13. The engine as set forth in claim 12, wherein the bypass ratio is greater than about 10.0.

14. The engine as set forth in claim 1, wherein a fan pressure ratio across the fan is less than about 1.5.

15. The engine as set forth in claim 1, wherein said fan has about 26 or fewer blades.

16. The engine as set forth in claim 14, wherein said fan drive turbine section has at least 3 stages and up to 6 stages.

17. The engine as set forth in claim 15, wherein a ratio between the number of fan blades and the number of fan drive turbine stages is between about 2.5 and about 8.5.

18. The engine as set forth in claim 1, wherein a pressure ratio across the fan drive turbine is greater than about 5:1.

19. The engine as recited in claim 1, including a power density greater than about 1.5 lbf/in^3 and less than or equal to about 5.5 lbf/in^3.

20. The engine as recited in claim 1, wherein the second turbine includes at least two stages and performs at a first pressure ratio and the fan drive turbine includes more than two stages and performs at a second pressure ratio less than the first pressure ratio.

21. A gas turbine engine comprising:

a fan rotatable about an axis;

a compressor section;

a combustor in fluid communication with the compressor section;

a turbine section in fluid communication with the combustor, the turbine section including a fan drive turbine and a second turbine, wherein the second turbine is disposed forward of the fan drive turbine, wherein the fan drive turbine includes at least one rotor having a live rim radius (r), and a bore width (W) in a direction parallel to the axis of rotation and a ratio of the bore width (W) to the live rim radius (r) is between about 4.65 and about 5.55; and

a speed change system driven by the fan drive turbine for rotating the fan about the axis.

22. The engine as set forth in claim 21, wherein the bore width (W) is between about 1.20 inches and about 2.00 inches where said bore width (W) is an unattached disk bore.

23. The engine as set forth in claim 21, wherein the rotor has a bore radius (R), and wherein a ratio of the live rim radius (r) and the bore radius (R) is between about 2.00 and about 2.30.

24. The engine as recited in claim 21, wherein the speed change system comprises a gearbox and the fan and the fan drive turbine both rotate in a first direction about the axis and the second turbine section rotates in a second direction opposite the first direction.

25. The engine as recited in claim 21, wherein the speed change system comprises a gearbox, and wherein the fan, the fan drive turbine, and the second turbine section all rotate in a first direction about the axis.

26. The engine as recited in claim 21, wherein the speed change system comprises a gearbox, and wherein the fan and the second turbine both rotate in a first direction about the axis and the fan drive turbine rotates in a second direction opposite the first direction.

27. The engine as recited in claim 21, wherein the speed change system comprises a gearbox, and wherein the fan is rotatable in a first direction and the fan drive turbine, and the second turbine section rotate in a second direction opposite the first direction about the axis.

CLAIMS

What is claimed is:

1. A gas turbine engine comprising:

a fan rotatable about an axis;

a compressor section;

a combustor in fluid communication with the compressor section;

a turbine section in fluid communication with the combustor, the turbine section including a fan drive turbine and a second turbine, wherein the second turbine is disposed forward of the fan drive turbine, wherein the fan drive turbine includes at least one rotor having a bore radius (R) and a live rim radius (r), and a ratio of r/R is between about 2.00 and about 2.30; and

a speed change system driven by the fan drive turbine for rotating the fan about the axis.

2. The engine as set forth in claim 1, wherein the bore radius (R) includes at least one bore width (W) in a direction parallel to the axis of rotation and a ratio of the bore width (W) to the live rim radius (r) is between about 4.65 and about 5.55.

3. The engine as set forth in claim 1, wherein the bore radius (R) includes at least one bore width (W) in a direction parallel to the axis of rotation and the bore width (W) is between about 1.20 inches and about 2.00 inches where said bore width (W) is an unattached disk bore.

4. The engine as recited in claim 1, wherein the fan drive turbine section has a first exit area and rotates at a first speed, the second turbine section has a second exit area and rotates at a second speed, which is faster than the first speed, wherein a first performance quantity is defined as the product of the first speed squared and the first area, a second performance quantity is defined as the product of the second speed squared and the second area, and a performance ratio of the first performance quantity to the second performance quantity is between about 0.5 and about 1.5.

