$$\text{Tooth length} - \left(\text{verge sep} - \tfrac{1}{\sqrt{2}}\text{ pallet}\right) = \text{overlap}$$

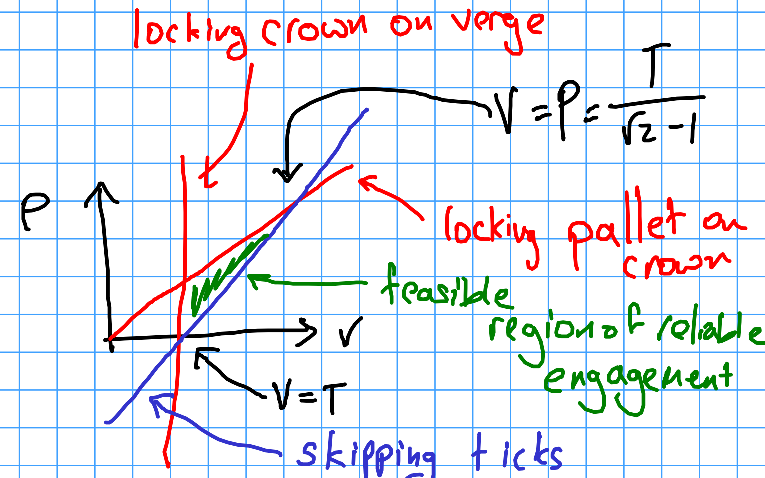
$$\text{Tooth} + \tfrac{1}{\sqrt{2}}\text{pallet} - \text{verge sep} = \text{overlap}$$

$$1 + \frac{1}{\sqrt{2}T}P - \frac{V}{T} = E$$

$$1 + \frac{1}{\sqrt{2}T}P - \frac{V}{T} \geq 0$$

$$\frac{P}{\sqrt{2}T} \geq \frac{V}{T} - 1$$

$$P \geq \sqrt{2}(V - T)$$

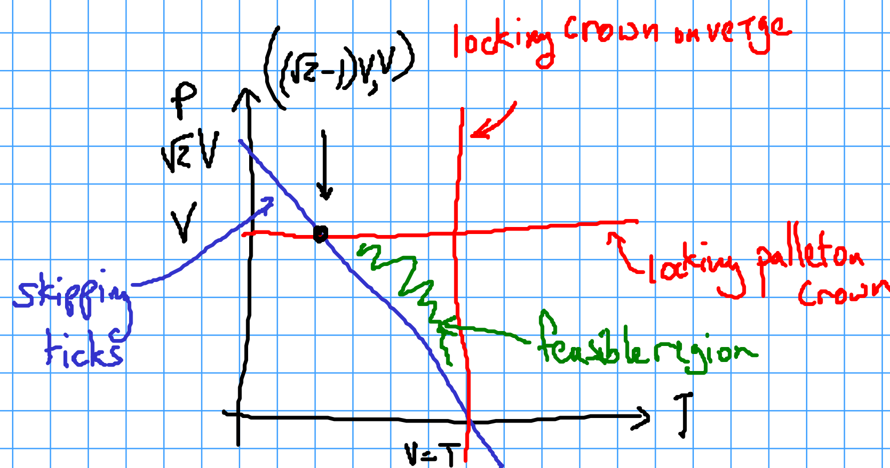


locking pallet on crown →

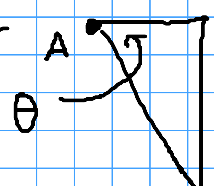
$$V = \sqrt{2}(V - T)$$

$$(\sqrt{2} - 1)V = T$$

$$V = \frac{1}{\sqrt{2}-1}T$$



Finding optimum pallet and tooth length as incenter of feasible region



$$\theta = \operatorname{atan}\frac{-V}{V - (\sqrt{2}-1)V} = \operatorname{atan}\left(\frac{-1}{\sqrt{2}}\right)$$

equation of angle bisector of A

$$P - V = \tan\left(\tfrac{1}{2}\operatorname{atan}\tfrac{-1}{\sqrt{2}}\right)\left(T - (\sqrt{2}-1)V\right)$$

Evaluating when $P = T$:

$$T - V = \tan\left(\tfrac{1}{2}\operatorname{atan}\tfrac{-1}{\sqrt{2}}\right)\left(T - (\sqrt{2}-1)V\right)$$

$$= \tan\left(\tfrac{1}{2}\operatorname{atan}\tfrac{-1}{\sqrt{2}}\right)T - \tan\left(\tfrac{1}{2}\operatorname{atan}\tfrac{-1}{\sqrt{2}}\right)(\sqrt{2}-1)V$$

$$\left(1 - \tan\left(\tfrac{1}{2}\operatorname{atan}\tfrac{-1}{\sqrt{2}}\right)\right)T = \left(1 - \tan\left(\tfrac{1}{2}\operatorname{atan}\tfrac{-1}{\sqrt{2}}\right)(\sqrt{2}-1)\right)V$$

$$P = T = \frac{\left(1 - \tan\left(\tfrac{1}{2}\operatorname{atan}\tfrac{-1}{\sqrt{2}}\right)(\sqrt{2}-1)\right)V}{\left(1 - \tan\left(\tfrac{1}{2}\operatorname{atan}\tfrac{-1}{\sqrt{2}}\right)\right)}$$

$$\approx 0.86V$$

Minimum length for engaging if $P = T$:

$$P \geq \sqrt{2}(V - T)$$

$$(1 + \sqrt{2})T \geq \sqrt{2}V$$

$$T \geq \frac{\sqrt{2}}{1+\sqrt{2}}V \approx 0.58V$$