Reverted gear train pdf

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Let T1 = Number of turns on gear 1, r1 = Pitch circle radius of gear 1, and N1 = Speed of gear 1 in r.p.m. Similar ly T2, T3, T4 = Number of teeth on each gear, r2, r3, r4 = Pitch circle radii of the respective gears, and N2, N3, N4 = Speed of each gear in r.p.m. 1 Returned Gear Train Because the distance between the centers of the axles of the gears 1 and 2 as well as gears 3 and 4 are the same, therefore also, circular pitch or module of all the gears is assumed to be the same, therefore the number of teeth on each gear is directly proportional to its circumference or radius. From equations (i), (ii) and (iii), we can determine the number of teeth on each gear for given center distance, speed ratio and module only when the number of teeth on a gear is selected arbitrarily. The reverse gear trains are used in vehicle transmissions, turning rear gears, industrial speed shipers and in clocks (where the minute and hour shafts are co-axial). There are different types of gear trains that are used to transfer movement and power from one axis to another with different speed ratios. The gear trains are divided into different types on the basis of arrangements and working methods. These different types of gear trains are as follows. Figure 1. Gear Gear is a rotating machine element or part used to transfer movement and power. In Figure 1 circular gear of some thickness is shown that has cut teeth. These all teeth have the same tooth profile with equal gaps between them along the perimeter. The number of teeth of gear is depending upon size of tooth and gear. A single gear cannot transfer movement and power, at least two or more gears must be masked to each other to transfer movement and power. Gear teeth are used to mesh with other gears as well as to transfer movement and power without slip. Figure 2. two mains switches As shown in Figure 2, two circular gears of different sizes are shown that have the same tooth profile and have equal space between them and have different number of teeth. These two gears are arranging in the way that both gears have to come into contact with each other to transfer movement and power without slipping and this is by inserting the tooth of both gears into each other in the distance between two teeth of both gears and these tooth make full contact with each along the thickness of the gears. In this way, these two switches come into contact with each other and this is called network of switches. For more information of visit Gear - Wikipedia A single gear cannot transfer movement and power from one axis to another axis, at least two or more gears must be masked to each other to transfer movement and power. Gear train is a mechanical system formed by mounting gears on axles and axles supported by a frame to mesh gears together and this combination of two or more gears that are mesh together, is used to transfer movement and force from one axle to another axle. It is used to achieve large and different speed ratios in small area or space, to increase or decrease speed, transfer movement at the same speed and to change the direction of rotation of the driven axis. Different types of gears are used in gear trains, such as spur gears, helical gears and bevel gears. Gear selection for gear trains depends on different aspect such as position axle shafts, speed of gear, increase or decrease speed, etc. Gear trains are used in various machines and there are large number of examples such as in car, gearbox, turning machine, milling machine, clock, toys, etc. For more information visit gear train Figure 3. Simple Gear Train Single Gear Train is a type of gear train used to transfer movement and power from one axis to another axis. Single gear trains consist of two or more gears but only one gear is mounted on each axle and these axles are rigidly fixed or not movable. Two simply mesh switches are known as simple gear trains. In simple gear trains, different types of gear are used as spur gears, helical gears, bevel gears, etc. These switches are different in size and have different number of teeth, which are used to achieve accelerate or slow down the final production. For more information visit simlpe gear train Figure 4. Compound Gear Compound Gear Train is a type of gear train used to transfer movement and force from one axis to another axis. Composite gear trains consist of one or more composite gears (intermediate gears) with input (driving) and output (driven) gears. Compound gear is use in composite gear trains which is a difference between simple gear trains and composite gear trains. Compound gear has two or more rigidly fixed gears of different sizes and has different number of teeth on the same shaft with the same axis of rotation and the same angular velocity. These switches are different in size and have different number of teeth, which are used to achieve accelerate or slow down the final production. For more information visit composite gear train Figure 5. Returned geaer train Returned gear train is a special type of gear train used to transfer movement and power from one axis to