5. The engine as recited in claim 4, wherein the performance ratio is above or equal to about 0.8.

6. The engine as recited in claim 4, wherein the first performance quantity is above or equal to about 4.

7. The engine as recited in claim 1, wherein the speed change system comprises a gearbox, and wherein the fan and the fan drive turbine both rotate in a first direction about the axis and the second turbine section rotates in a second direction opposite the first direction.

8. The engine as recited in claim 1, wherein the speed change system comprises a gearbox, and wherein the fan, the fan drive turbine, and the second turbine section all rotate in a first direction about the axis.

9. The engine as recited in claim 1, wherein the speed change system comprises a gearbox, and wherein the fan and the second turbine both rotate in a first direction about the axis and the fan drive turbine rotates in a second direction opposite the first direction.

10. The engine as recited in claim 1, wherein the speed change system comprises a gearbox, and wherein the fan is rotatable in a first direction and the fan drive turbine, and the second turbine section rotate in a second direction opposite the first direction about the axis.

11. The engine as recited in claim 1, wherein the speed change system comprises a gear reduction having a gear ratio greater than about 2.3.

12. The engine as set forth in claim 1, wherein said fan delivers a portion of air into a bypass duct, and a bypass ratio being defined as the portion of air delivered into the bypass duct divided by the amount of air delivered into the compressor section, with the bypass ratio being greater than about 6.0.

13. The engine as set forth in claim 12, wherein the bypass ratio is greater than about 10.0.

14. The engine as set forth in claim 1, wherein a fan pressure ratio across the fan is less than about 1.5.

15. The engine as set forth in claim 1, wherein said fan has about 26 or fewer blades.

16. The engine as set forth in claim 14, wherein said fan drive turbine section has at least 3 stages and up to 6 stages.

17. The engine as set forth in claim 15, wherein a ratio between the number of fan blades and the number of fan drive turbine stages is between about 2.5 and about 8.5.

18. The engine as set forth in claim 1, wherein a pressure ratio across the fan drive turbine is greater than about 5:1.

19. The engine as recited in claim 1, including a power density greater than about 0.422 N/cm^3 (1.5 lbf/in^3) and less than or equal to about 1.49 N/cm^3 (5.5 lbf/in^3).

20. The engine as recited in claim 1, wherein the second turbine includes at least two stages and performs at a first pressure ratio and the fan drive turbine includes more than two stages and performs at a second pressure ratio less than the first pressure ratio.

21. A gas turbine engine comprising:

a fan rotatable about an axis;

a compressor section;

a combustor in fluid communication with the compressor section;

a turbine section in fluid communication with the combustor, the turbine section including a fan drive turbine and a second turbine, wherein the second turbine is disposed forward of the fan drive turbine, wherein the fan drive turbine includes at least one rotor having a live rim radius (r), and a bore width (W) in a direction parallel to the axis of rotation and a ratio of the bore width (W) to the live rim radius (r) is between about 4.65 and about 5.55; and

a speed change system driven by the fan drive turbine for rotating the fan about the axis.

22. The engine as set forth in claim 21, wherein the bore width (W) is between about 1.20 inches and about 2.00 inches where said bore width (W) is an unattached disk bore.

23. The engine as set forth in claim 21, wherein the rotor has a bore radius (R), and wherein a ratio of the live rim radius (r) and the bore radius (R) is between about 2.00 and about 2.30.

24. The engine as recited in claim 21, wherein the speed change system comprises a gearbox and the fan and the fan drive turbine both rotate in a first direction about the axis and the second turbine section rotates in a second direction opposite the first direction.

25. The engine as recited in claim 21, wherein the speed change system comprises a gearbox, and wherein the fan, the fan drive turbine, and the second turbine section all rotate in a first direction about the axis.

26. The engine as recited in claim 21, wherein the speed change system comprises a gearbox, and wherein the fan and the second turbine both rotate in a first direction about the axis and the fan drive turbine rotates in a second direction opposite the first direction.

27. The engine as recited in claim 21, wherein the speed change system comprises a gearbox, and wherein the fan is rotatable in a first direction and the fan drive turbine, and the second turbine section rotate in a second direction opposite the first direction about the axis.