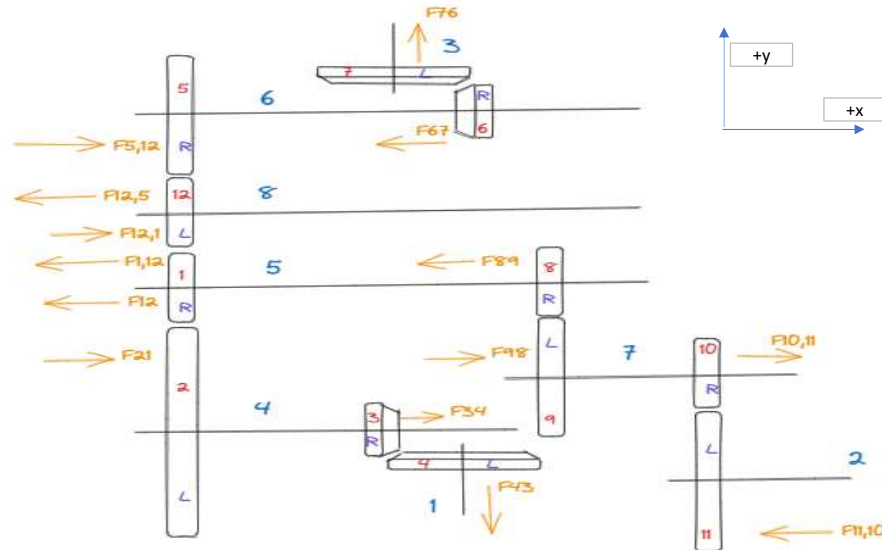


Shaft 1	Directions	Shaft 2	Directions	Shaft 3	Directions	Shaft 4	Directions	Shaft 5	Directions	Shaft 6	Directions	Shaft 7	Directions	Shaft 8	Directions
F4,3 (lb)		F11,10 (lb)		F7,6 (lb)		F2,1 (lb)		F1,2+F1,12 (lb)		F6,7 (lb)		F9,8 (lb)		F12,1+F12,5	
475.003142	-y	222.298589	-x	211.112508	+y	133.379154	+x	244.528448	-x	105.556254	-x	111.149295	+x	88.9194357	+x
						F3,4 (lb)		F8,9 (lb)		F5,1 (lb)		F10,11 (lb)			
						237.501571	+x	111.149295	-x	88.9194357	+x	222.298589	+x		
						Net Thrust		Net Thrust		Net Thrust		Net Thrust			
						370.880725	+x	355.677743	-x	16.6368181	-x	333.447884	+x		



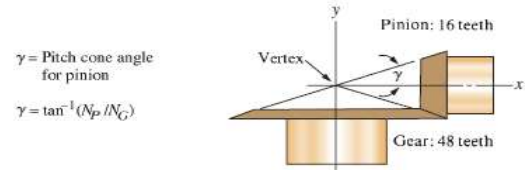
Analysis was done based on mode 3 i.e.  
That is 1, 12, 5, 6 and 7 has no power flow.  
i.e. no forces between 1, 12, 5, 6 and 7.

Mode 1

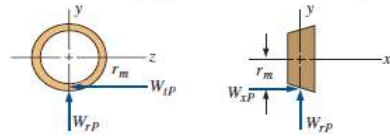
Shaft 1	Directions	Shaft 2	Directions	Shaft 3	Directions	Shaft 4	Directions
F4,3 (lb)		F11,10 (lb)		F7,6 (lb)		F2,1 (lb)	
475.003142	-y	222.298589	-x	211.112508	+y	133.379154	+x
						F3,4 (lb)	
						237.501571	+x
						Net Thrust	
						370.880725	+x

Shaft 5	Directions	Shaft 6	Directions	Shaft 7	Directions	Shaft 8	Directions
F1,2+F1,12 (lb)		F6,7 (lb)		F9,8 (lb)		F12,1+F12,5	
244.528448	-x	105.556254	-x	111.149295	+x	88.9194357	+x
F8,9 (lb)		F5,12 (lb)		F10,11 (lb)			
111.149295	-x	88.9194357	+x	222.298589	+x		
Net Thrust		Net Thrust		Net Thrust			
355.677743	-x	16.6368181	-x	333.447884	+x		

