

Torque Spool



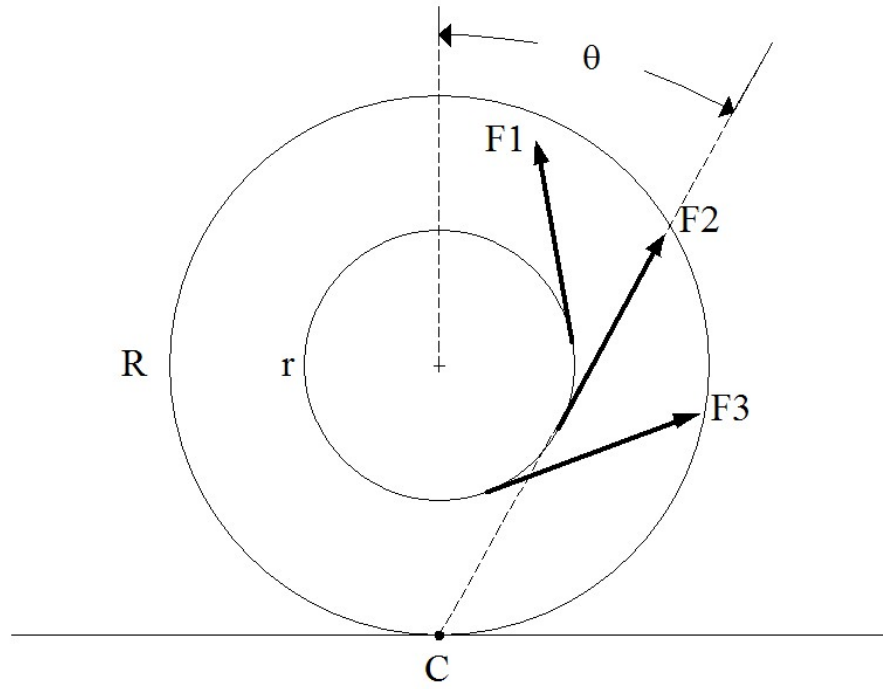
Purpose: Shows how the angle between force and moment arm determines the sense of the applied torque.

Place the spool on a table top with the strap coming up from the bottom. Pulling the strap upwards causes the spool to roll away – which will be no surprise to the students. However, pulling the strap horizontally causes the spool to roll towards the pull, which is a surprise! By experiment, you can find a critical angle of pull where the spool drags without rolling.

Note: The behavior can be explained by considering the torque applied about the point of contact (C). When force is applied at the critical angle (F_2), the angle between the moment arm and the force is zero and there is no rotation. The critical angle is easily figured as $q = \sin^{-1}(r/R)$.

For angles less than q , the torque is positive and the spool rolls to the left (F_1). For larger angles (F_3) the torque is negative and the spool rotates to the right. For our spool $r/R = 1/2$, so that $q = 30^\circ$.

The clear sides of the spool help in demonstrating the critical angle: a straight edge run from C up tangent to the inner spool rim should line up with the strap.



How it works

Extra Equipment: None

Location: Shelf B1