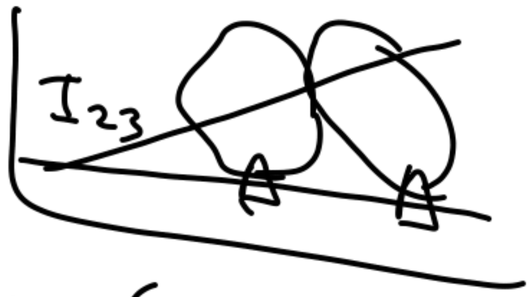
Gears:



Law of gearing (principle of conjugate action)

$$\frac{\omega_3}{\omega_2} = \frac{O_2 I_{23}}{O_3 I_{23}}$$

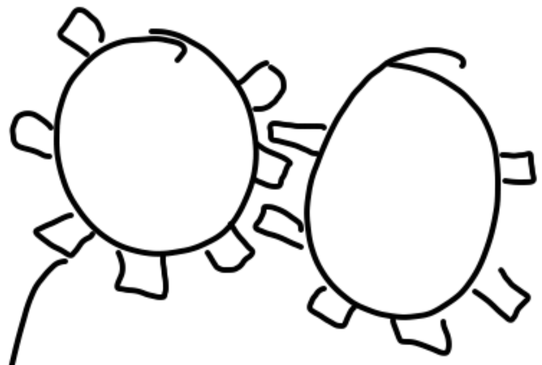
I_{23} i.e. pitch point should remain same.

One option: Gear

No slippage

$\omega_2 r_2 = \omega_3 r_3$

$\frac{\omega_3}{\omega_2} = \frac{r_2}{r_3}$



Toothed wheel

Same module

$m = \frac{\text{Dia. of di... or whee}}{\text{No. of teeth}}$

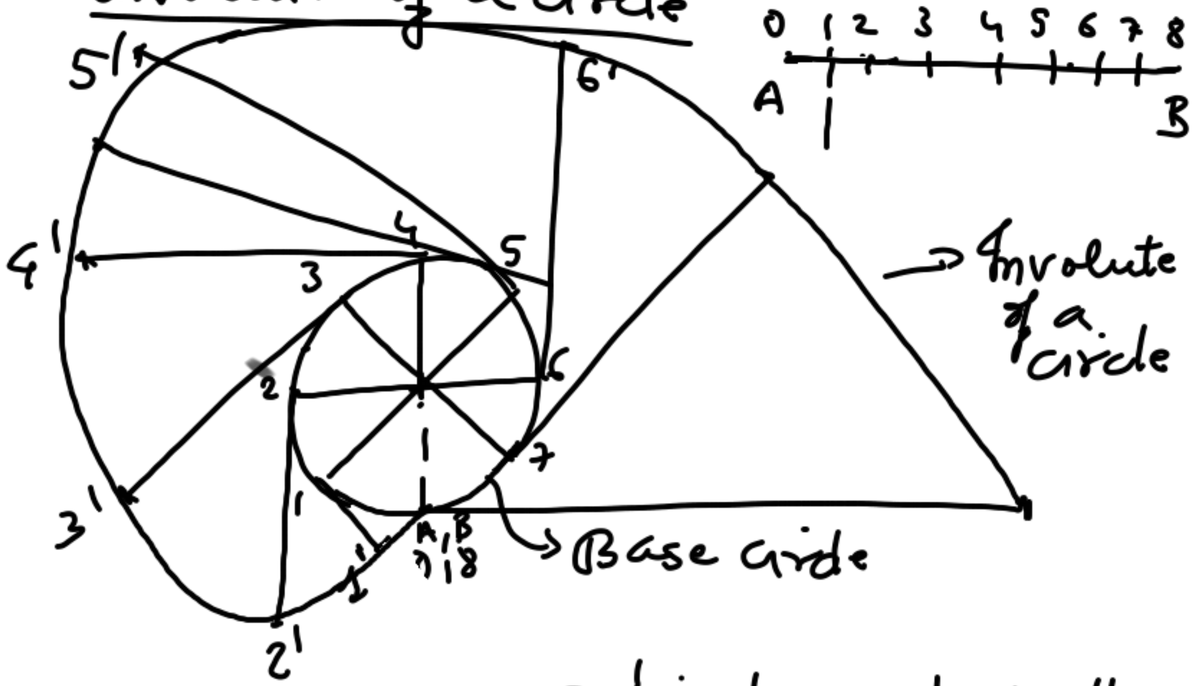
Positive drive

In general, law of gearing is not satisfied by any arbitrary tooth profile.

