Torque and Speed Calculations

FRS 102
23 Feb 2011

1 Objective

We know the brake horsepower is 10 at 6000 RPM. We want to find top speed.

2 Calculations

2.1 Data

B.H.P is 10 hp at 6000 rpm.
The gear ratio between the engine and clutch is 19:48.
The gear ratio between the clutch and highest gear is 1:1.
The gear ratio between the highest gear and the rear sprocket is 17:46.
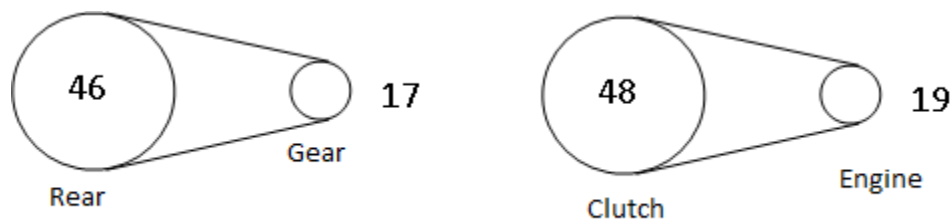

Figure 1: Gear Ratios

2.2 Power to Torque

At, 6000 rpm, power is 10 hp.
10 hp $= 330,000$ ft-lbs/min
Rotational speed:
$$\omega = 6000 \tfrac{\text{rev}}{\text{min}} = 12000\pi \tfrac{\text{rad}}{\text{min}}$$

Torque:

$$\tau = \frac{P}{\omega}$$
$$= \frac{330000}{12000\pi}$$
$$= 8.75\text{ft-lbs}$$

2.3 Top Speed

$$\text{Clutch} = 6000\ rpm * \frac{19}{48}$$
$$= 2375\ rpm$$
$$\text{Transmission} = 2375\ rpm * \frac{1}{1}$$
$$= 2375\ rpm$$
$$\text{Rear Sprocket} = 76000\ rpm * \frac{17}{46}$$
$$= 878\ rpm$$
$$\text{Circumference} = 2\pi r$$
$$\approx 6.8\ ft$$
$$\text{Top Speed} = 878 rpm * 6.8\ ft/rev$$
$$= 5984\ ft/min$$
$$\approx 68\ mph$$

2.4 Torque

$$\text{Clutch} = 8.75\text{ft-lbs} * \frac{48}{19}$$
$$= 22 ft - lbs$$
$$\text{Transmission} = 22\text{ft-lbs} * \frac{1}{1}$$
$$= 22\text{ft-lbs}$$
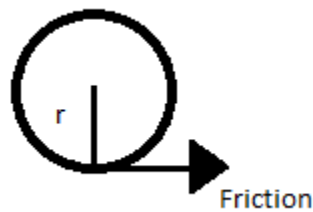$$\text{Rear} = 22\text{ft-lbs} * \frac{46}{17}$$
$$= 60\text{ft-lbs}$$

2.5 Forces

Figure 2: Force Wheel

High Gear:

$$F_{fric} = \frac{\tau}{r}$$
$$= \frac{60 \text{ ft-lbs}}{1.08 \text{ ft}}$$
$$= 55 \text{ lbs}$$