another axis. Reversed gear trains consist of a multiple composite gears (intermediate gears) with (driving) and outgoing (driven) gears. Reverted gear is use in composite gear trains which is a difference between simple gear trains and returned gear trains. Reanned gear has two or more rigid fixed gears of different sizes and has different number of teeth on the same shaft with the same axis of rotation and the same angular velocity. These switches are different in size and have different number of teeth, which are used to achieve accelerate or slow down the final production. In returned gear trains, different types of gear are used as spur gears, helical gears, bevel gears and many more. In Reverted gear train, drifting gear axle shaft and driven gear axis axis are in a line or coaxial and this makes it different than composite gear trains. For more information visit reverted gear train Figure 6. epicyclic gear train Epicyclic gear train is a special type of gear train used to transfer movement and force from one axis to another axis. In simple, composite and reverted gear, gear axis axis is fixed or not moving but in epicyclic gear trains, the shaft axles are not fixed meaning the axle axis axle is moving. There is a relative movement between the gear shaft. Epicyclic gear trains can consist of simple gear trains, compound train gears and mixed simple and compound train implements. The advantage of the epicyclic gear train is that, it can get very high or very low speed ratio compared to simple gear trains and compound train gears. In epicyclic gear trains, various types of gear are used as spur gears, helical gears, bevel gears and many more. These switches are different in size and have different number of teeth, which are used to achieve accelerate or slow down the final production. For more information visit epicyclic gear trains These are the type gear trains used in machine according to requires speed ratio, space and application. 1. Gear Train Department of Mechanical Engineering JSS Academy of Technical Education, Bangalore-560060 Kinematics of Machines (Course Code:17ME42) 2. Switchboard Train: • Simple gear train • Composite gear train. Epicyclic gear train: • Algebraic and tabular methods to find the speed ratio of epicyclic gear trains • Torque calculation in epicyclic gear trains. Content 3. When two or more gears are made to mesh with each other to transfer power from one axle to another, such a combination is called gear train or train of toothed wheels. The nature of the train depends on ☛ The speed ratio required ☛ The relative position of the axes of shafts. A gear train may consist of spur and bevel gears. Gear Train 4. Depending upon arrangement of wheels / gears: 1. Simple gear drive 2. Composite gear train 3. Rewood gear train 4. Epicaltic gear train • In the first three types of gear trains, the axles of the axles in the axles above which the gears are mounted are fixed relative to each other. • In the case of epicacal gear trains, the axles of the axles on the axles moved in relation to a fixed shaft. Types of Gear Train 5. When it comes to only one gear on each axle, according to Fig. It is known as single gear train. • The gears are represented by their pitch circles. • The two gears 1 and 2 transfer movement from one axis to the other axis. • Since gear 1 drives gear 2, therefore gear1 is called the driver and gear 2 is called driven or successor Simple Gear Train 6. Simple gear train The ratio of the speed of the driven or follower to the speed of the driver is known as Train Value (TV). 7. Single gear train 8. Intermediate gears are called idle gears, because they do not power the speed ratio or the train's value of the system. The idling gears serve the following two purposes; 1. To connect switches at a large center distance. 2. To obtain the desired direction of movement of the driven gear (i.e. clockwise or counterclockwise). Idling gears / Intermediate switches 9. Compound Gear Train When there is more than one gear on one shoulder, as shown in Fig. is called as a composite train of gear. 10. Compound Gear Train • Gear 1 is the driving gear mounted on axle A • Gears 2 and 3 are composite gears mounted on axle B. • Gears 4 and 5 are also composite gears mounted on axle C • Gear 6 is the driven gear mounted on the axle D. N1 = Speed of driving gear 1, T1 = Number of teeth on the drive gear 1, N2 ,N3 ..., N6 = Speed of the respective gears in r.p.m., T2 ,T3..., T6 = Number of lights on each gear. 11. Since gear 1 is in grid with gear 2, its speed ratio is; The speed ratio of compound gear trains is obtained by multiplying the equations (i), (ii) and (iii), Compound Gear Train 12. Compound Gear Train 13. Example 1. The gearing of a machine tool is shown in Fig. The motor axle is connected to gear A and rotates at 975 r.p.m. The gears B, C, D and E are fixed to parallel axles that rotate together. The f-f end switch is fixed to the output shaft. What is the speed of gear F ? The number of teeth on each gear is listed below. Gear A B C D E F No. of light 20 50 25 75 26 65 Numeric 14. Numeric example 1. Solution 15. Returned Gear train When the axles of the first gear (i.e. first driver) and the last gear (i.e. last driven or successor) are co-axial, then gear train is known as the returned gear train. 