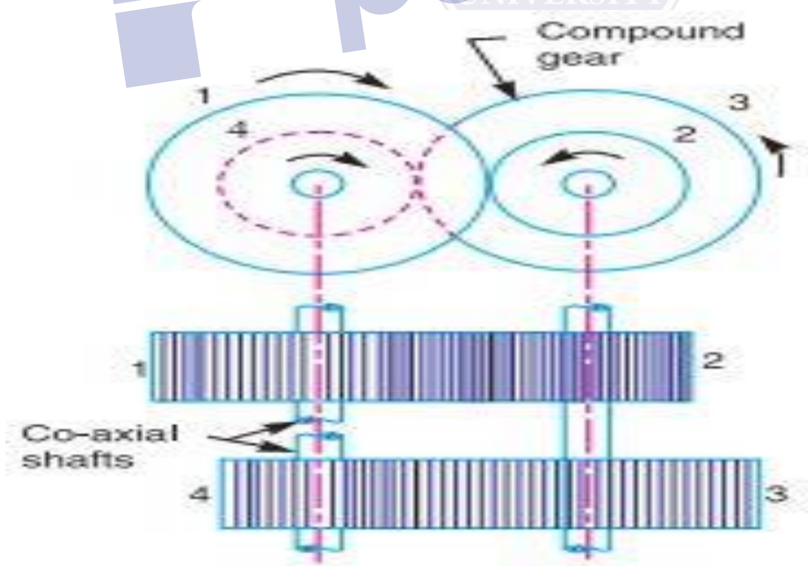
Reverted Gear Train

When the axes of the first gear (i.e. first driver) and the last gear (i.e. last driven or follower) are co-axial, then the gear train is known as reverted gear trainas shown in Fig.

We see that gear 1 (i.e. first driver) drives the gear 2 (i.e. first driven or follower) in the opposite direction. Since the gears 2 and 3 are mounted on the same shaft, therefore they form a compound gear and the gear 3 will rotate in the same direction as that of gear 2. The gear 3 (which is now the second driver) drives the gear 4 (i.e. the last driven or follower) in the same direction as that of gear 1. Thus we see that in a reverted gear train,the motion of the first gear and the last gear is like



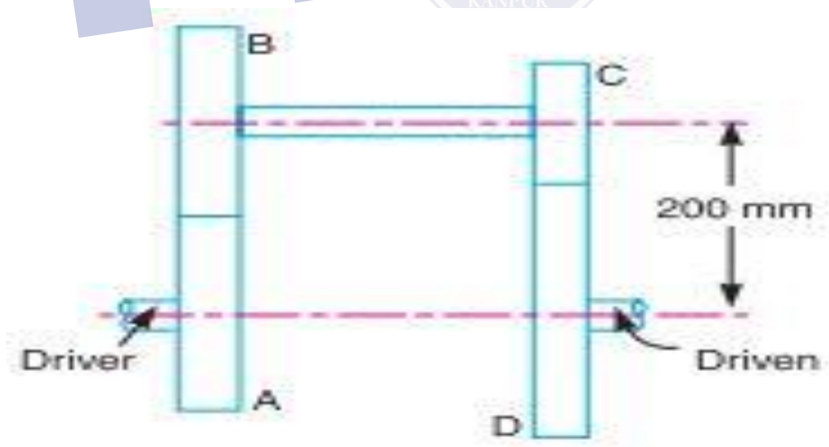
Since the distance between the centres of the shafts of gears 1 and 2 as well as gears 3 and 4 is same, therefore

$r1 + r2 = r3 + r4$ ...(i)

Also, the circular pitch or module of all the gears is assumed to be same, therefore number of teeth on each gear is directly proportional to its circumference or radius.

∴ *T1 + T2 = T3 + T4

Question-The speed ratio of the reverted geartrain, as shown in Fig, is to be 12. The module pitch ofgears A and B is 3.125 mm and of gears C and D is 2.5 mm.Calculate the suitable numbers of teeth for the gears. No gear is to have less than 24 teeth.



Since the speed ratio between the gears *A* and *B* and between the gears *C* and *D* are to be same, therefore

$$^* \frac{N_A}{N_B} = \frac{N_C}{N_D} = \sqrt{12} = 3.464$$

Also the speed ratio of any pair of gears in mesh is the inverse of their number of teeth, therefore

$$\frac{T_B}{T_A} = \frac{T_D}{T_C} = 3.464 \qquad \text{...}(i)$$

We know that the distance between the shafts

$$x = r_A + r_B = r_C + r_D = 200 \text{ mm}$$

or $$\frac{m_A . T_A}{2} + \frac{m_B . T_B}{2} = \frac{m_C . T_C}{2} + \frac{m_D . T_D}{2} = 200 \qquad \text{...}\left(\because r = \frac{m.T}{2} \right)$$

$$3.125 \, (T_A + T_B) = 2.5 \, (T_C + T_D) = 400 \qquad \text{...}(\because m_A = m_B, \text{ and } m_C = m_D)$$

$\therefore$ $$T_A + T_B = 400 / 3.125 = 128 \qquad \text{...}(ii)$$

and $$T_C + T_D = 400 / 2.5 = 160 \qquad \text{...}(iii)$$

From equation (*i*), $T_B = 3.464\, T_A$. Substituting this value of T_B in equation (*ii*),

$$T_A + 3.464\, T_A = 128 \quad \text{or} \quad T_A = 128 / 4.464 = 28.67 \text{ say } 28 \quad \textbf{Ans.}$$

and $$T_B = 128 - 28 = 100 \ \textbf{Ans.}$$

Again from equation (*i*), $T_D = 3.464\, T_C$. Substituting this value of T_D in equation (*iii*),

$$T_C + 3.464\, T_C = 160 \quad \text{or} \quad T_C = 160 / 4.464 = 35.84 \text{ say } 36 \quad \textbf{Ans.}$$

and $$T_D = 160 - 36 = 124 \ \textbf{Ans.}$$

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Epicyclic Gear Train

- We have already discussed that in an epicyclic gear train, the axes of the shafts, over which the gears are mounted, may move relative to a fixed axis. \
- A simple epicyclic gear train is shown in Fig., where a gear A and the arm C have a common axis at O1 about which they can rotate.
- The gear B meshes with gear A and has its axis on the arm at O2 , about which the gear B can rotate.
- If the arm is fixed, the gear train is simple and gear A can drive gear B or vice- versa, but if gear A is fixed and the arm is rotated about the axis of gear A(i.e. O1), then the gear B is forced to rotate upon and around gear A.
- Such a motion is called epicyclic and the gear trains arranged in such a manner that one or more of their members move upon and around another member are known as epicyclic gear trains (epi.means upon and cyclic means around). The epicyclic gear trains may be simple or compound.