ME-372 : Heat transfer and Metrology lab

Experiment No.- 4B

Inspection of Gears

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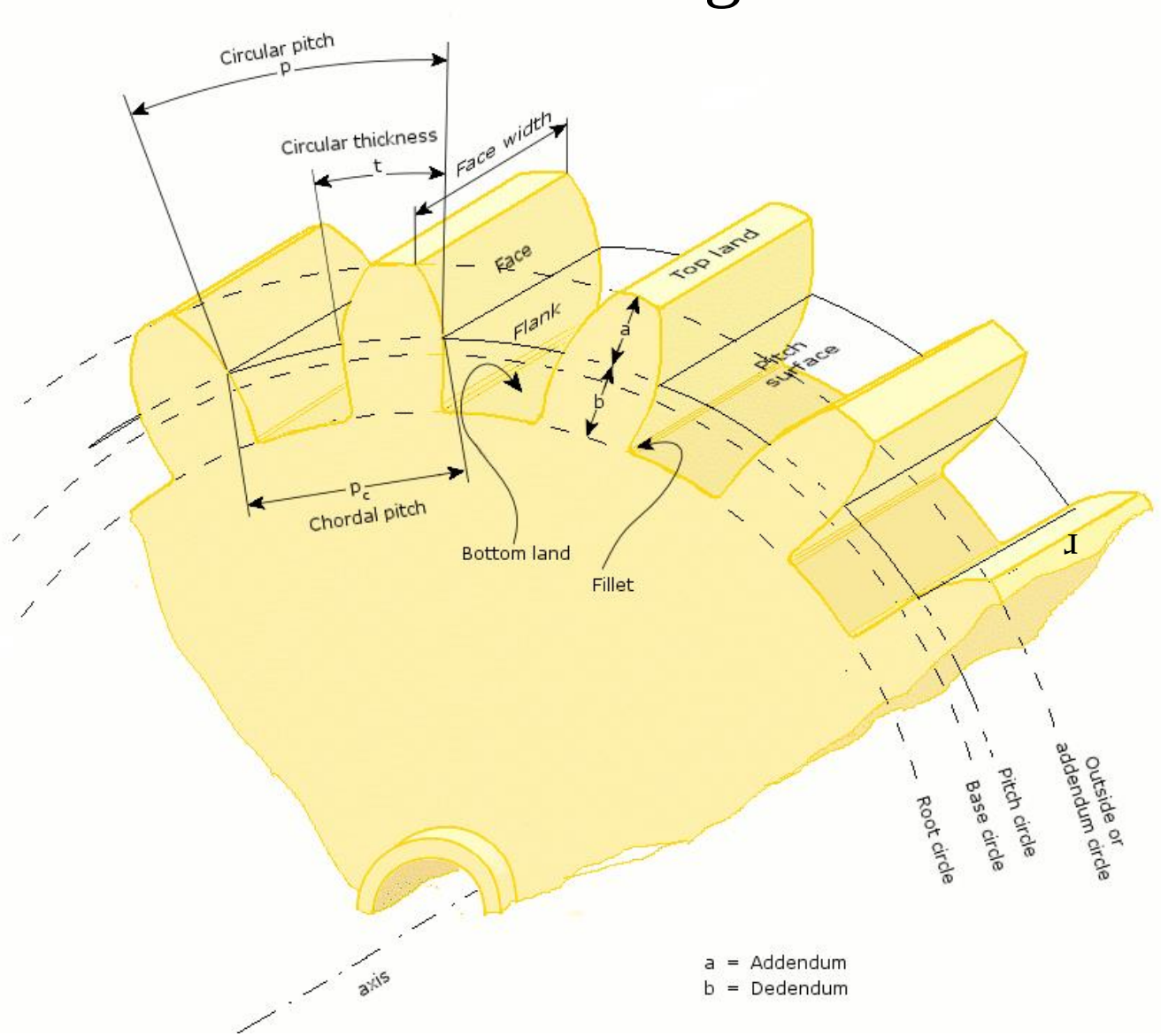
Introduction

- Gears are mainly used to transmission of power and motion
- The rotary motion of the driven shaft be perfectly uniform relative to the driving shaft.
- It is essential that both the gears be of correct geometrical form
- Hence the precision with which gears are manufactured and inspected plays a vital role.

Objective:-

- To inspect spur gears for their parameters specified.