Involute Profile

Engineering curve

Involute of a circle



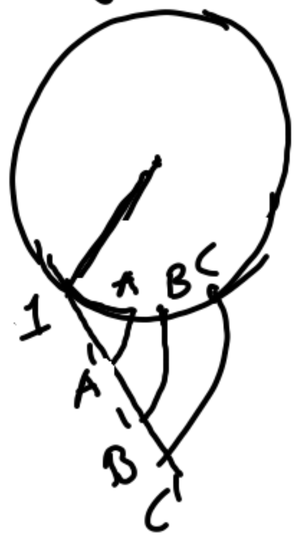
Property: 66' is tangent to the circle

CC' is normal to the involute

with 6 as the centre of curvature.

During construction, the string undergoes rotation and translation

As per the construction, string is rotating in the clockwise direction.



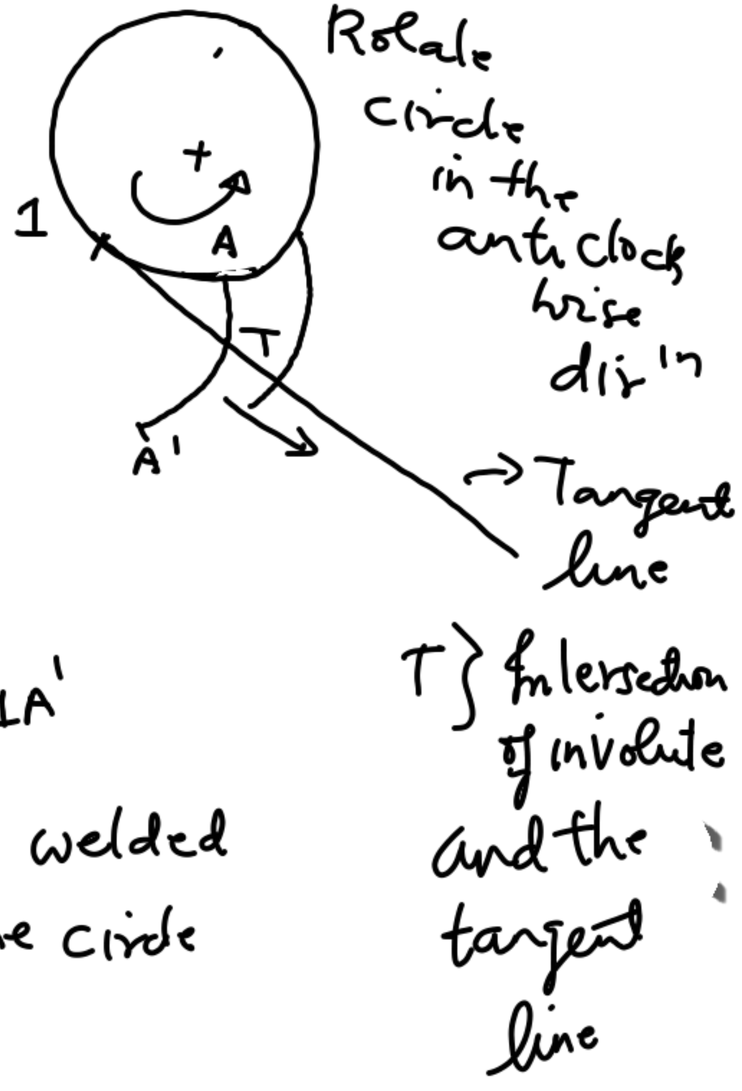
$\overset{\frown}{1A} = 1A'$

$\overset{\frown}{1B} = 1B'$

$\overset{\frown}{1C} = 1C'$

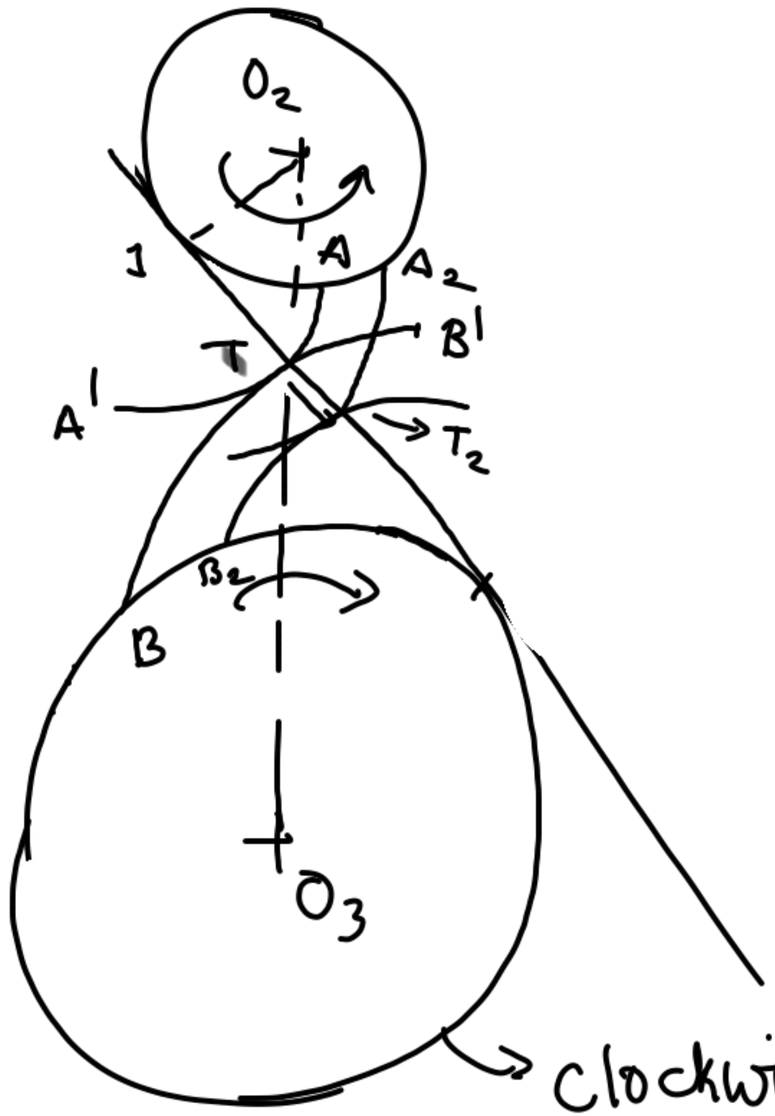
AA', BB', CC'

