CLAIMS

1. A gas turbine engine turbine comprising:

a high pressure turbine configured to rotate with a high pressure compressor as a high pressure spool in a first direction about a central axis;

a low pressure turbine configured to rotate with a low pressure compressor as a low pressure spool in a second direction about said central axis;

a mid-turbine frame for supporting said high pressure turbine, said mid-turbine frame including a first bearing supporting said high pressure turbine, and a strut supporting said first bearing at a location between said high pressure turbine and said low pressure turbine; and

a plurality of vanes are associated with a first stage of said low pressure turbine, said plurality of vanes being incorporated into said mid-turbine frame; and

including a power density ratio that is greater than or equal to 1.5 lbf/cubic inches (407170.706 m^{-2} kg s^{-2}) and less than or equal to 5.5 lbf/ cubic inches (1492959.26 m^{-2} kg s^{-2}).

2. The engine as set forth in claim 1, wherein said ratio is greater than or equal to 2.0, again expressed in pounds force divided by cubic inches (m^{-2} kg s^{-2}).

3. The engine as set forth in claim 1, wherein said ratio is greater than or equal to 4.0.

4. The engine as set forth in claim 1, wherein a fan is connected to the low pressure spool via a speed changing mechanism and rotates in the first direction.

5. The engine as set forth in claim 1, wherein said high pressure spool is also supported at the high pressure compressor by a thrust bearing, and supported relative to the outer housing through a second strut creating a straddle-mounted arrangement of the spool.

6. The engine as set forth in claim 1, wherein a nut secures a plurality of struts from said outer core housing.

7. The engine as set forth in claim 1, wherein a support leg extends radially inwardly from said vanes and is connected to said mid-turbine frame.

8. The engine as set forth in claim 7, wherein a radially inner end of said leg is bolted to a portion of said mid-turbine frame at a radially inner location.

9. The engine as set forth in claim 8, wherein said radially inner end is radially outward of the first bearing.

10. The engine as set forth in claim 1, wherein said plurality of vanes is configured in a single row.

11. A gas turbine engine comprising:

a fan section, a compressor section, and a turbine section;

said turbine section having a volume; and

the fan section, compressor section and turbine section being operatively connected to produce a thrust such that a ratio of said thrust, expressed in pounds force, to said turbine section volume, expressed in cubic inches (m^{-2} kg s^{-2}), is greater than or equal to 1.5.

12. The engine as set forth in claim 11, wherein said ratio is greater than or equal to 2.0, again expressed in pounds force divided by cubic inches (m^{-2} kg s^{-2}).

13. The engine as set forth in claim 12, wherein said ratio is greater than or equal to 4.0.

14. The engine as set forth in claim 11, wherein said ratio is greater than or equal to 1.5 and less than or equal to 5.5.

15. The engine as set forth in claim 11, wherein said turbine section includes a low pressure turbine and a high pressure turbine, and said low and high pressure turbines rotate in opposed directions.

16. The engine as set forth in claim 15, wherein said low pressure turbine driving a fan through a gear reduction, and such that said fan rotates in the same direction as said high pressure turbine.

18. The engine as set forth in claim 11, wherein said thrust is sea level take-off, flat-rated static thrust.

19. A gas turbine engine comprising:

a fan, said fan delivering air into a low pressure compressor, and into a bypass duct, a low pressure compressor compressing air and delivering the air into a high pressure compressor, air from the high pressure compressor being delivered into a combustion section where it is mixed with fuel and ignited, and products of the combustion passing downstream over a high pressure turbine, and then a low pressure turbine;

said high pressure turbine configured to rotate in a first direction about a central axis with said high pressure compressor as a high pressure spool, said low pressure turbine configured to rotate in a second direction, opposed to said first direction, about said central axis with said low pressure compressor as a low pressure spool;

said fan being driven by said low pressure turbine through a speed reduction mechanism, and such that said fan and said low pressure compressor rotate at different speeds, and said gear reduction being such that said fan rotates in said first direction;

a mid-turbine frame for said high pressure turbine, said mid-turbine frame including a first bearing supporting said high pressure turbine relative to an outer core housing of the gas turbine engine, said mid-turbine frame including a strut supporting said first bearing at a location intermediate a downstream end of said high pressure turbine and an upstream end of said low pressure turbine; and

a plurality of vanes positioned upstream of a first stage of said low pressure turbine, and said plurality of vanes being incorporated into said mid-turbine frame; and

having a power density ratio that is greater than or equal to 1.5 lbf/cubic inches (407170.706 m^{-2} kg s^{-2}) and less than or equal to 5.5 lbf/ cubic inches (1492959.26 m^{-2} kg s^{-2}).

20. The engine as set forth in claim 19, wherein said vanes are positioned downstream of said strut.

21. The engine as set forth in claim 19, wherein said high pressure spool is also supported at an upstream end of the high pressure compressor by a second bearing, and supported relative to the outer housing through a second strut in a straddle-mounted arrangement.

21. The engine as set forth in claim 19, wherein said high pressure spool is also supported at an upstream end of the high pressure compressor by a second bearing, and supported relative to the outer housing through a second strut in a straddle-mounted arrangement.

22. The engine as set forth in claim 19, having a bypass ratio greater than 6.

23. The engine as set forth in claim 19, wherein a gear ratio of the gear reduction is greater than or equal to 2.0:1, and less than or equal to 3.5:1.

24. The engine as set forth in claim 19, wherein said ratio is greater than or equal to 2.0, again expressed in pounds force divided by cubic inches ($\underline{m^{-2}\ kg\ s^{-2}}$).

25. The engine as set forth in claim 19, wherein said ratio is greater than or equal to 4.0.