Gear Design and nomenclature



$$(\textbf{Diametral pitch}) = \frac{N}{D}$$

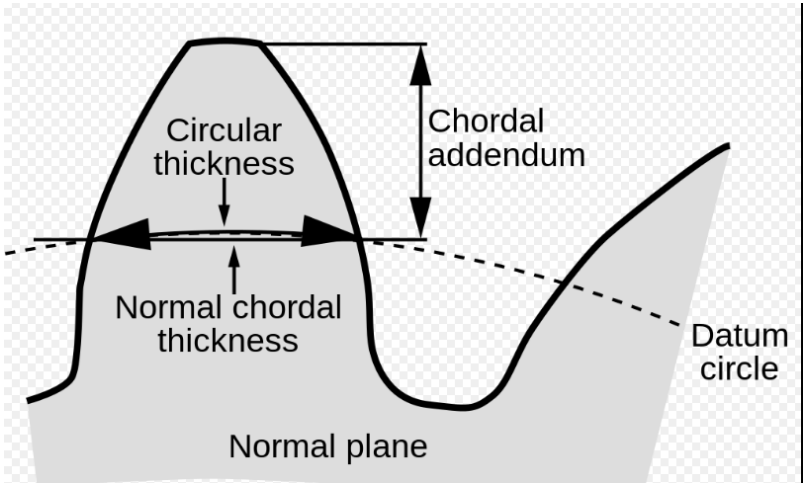
$$m(module) = \frac{D}{N}$$

$$(Circular\ Pitch)P_c = \frac{\pi D}{N}$$

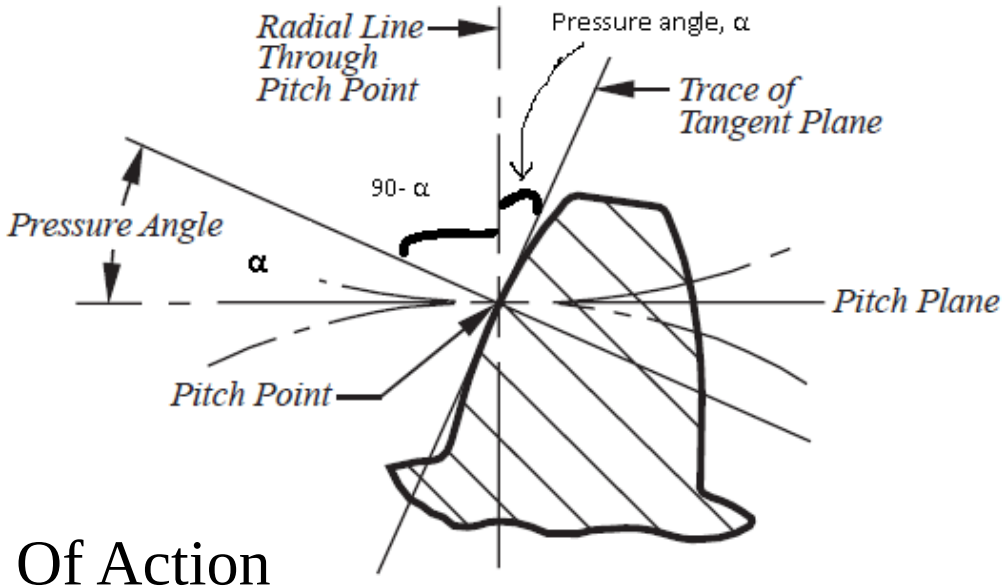
Addendum = m

*Source Google

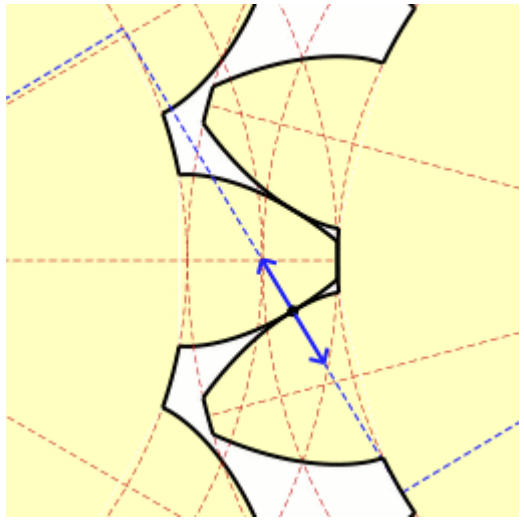
Circular Pitch & Chordal Pitch



Pressure Angle & Pitch Line



Pitch Point & Line Of Action



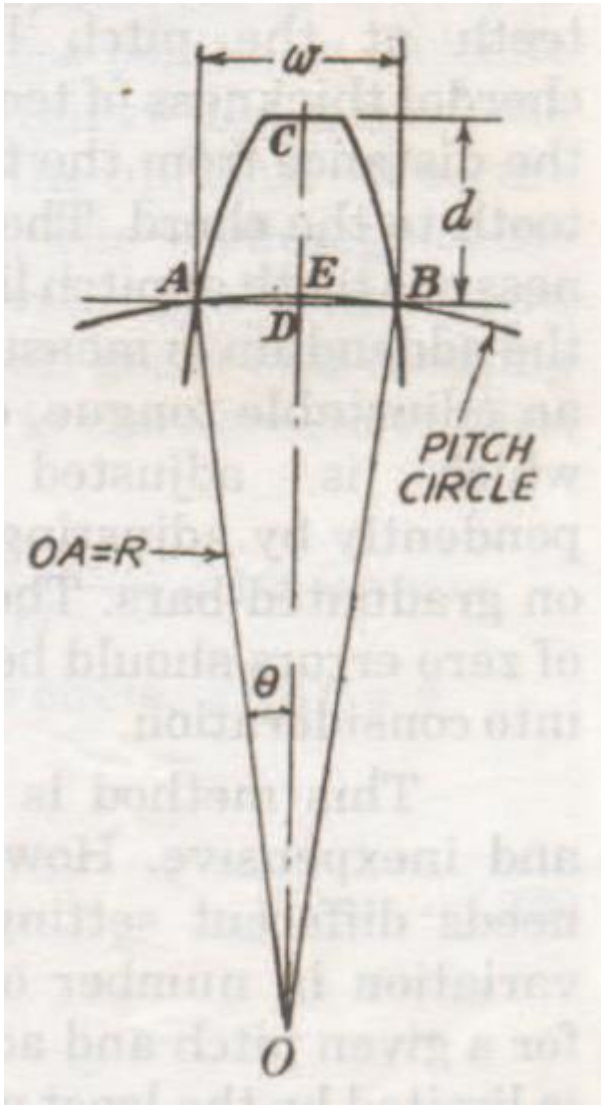
* Source google

Tooth Thickness Error

Tooth Thickness:
Measured at Pitch, So the Pitch line thickness of the tooth.

Error in Thickness:
- Permissible Error or tolerance on the thickness of the tooth.

Measurement of Thickness:
- Difficult to measure the length of arc.
- So sufficient to measure the chordal thickness.



Now, $A\hat{O}D = \theta = 360°/4N$, where N is the number of teeth,

$w = 2AD = 2 \times AO \sin\theta = 2R \sin 360/4N$ (N = pitch circle radius)

$$\text{module } m = \frac{\text{P.C.D.}}{\text{No. of teeth}} = \frac{2R}{N}, \quad \therefore \quad R = \frac{N.m.}{2}$$

here, (PCD)$D = 2R$ & $D_a = 2R_a$ *(Addendum Dia)*

$$m = R_a - R$$

$$m = \frac{D_a}{(2+N)}$$

$$\therefore \quad w = 2\frac{Nm}{2}\sin\left(\frac{360}{4N}\right) = N.m.\sin\left(\frac{90}{N}\right)$$