16. • Gear 1 (i.e. first driver) drives gear 2 (i.e. first driven or successor) in the opposite direction. • Gears 2 and 3 are mounted on the same axis, they form a composite gear, and gear 3 will rotate in the same direction as for gear 2. • Gear 3 pushes gear 4 (i.e. the last drive or successor) in the same direction as for gear 1. • in a returned gear train is the movement of the first gear and the last gear set. Returned Gear train 17. Returned Gear train Because the distance between the center of the axles of switches 1 and 2 and switches 3 and 4 is the same, therefore r1 + r2 = r3 + r4 ... (i) Also, the circular pitch or module of all gears is assumed to be the same, therefore no. of the teeth of each gear is in direct proportion its circumference or or T1 + T2 = T3 + T4 ... (ii) 18. • The reverse gear trains are used in vehicle transmissions, turning rear gears, industrial speed shipers, and in clocks (where the minute and hour shafts are co-axial). Applications 19. Epicyclic Gear Train • In an epicyclic gear train, the axes on the axles, over which the gears are mounted, can move relative to a fixed axle. • Gear A and Arm C have a common shaft at O1 about which they can rotate. • Gear B mesh with Gear A and has its shoulder on the arm at O2, about which Gear B can rotate. 20. • If the arm is fixed, the gear is easy and gear A can drive gear B or vice versa. • If gear A is fixed and the arm is rotated about axis gear A (i.e. O1), then gear B is forced to rotate on and around gear A, such a movement is called epicyclic. The gear trains arranged in such a way that one or more of their members move on and around another member are known as epicyclic gear trains. • The epicyclic gear train can be simple or compound. • The epicyclic gear trains are useful for transferring high-speed ratios with moderate-sized gears in a comparatively smaller space. • The epicyclic gear train is used in the back gear of the lathe, differential gears of the cars, lifts, pulley blocks, wristwatches etc. Epicyclic Gear Train 21. The speed ratio of Epicyclic Gear Train 1. Tabular method. 2. Algebraic method. 22. Tabular method Consider an epicyclic gear train as shown in Fig. Let, TA = Number of teeth on gear A TB = Number of teeth on gear B. 23. Tabular method 24. Tabular form method 25. Tabular method 26. Tabular method 27. 1. In an epicyclic gear train, one arm carries two gears A and B with 36 and 45 teeth respectively. If the arm rotates at 150 rpm. in the counterclockwise direction if the midpoint of gear A is fixed, determine the speed of gear B. If gear A instead of being fixed, do 300 rpm. in a clockwise direction, what will be the speed of gear B ? Numeric 28. Solution 29. Speed of gear B when gear A is fixed Speed on gear B when gear A is 300 rpm. clockwise Because the arm speed is 150 rpm. (CCW), therefore from the fourth row of the table, y = + 150 rpm. 30. 2. In a reverted epicyclic gear train, arm A carries two gears B and C and a composite gear D - E. Gear B meshes with gear E and gear C meshes with gear D. The number of teeth on gears B, C and D is 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and arm A does 100 rpm. Clockwise. Numeric 31. From the geometry of the figure, Center distance, C = r1+r2 = r3+r4 Diametric pitch = dB + dE = dC + dD Wrt switches; TB + TE = TC + TD TE = TC + TD - TB = 30 + 90 – 75 = 45 Solution 32. Solution 33. Compound Epicyclic Gear Train-Sun and Planet Gear 34. Compound Epicyclic Gear Train-Sun and Planet Gear • A composite epicyclic gear train is shown in Fig. It consists of two co-axial shafts S1 and S2. • Annulus gear A that is fixed, the gear (or planetary gear) B-C, solar gear D and arm H. • Annulus gear has internal teeth and the composite gear is carried by the arm and circuits freely on the arm H. • The solar gear is co-axial with the annulus gear and arm, but independently of them. • Gear in the centre is called solar gear • Gears whose axles move are called planetary gears 35. • Annulus switch A worms with gear B • Solar gear D worms with gear C. • When the annulus switch is fixed, the solar gear gives the drive unit and when the solar gear is fixed, the annulus gear produces the drive unit. In both cases, the arm acts as a supporter. Composite Epicyclic Gear Train-Sun and Planet Gear 36. Composite Epicyclic Gear Train-Sun and Planet Gear 37. 1. An epicaltic gear consists of three gears A, B and C as shown in Fig. Gear A has 72 internal teeth and gear C has 32 external teeth. Gear b the meshes with both A and C and worn on an arm EF that rotates about the center of A at 18 rpm. If gear A is fixed, determine the speed of gears B and C. Numeric 38. An epicyclic train of gears is arranged as shown in Fig. How many turns does the arm, to which the pinions B and C are attached, do : 1. when A does a turn clockwise and D makes half a revolution counterclockwise, and 2. when A makes a revolution clockwise and D is stationary ? The number of teeth on gears A and D is 40 and 90 respectively. 39. Module end module