SECTION 2
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OLYMPUS 104

REFERENCE DATA

Type	A jet propulsion engine employing compound axial compressors individually driven by separate single stage turbines.
Take off Thrust	13,000 lbs: I.SA at S.L.
Combustion system	Straight flow "Cannular" combustion chamber, with 10 separate flame tubes.
Numbering of flame tubes	Clockwise viewed from the rear of engine No.1 position at 1 o'clock.
Fuel specification	"AVTUR" Kerosine D.E.R.D. 2482 0.8 "AVTAG" " " 2486 0.7 → 0.78
Oil specification	D.E.R.D. 2487 (OX.38)
Oil tank capacity	10 gallons, 7 gallons oil 3 gallons air space.
Oil pressure normal (Max Cont)	50 - 60 p.s.i. at S.L. Max. Cont R.P.M. and above.
Oil pressure Min. in flight	35 p.s.i.
Oil temperature Min. for starting	- 26°C.
Oil temperature Min. for opening up.	- 26°C.
Oil inlet temperature (Max) unlimited	105°C
Oil inlet temperature (Max) 5 min. limit	115°C
Oil consumption	1½ pts/Hr. (Max)

Conditions	L.P. RPM.	% RPM	Max. J.P.T. °C	Time Limit
Take Off	6,430 $^{+30}_{-0}$	98 to 98½	655	10 Mins.
Max Continuous	6,330 $^{+30}_{-0}$	96 to 97	600	Unrestricted
Ground Idling	2,100 $^{+100}_{-35}$	31½ to 33½	600	Unrestricted

OLYMPUS 104 UPRATED

Take Off Thrust 13,500 lbs. I.S.A. at S.L.

Conditions	L.P. RPM.	% RPM	Max. J.P.T	Time Limit
Take Off	6,530 $^{+35}_{-0}$	99½ to 100	660	10 Mins
Max Continuous	6,530 $^{+35}_{-0}$	99½ to 100	635	Unrestricted
Ground Idling	2,100 $^{+35}_{-0}$	31½ to 32½	635	Unrestricted

ADVANTAGE OF THE TWO SPOOL COMPRESSOR

High Pressure Ratio

For pressure ratio above 5:1 blow off valves are required for single spool engines to avoid stalling of the early compressor stages at around 70% max. r.p.m.

For pressure ratios of 7:1 on single spool engines, blow off valves and variable intake vanes are necessary. With two spools the compressor speeds adjust their relative values at off-design conditions so that no blow-off valves are required and the compressor is less sensitive to intake velocity patterns.

The higher pressure ratio obtainable with a two spool engine results in the following advantages :-

a. Lower specific fuel consumption

b. The pressure in the combustion chambers is higher so that efficient burning is possible to higher altitudes. The altitude limit for combustion blow out is also higher.

c. Smaller frontal area for the same thrust since for pressure ratios above 8:1 the combustion chambers can be accommodated in a diameter smaller than that of the compressor entry.

2. Improved Acceleration

Owing to the better part load component efficiencies (compressor and turbine) which results from the ability of the two spools to adjust their relative speeds

Automatically........

automatically, the acceleration of the engine is markedly improved.

3. <u>Easier Starting</u>

Only the high pressure system has to be rotated for starting, so that a smaller starter motor can be used.

4. <u>Weight Saving.</u>

a. The low pressure can be made of light alloy and the high pressure of Steel. A single spool engine of comparable pressure ratio would be entirely of steel.

