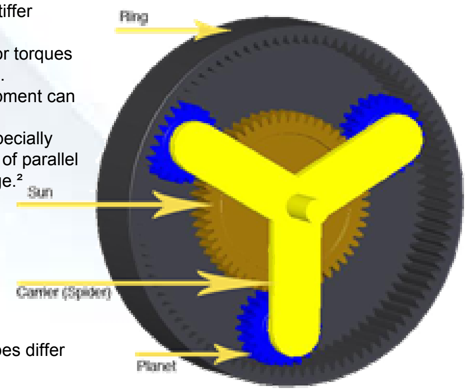
Planetary Gears

Planetary gear trains are one of the main subdivisions of the simple epicyclic gear train family. The epicyclic gear train family in general has a central "sun" gear which meshes with and is surrounded by planet gears. The outermost gear, the ring gear, meshes with each of the planet gears. The planet gears are held to a cage or carrier that fixes the planets in there orbit relative to each other.

There are five distinct advantages to using an epicyclic gear train as opposed to a single load path parallel gear train:

1) Because they share load between several gear meshes, epicyclic trains take up less space and have a lighter weight.
2) Because they share load between several meshes, epicyclic trains have smaller and stiffer components which lead to reduced noise and vibration while increasing efficiency.
3) The input and output shafts of epicyclic trains are concentric so no bending moments or torques are created from radial forces that develop from the change of the force's line of action.
4) The input and output shafts of epicyclic trains are concentric so driver and driven equipment can be mounted in line, providing additional space savings.
5) The reduced size of epicyclic components often offsets the cost of additional parts, especially when manufacturing many gear trains. In very high horsepower units the components of parallel shaft designs become so bulky that epicyclic trains gain a further economical advantage.[2]



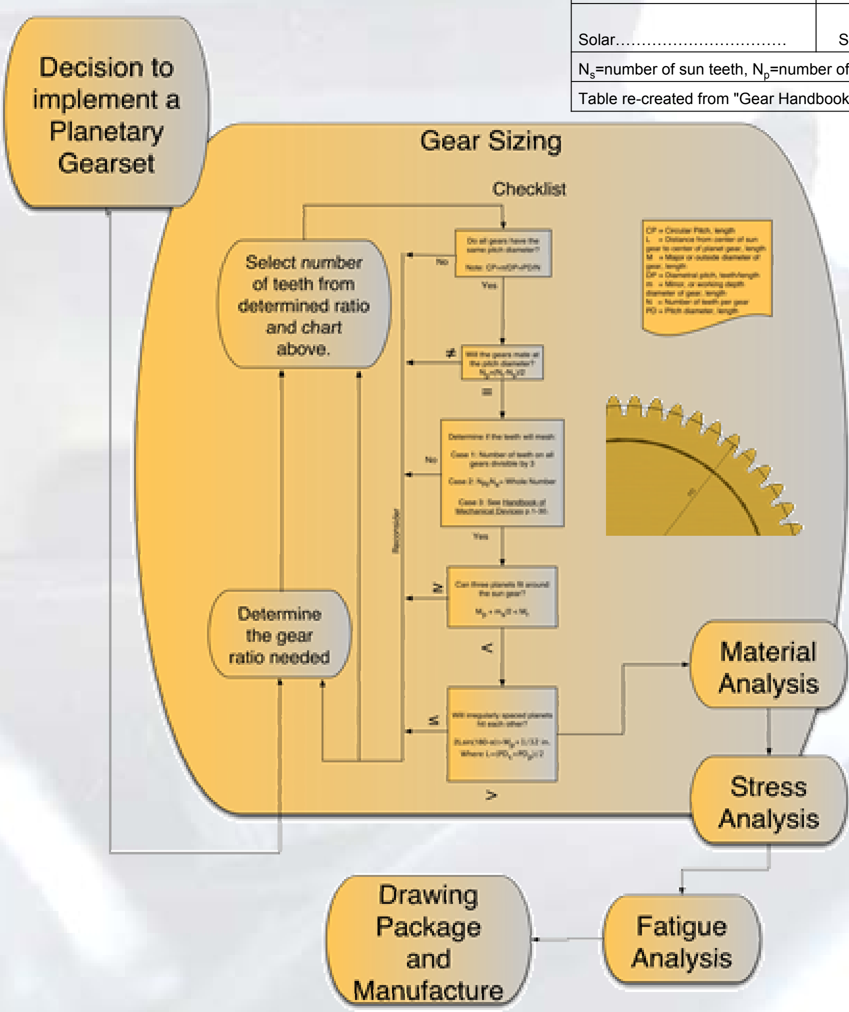
As with all design choices, there are disadvantages to epicyclic gear trains:

1) Complexity.
2) Assembly of gear trains is limited to specific teeth per gear ratios.
3) Efficiency calculations are difficult.
4) Driver and driven equipment must be in line to avoid additional gearing.

The three main types of simple epicyclic gears are the planetary, the star, and the solar. These three types differ only in arrangement.

Arrangement of epicyclic train	Fixed Member	Input Member	Output Member	Over-all Gear ratio	Range of ratios normally used
Planetary..........................	Ring	Sun	Carrier	$(N_r/N_s)+1$	3:1-12:1
Star................................	Carrier	Sun	Ring	(N_r/N_s)	2:1-11:1
Solar...............................	Sun	Ring	Carrier	$(N_s/N_r)+1$	1.2:1-1.7:1
N_s=number of sun teeth, N_p=number of planet teeth, N_r=Number of ring teeth (per gear)					
Table re-created from "Gear Handbook" By: Darle W. Dudley, McGraw-Hill books, pg. 3-15, 1962					

Design Flowchart



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