↳ Involute Profile



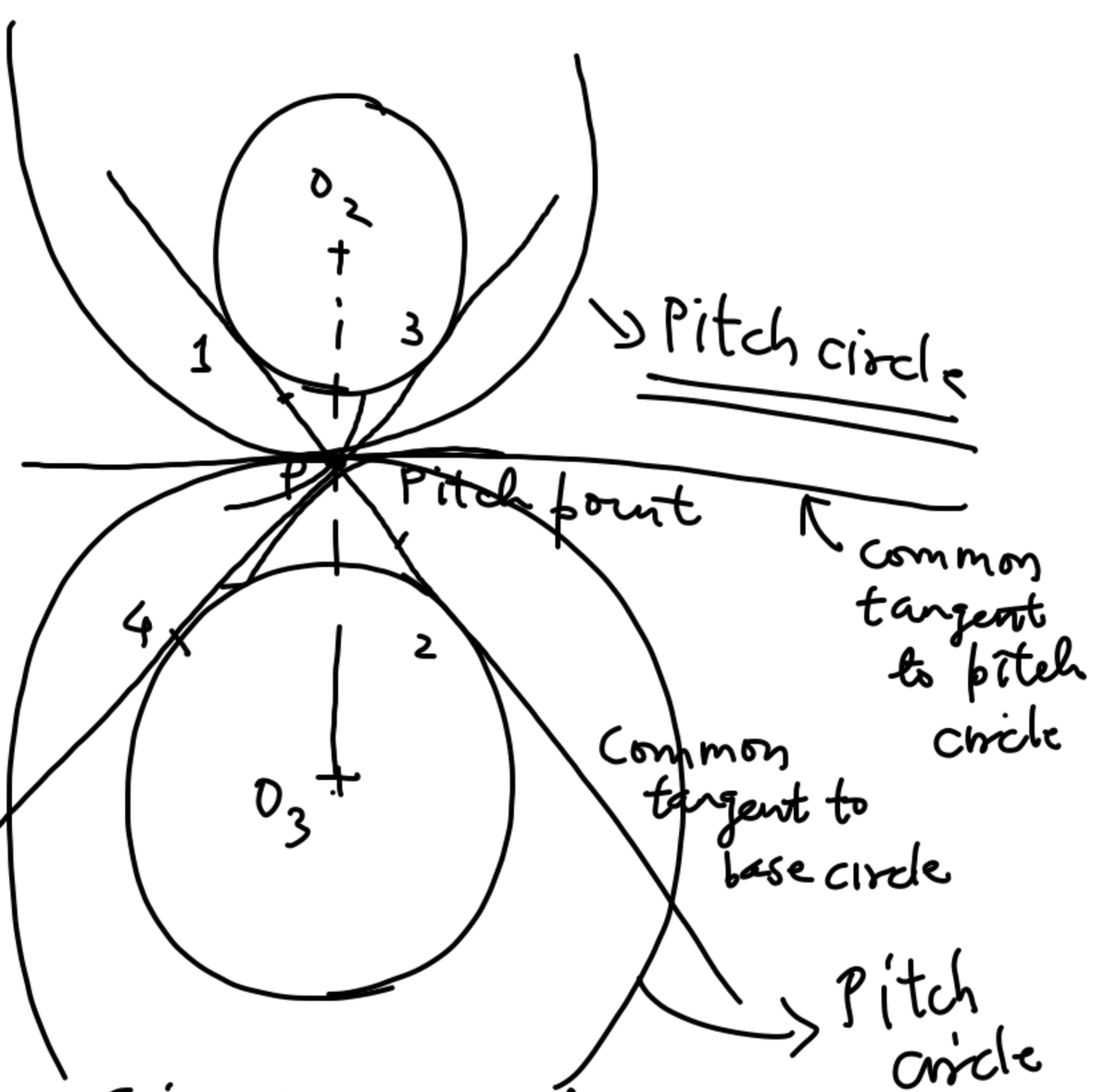
$\widehat{1A} = 1A'$

AA' is welded to the circle



At every instant of contact between involutes, point of contact lies on the common tangent (1T2)

By the property of involutes, the common tangent to the base circle is normal to the involute.



Since O_2O_3 and common tangent are fixed in space, their intersection P will satisfy the Law of Gearing

At pitch point P,

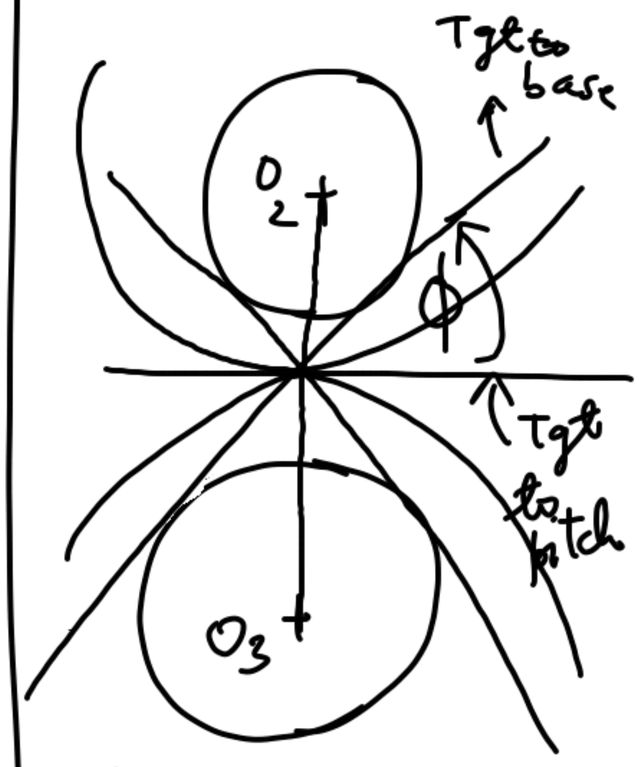
$V_P^{(\text{Top circle})} = V_P^{(\text{Bottom circle})}$

