I have two possible solutions. This one will yield a conservation of momentum with all values of **n** (**n** is the inverse of the ratio –e.g. 0…0.3 and is a function of time; $\omega_{\mathbf{fw1i}}$ is the initial velocity of fw1):

Eq. 1: $$\omega_{.fw1}(t) := \frac{I_{.fw1} \cdot \omega_{.fw1i}}{I_{.fw1} + n(t) \cdot I_{.fw2}}$$ Eq.2: $$\omega_{.fw2}(t) := n(t) \cdot \omega_{.fw1}(t)$$

The problem with this "solution" is that the torque of flywheel 1 is not equal to the torque of flywheel 2 times n, as it must be. Momentum is always equal to the initial momentum (conserved) and the velocity of fw1 is equal to the velocity of fw2/n. Kinetic energy is not conserved.

The second solution yields a result that meets the mechanical constraints: torque on fw 1 = torque fw2*n and velocity of fw1 = velocity of fw2/n

Eq. 3: $$\omega_{.fw1}(t) := \frac{I_{.fw1} \cdot \omega_{.fw1i}}{I_{.fw1} + n(t)^2 \cdot I_{.fw2}}$$ Eq. 2: $$\omega_{.fw2}(t) := n(t) \cdot \omega_{.fw1}(t)$$

Note that the only difference is that **n** is now squared. With this "solution" momentum is not conserved nor is kinetic energy, yet it yields the only possible mechanical solution.

The torque on the gear reducer housing will be $\mathbf{t_{fw2}}$**-**$\mathbf{t_{fw1}}$ in the same direction as $\mathbf{t_{fw1}}$. Even though this housing is grounded to earth, torque equals delta momentum (L) over time, so **d**$\omega_{\mathbf{grd}}$ ***** $\mathbf{I_{grd}}$ **=** $\tau_{\mathbf{grd}}$.

I suppose you could say that either I_{grd} is huge (e.g. earth), therefore ω_{grd} is immeasurably small, or, if the gear reducer (grd) is grounded to something like a space satellite, then I_{grd} will be in the realm of significant and ω_{grd} will likewise be significant. In any case, it can't be ignored and does explain the "lost" momentum.

This appears to work; However kinetic energy still seems not to be conserved, which of course it must be.