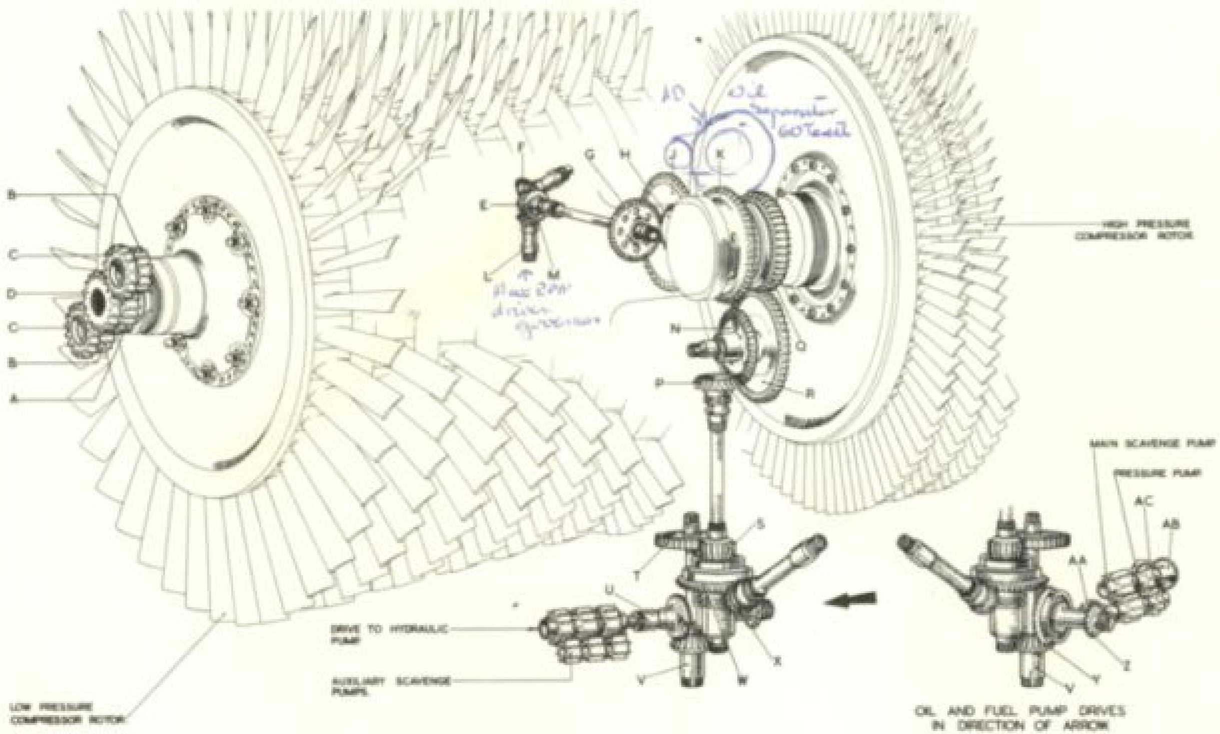
b. Since the high pressure compressor can rotate at a higher r.p.m., fewer stages are required for a given pressure ratio (N.B. the high pressure compressor can rotate faster because the higher temperatures result in lower mach numbers).

5. <u>Improved High Altitude Performance</u>

The ability of the two compressors to adjust their relative speeds to give high efficiencies and the better combustion efficiency results in improved performance at very high altitudes by comparison with a single spool engine.

6. <u>Ease of Mounting Accessories</u>

Accessories can conveniently be driven from the end of the low pressure compressor in a region where the temperature is not high so that the heat passed to oil in the case is kept to a low value. The position for mounting the accessories also avoids cluttering up the intake to the engine.



