pitch velocity V_p often used to characterize speed of gears

$V = \frac{\pi \cdot d n}{12}$ d : inch (pitch diameter)
n : rpm
V : ft/min

horse power transmitted

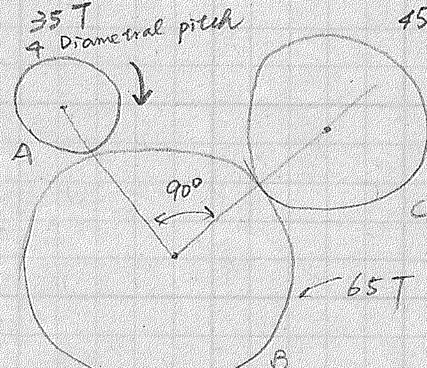
$$H = \frac{W_t \cdot V}{33000}$$

$$= \frac{W_t \ \pi d n}{33000 \ \ 12}$$

W_t in lb
V_p in ft/min

see example 13-5 yourself.

ex/



A: 4 hp at 600 rpm
pressure angle 20°

(1) torque each shaft must transmit

(2) tooth load each gear must be designed

(3) force applied to the idler shaft

Diametral pitch $= \frac{N}{d}$

(1)

$d_A = \frac{35}{4} = 8\frac{3}{4}$ in

$d_B = 65/4 = 16\frac{1}{4}$ in

$d_c = 45/4 = 11\frac{1}{4}$ in

horse power on A $\quad 4 = \frac{W_t \cdot \pi \cdot 8\frac{3}{4} \cdot 600}{33000 \quad 12} \Rightarrow W_t = 96.04$ lb

Torque on A $= W_t \cdot \frac{d_A}{2} = 96.04 \cdot \frac{8\frac{3}{4}}{2} = 420$ lb-in

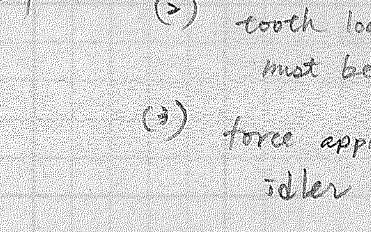
" " B = 0 (∵ B is idler, no power (torque) output)

" " C = ? $\quad \omega_c = \omega_A \frac{N_A}{N_C} = \omega_A \cdot \frac{d_A}{d_C}$

power $= T_A \omega_A = T_B \omega_B = T_C \omega_C$

$$4 = \frac{W_t \cdot \pi \cdot 11\frac{1}{4} \left[600 \cdot \frac{8\frac{3}{4}}{11\frac{1}{4}}\right]}{33000 \quad 12}$$

$\Rightarrow W_t = 96.04$



Torque at C $= W_{t,c} \cdot \frac{d_c}{2}$

$= 96.04 \cdot \frac{11\frac{1}{4}}{2} = 540$ lb-in

University of California at Berkeley
College of Engineering
Department of Mechanical Engineering

ME102B, Spring 2013 **Liwei Lin**

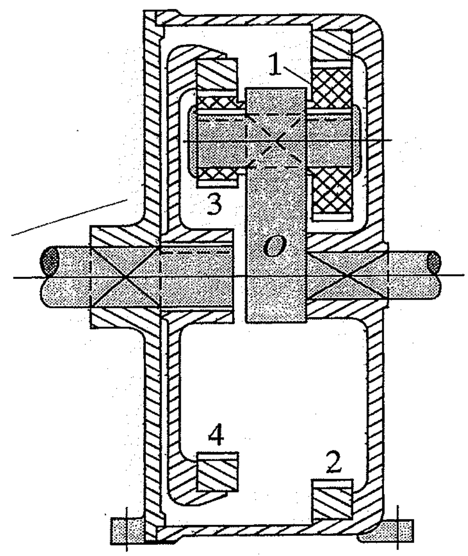
Exam (April 15, 2013)
Close book, Open one formula sheet

Problem 1 (30%)

Consider the planetary gear train shown in figure. The right-hand side shaft is integral with the arm "a." Gears 1 and 3 are keyed to a short length of shaft, which revolves in a bearing in the arm. Gear 1 meshes with fixed gear 2, and gear 3 meshes with gear 4, which, in turn, is keyed to the left-hand shaft. If $N_1 = 40$ teeth, $N_2 = 100$ teeth, $N_3 = 20$ teeth, and $N_4 = 120$ teeth, and $n_4 = 100$ rpm CCW (counter-clock-wise) as viewed from the left-hand side,

(a) what will be the speed and direction of the right-hand shaft n_0? (15%)

(b) if the input torque is $T_4 = 200$ in.lb, what will be the output torque T_0? (15%)



2013 spring

1. $\begin{cases} W_2 = 0 \\ W_4 = 100 \end{cases}$

$W_a = W_0$

$$W_{1/a} = W_{2/a}\left(\frac{N_2}{N_1}\right)$$

$$W_{3/a} = W_{1/a} = W_{4/a} \cdot \frac{N_4}{N_3} = W_{2/a}\left(\frac{N_2}{N_1}\right)$$

$$(W_4 - W_a) \cdot \frac{120}{20} = (0 - W_a) \cdot \frac{100}{40}$$

(6) (2.5)

~~$W_4 = W_a$~~ $W_a = \frac{1200}{7}$ same direction as W_4

$T_4 = 200$ in lb $\Rightarrow$ $T \cdot rpm = constant$

$$\Rightarrow T_0 \cdot \frac{1200}{7} = 200 \cdot 100$$

$$\Rightarrow T_0 = \frac{700}{6} \text{ lb}\cdot\text{in}$$