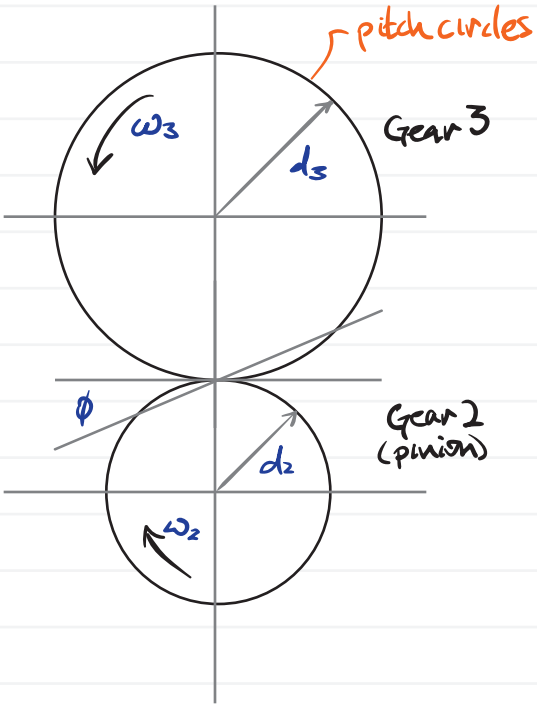
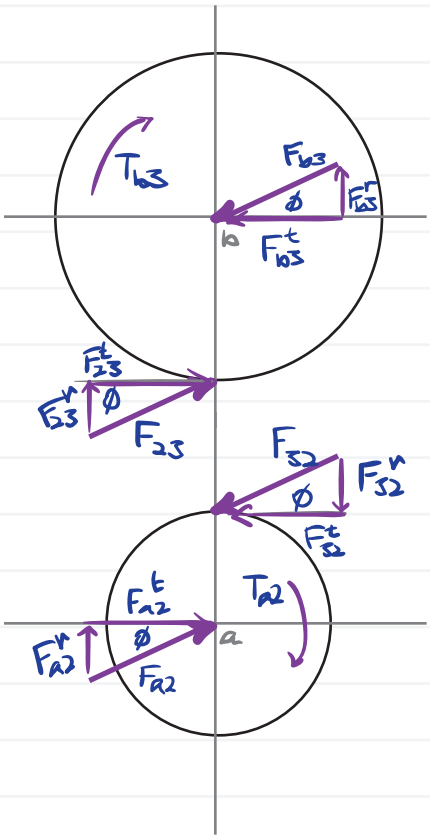
Spur Gear Loads and Power

Let's begin with some diagrams.





We consider the constant velocity (static) case.

Force:

Torque (about a + b): ΣT:

Third Law:

These relations imply ★

This result gives the torque transmission. we have previously

derived that

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The power transmission equations for the gears are

Combining the former of these with * and **,

This proves that under our assumptions (e.g. no friction) no power is lost.

Therefore, if power is constant, torque and angular velocity must be traded-off.

Spur gears actually have losses less than 2%. In fact, most gear types are highly efficient (98%-99%). However, a few (like worm gears) can be very inefficient (even as low as ~20%!).