DRIVEN BY L.P. COMPRESSOR

	GEAR	No. OF TEETH	UNIT	RATIO
A	DRIVING GEAR (FRONT)	23	GENERATOR DRIVE.	
B	DRIVEN PLANET GEAR	15	$\frac{A}{B} \times \frac{C}{D} = \frac{23}{15} \times \frac{15}{17} =$	1·353 : 1
C	DRIVING PLANET GEAR	15		
D	SUN GEAR	17		
E	DRIVING BEVEL PINION	28	L.P. COMP TACHOMETER GENERATOR DRIVE.	
F	DRIVEN BEVEL GEAR UNIT	35		
G	DRIVEN BEVEL GEAR (INNER END)	40	$\frac{K}{J} \times \frac{H}{G} \times \frac{E}{F} = \frac{48}{48} \times \frac{32}{40} \times \frac{28}{35} =$	0·640 : 1
H	DRIVING BEVEL PINION (INNER END)	32		
J	ACCESSORY DRIVE SPUR GEAR	48		
K	L.P. COMP SHAFT SPUR GEAR	48	ACCESSORY DRIVE. $\frac{K}{J} \times \frac{H}{G} = \frac{48}{48} \times \frac{32}{40} =$	0·800 : 1
L	DRIVEN BEVEL PINION (OUTER END)	20	L.P. COMP GOVERNOR.	
M	DRIVING BEVEL (OUTER END)	25	$\frac{K}{J} \times \frac{H}{G} \times \frac{M}{L} = \frac{48}{48} \times \frac{32}{40} \times \frac{25}{20} =$	1·000 : 1

DRIVEN BY H.P. COMPRESSOR

	GEAR	No. OF TEETH	UNIT	RATIO
N	DRIVING BEVEL GEAR	36	AUXILIARY DRIVE.	
P	DRIVEN BEVEL PINION	22	$\frac{O}{R} \times \frac{N}{P} = \frac{40}{50} \times \frac{36}{22} =$	1·309 : 1
O	ACCESSORY DRIVING GEAR	40		
R	DRIVEN SPUR GEAR	50		
S	DRIVING PINION	17	INTERMEDIATE DRIVE.	
T	AUXILIARY DRIVE GEAR	38	$\frac{O}{R} \times \frac{N}{P} \times \frac{S}{T} = \frac{40}{50} \times \frac{36}{22} \times \frac{17}{38} =$	0·585 : 1
U	HYDRAULIC PUMP DRIVING GEAR	27	AUXILIARY SCAVENGE PUMP DRIVE. $\frac{O}{R} \times \frac{N}{P} \times \frac{S}{T} \times \frac{V}{U} =$	
V	INPUT DRIVE GEAR	19	$\frac{40}{50} \times \frac{36}{22} \times \frac{17}{38} \times \frac{19}{27} =$	0·412 : 1
W	BEVEL WHEEL AND SHAFT UNIT	45	STARTER DRIVE.	
X	BEVEL PINION	15	$\frac{O}{R} \times \frac{N}{P} \times \frac{W}{X} = \frac{40}{50} \times \frac{36}{22} \times \frac{45}{15} =$	3·930 : 1
Y	DRIVING BEVEL GEAR	27	FUEL PUMP DRIVE. $\frac{O}{R} \times \frac{N}{P} \times \frac{S}{T} \times \frac{V}{Y} =$ $\frac{40}{50} \times \frac{36}{22} \times \frac{17}{38} \times \frac{19}{27} =$	0·412 : 1
Z	DRIVING BEVEL GEAR	15	OIL PUMP DRIVE. $\frac{O}{R} \times \frac{N}{P} \times \frac{S}{T} \times \frac{V}{Y} \times \frac{Z}{AA} =$	
AA	DRIVEN BEVEL GEAR	16	$\frac{40}{50} \times \frac{36}{22} \times \frac{17}{38} \times \frac{19}{27} \times \frac{15}{16} =$	0·386 : 1
AB	DRIVING BEVEL GEAR	22	H.P. COMP SPEED INDICATOR AND SIGNAL GENERATOR DRIVES. $\frac{O}{R} \times \frac{N}{P} \times \frac{S}{T} \times \frac{V}{Y} \times \frac{Z}{AA} \times \frac{AB}{AC} =$	
AC	DRIVEN BEVEL GEAR	17	$\frac{40}{50} \times \frac{36}{22} \times \frac{17}{38} \times \frac{19}{27} \times \frac{15}{16} \times \frac{22}{17} =$	0·500 : 1

AD Oil Separator 60 $\frac{40}{60}$ 0.667

RESTRICTED

GEAR TRAIN DIAGRAM
BRISTOL OLYMPUS TURBOJET MK.10400 E.C.U.

TP.4120