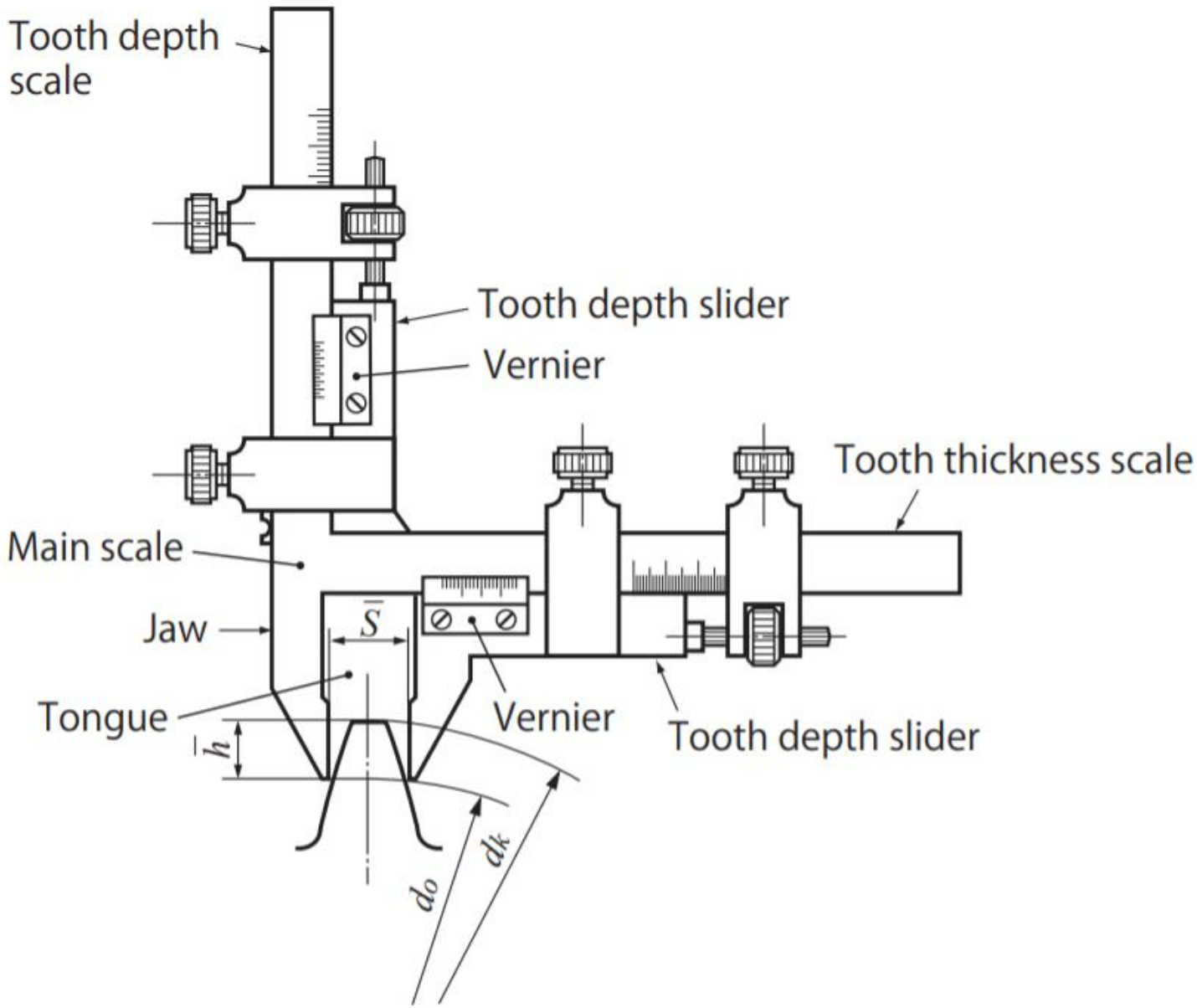
Also from Fig. 15.14, $d = OC - OD$

But $OC = OE + \text{addendum} = R + m = (Nm/2) + m$

and $$OD = R\cos\theta = \frac{Nm}{2}\cos\left(\frac{90}{N}\right)$$

$$\therefore \quad d = \frac{Nm}{2} + m - \frac{Nm}{2}\cos\left(\frac{90}{N}\right) = \frac{Nm}{2}\left[1 + \frac{2}{N} - \cos\left(\frac{90}{N}\right)\right]$$

d = chordal depth, w = chordal width and take, N = 36(teeth)


Tooth depth scale
Tooth depth slider
Vernier
Tooth thickness scale
Main scale
Jaw
$\bar{S}$
Tongue
Vernier
Tooth depth slider
$\bar{h}$
d_o
d_k

Procedure: Inspection of the spur gear for its chordal thickness

- Tooth thickness of spur gear is measured using gear tooth vernier caliper.
- Set the chordal depth value in the vertical scale of the vernier and measure the tooth thickness by adjusting the jaws of the horizontal scale to be tangent to the tooth.
- Take readings over the entire circumference so that Chordal thickness error can be calculated.

Results and Analysis

- Tabulate all the parameters measured.

(Addendum Diameter D_a-3 readings, Chordal Width W- 36 reading)

- Measure mean for addendum diameter of spur gear.
- Error in Chordal width wrt theoretical value of chordal width

Conclusion:

Discuss the source of errors in the experiment.