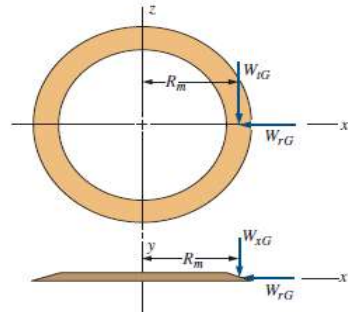
Gear #	No. Teeth	Power Transmitted (hp)	Rotational Speed (rpm)	Torque (lb-in)	Diametral Pitch	Pitch Diameter	Spiral Angle (degrees)	Pressure Angle (degrees)	Pinion Pitch Cone Angle (degrees)	Face Width (in)	Mean Radius Of Pinion	Tangential Force (lb)	Radial Force (lb)	Axial Force (lb)	Pitch Line Velocity (fpm)	Quality Number
3	18	24	900	1680	6.545	2.75	35	20	26.56505118	1	1.151393202	1459.101892	475.0031	237.5016	647.9535	A10
4	36	24	450	3360	6.545	5.5	35	20	n/a	1	n/a	1459.101892	237.5016	475.0031	647.9535	A10
6	18	16	1350	746.6666667	6.545	2.75	35	20	26.56505118	1	1.151393202	648.4897298	211.1125	105.5563	971.9302	A8
7	36	16	675	1493.333333	6.545	5.5	35	20	n/a	1	n/a	648.4897298	105.5563	211.1125	971.9302	A8



(a) Mating pinion and gear (only pitch cone surface shown)



(b) Free-body diagram: pinion



(c) Free-body diagram: gear

Notes: Shaded area is pitch cone surface.  
 Considering magnitudes:  
 $W_{tP} = W_{tG}$   
 $W_{xP} = W_{rG}$   
 $W_{rP} = W_{xG}$

Gear #	No. Teeth	Gear Diameter (in)	Max Power Transmitted (hp)	Face Width (in)	Helix Angle (Degrees)	Normal Pressure Angle (Degrees)	Transverse Pressure Angle (Degrees)	Rotational Speed (rpm)	Torque (lb-in)	Number of Load Cycles / Revolution	Pitch Line Velocity (fpm)	Tangential Force (lb)	Radial Force (lb)	Axial Force (lb)	Normal Force (lb)	Hand of Helical Gears	Hand direction arbitrary, along parallel shafts hand direction between meshing gears must be opposite.
1	18	2.25	44	3	15	20	20.64689649	2700	1026.667	2	1590.431281	912.5925926	343.87375	244.52845	1005.42	Right	
5	36	4.5	16	3	15	20	20.64689649	1350	746.6667	1	1590.431281	331.8518519	125.045	88.919436	365.6071	Right	No Power Flow
2	54	6.75	24	3	15	20	20.64689649	900	1680	1	1590.431281	497.7777778	187.5675	133.37915	548.4107	Left	
8	18	2.25	20	3	15	20	20.64689649	2700	466.6667	1	1590.431281	414.8148148	156.30625	111.14929	457.0089	Right	
9	36	4.5	20	3	15	20	20.64689649	1350	933.3333	1	1590.431281	414.8148148	156.30625	111.14929	457.0089	Left	
10	18	2.25	20	3	15	20	20.64689649	1350	933.3333	1	795.2156404	829.6296296	312.6125	222.29859	914.0178	Right	
11	45	5.625	20	3	15	20	20.64689649	540	2333.333	1	795.2156404	829.6296296	312.6125	222.29859	914.0178	Left	
12	18	2.25	16	3	15	20	20.64689649	2700	373.3333	2	1590.431281	331.8518519	125.045	88.919436	365.6071	Left	No Power Flow