$\therefore \omega_2(O_2P) = \omega_3(O_3P)$

$\frac{\omega_3}{\omega_2} = -\left(\frac{O_2P}{O_3P}\right)$

-ve sign indicates reversal of direction

(1-2) and (3-4) are the two common tangents;

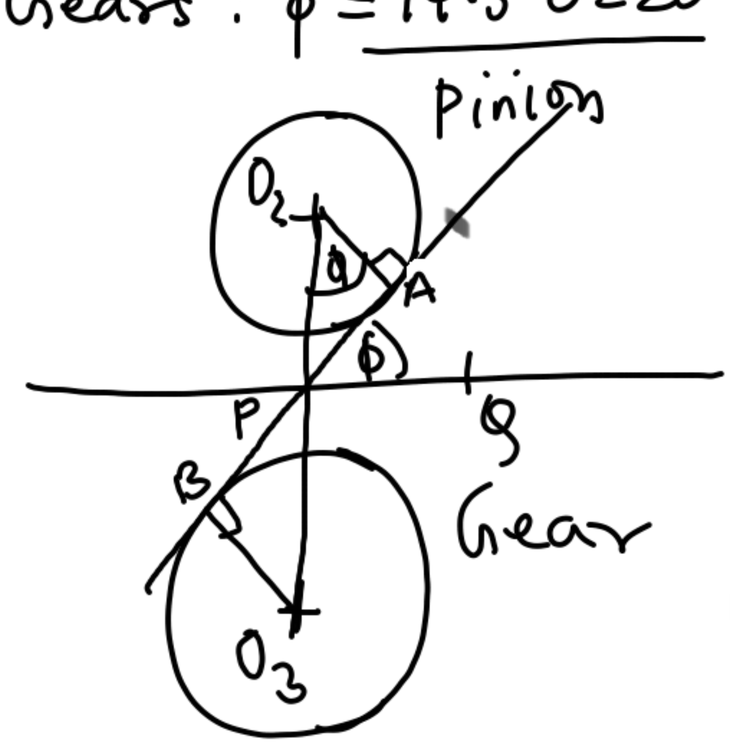


ϕ = Pressure angle

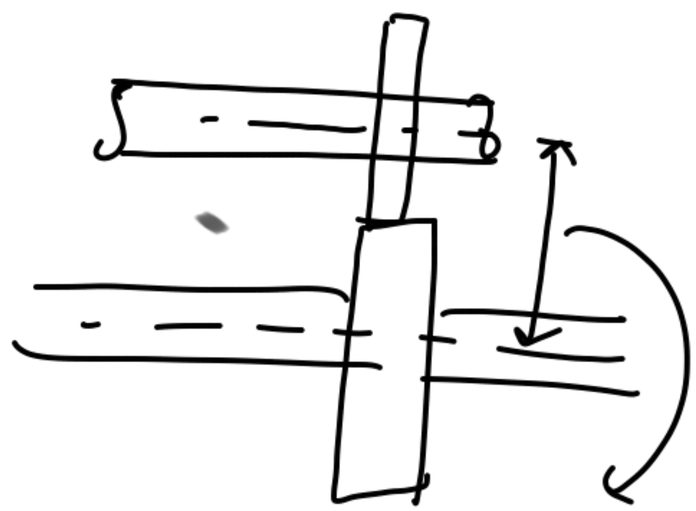
Pressure angle is the angle between common tangent to base and pitch circle.

Gears : $\phi = \underline{14.5^\circ \text{ or } 20^\circ}$

Pinion



Centre to centre distance O_2O_3



Same as centre to centre distance O_2O_3

$O_2O_3 = O_2P + PO_3$

$$O_2O_3 = r_p + r_G$$

In $\triangle PO_2A$

$O_2A = O_2P \cos\phi$

$$r_B^{(p)} = r_p \cos\phi$$

$$r_B^{(G)} = r_G \cos\phi$$

Relationship bet^{n} base circle radius & pitch circle radius