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(54) **GEARED TURBOFAN GAS TURBINE ENGINE ARCHITECTURE**

(71) Applicant: **United Technologies Corporation**, Farmington, CT (US)

(72) Inventors: **Daniel Bernard Kupratis**, Wallingford, CT (US); **Frederick M. Schwarz**, Glastonbury, CT (US)

(73) Assignee: **United Technologies Corporation**, Farmington, CT (US)

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,258,792 A 4/1941 New
2,936,655 A 5/1960 Peterson et al.

(Continued)

FOREIGN PATENT DOCUMENTS

EP 3791383 8/1997
EP 1142850 10/2001

(Continued)

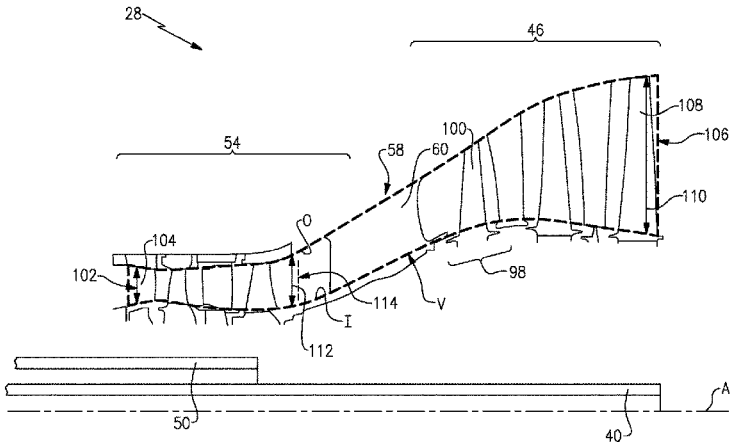
OTHER PUBLICATIONS

European Search Report for European Application No. 16174322.4 mailed Nov. 18, 2016.

(Continued)

Primary Examiner — Steven Sutherland
(74) *Attorney, Agent, or Firm* — Carlson, Gaskey & Olds, PC

(57) **ABSTRACT**

A gas turbine engine typically includes a fan section, a compressor section, a combustor section and a turbine section. A speed reduction device such as an epicyclical gear assembly may be utilized to drive the fan section such that the fan section may rotate at a speed different than the turbine section so as to increase the overall propulsive efficiency of the engine. In such engine architectures, a shaft driven by one of the turbine sections provides an input to the epicyclical gear assembly that drives the fan section at a speed different than the turbine section such that both the turbine section and the fan section can rotate at closer to optimal speeds providing increased performance attributes and performance by desirable combinations of the disclosed features of the various components of the described and disclosed gas turbine engine.

30 Claims, 13 Drawing Sheets