Transmissions

the medium that transmits power generated by the engine

driving and driven gear

Two gears with teeth on their outer edges, act like a first class lever when one gear drives the other.

1, The gear with the input force is called the drive gear, and the other is called the driven gear.

2, The effort arm is the diameter of the driven gear, and the resistance arm is the diameter of the drive gear.

Bevel gears

Bevel gears are used to change the plane of rotation, so that a shaft turning horizontally can make a vertical shaft rotate.

The size of the gears and their number of teeth determine the mechanical advantage, and whether force is being increased or rpm is being increased

If each gear has the same number of teeth, there would be no change in force or rpm

worm gear

The worm gear has an extremely high mechanical advantage.

1, The input force goes into the spiral worm gear, which drives the spur gear.

2, One complete revolution of the worm gear only makes the spur gear turn an amount equal to one tooth.

3, The mechanical advantage is equal to the number of teeth on the spur gear, which in this case is 25.

4, This is a force gaining machine, to the tune of 25 times more output force.

planetary sun gear

The planetary sun gear system is typical of what would be found in a propeller reduction gearbox.

The power output shaft of the engine would drive the sun gear in the middle, which rotates the planetary gears and ultimately the ring gear.

In this example, the sun gear has 28 teeth, each planet gear has 22 teeth, and the ring gear has 82 teeth.

To figure how much gear reduction is taking place, the number of teeth on the ring gear is divided by the number of teeth on the sun gear.

In this case, the gear reduction is 2.93, meaning the engine has an rpm 2.93 times greater than the propeller.

RACK AND PINION GEARS

The rack and pinion gear is a type of spur gear.

he rack is a piece cut from a gear with an extremely large radius. The rack and pinion arrangements useful in changing rotary motion into linear motion or the reverse.

While this arrangement has limited usefulness, its advantage within this purpose is greater better precision than most other options.

GEAR TERMS

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Backlash (or lash)

he terms used to describe the clearance which must exist between gear teeth at point of mesh

to allow for expansion and lubrication

Idler Gear

A gear which is interposed between the driving and driven gear, its function is to connect the drive between two shafts

used between two parallel shafts to maintain the direction of rotation and does not affect the ratio of the gears. A bevel idler may be used where two shafts intersect and/or are co-axial

Intermediate Gear

A gear which is positioned between the driving gear and one or more driven gears in a gear train.

It may function as an idler gear or transmit drive through its own shaft

transmits torque and changes the angle of drive from the main transmission gearbox to the tail gearbox.

Compound Gear

this is a gear wheel which has more than one driving face.

these faces may be formed integrally on one casting or forging, or it may comprise two or more gears bolted or splined together to transmit drive to a number of shafts

Pinion Gear

the pinion is a round gear, usually the smaller of two meshed gears, used in several applications.

Lay-shaft

,shaft which supports an idler gear or intermediate gear

it may be integral with the gear and be supported by bearings, or may be fixed and provide a bearing surface for the rotating gear

Step-Up Drive

A drive through a gear train in which the speed of rotation of the output (driven) shaft is increased

Used in aeroengines in a generator drive. It ensures that the generator has sufficient .rev/mm to remain "on charge" at engine idling rev/mm

Step-Down Drive

A reduction gear in which the rev/mm of the output shaft is reduced while the torque is .increased

Used between the engine and propeller in order to allow the engine to develop its power by running at high RPM while maintaining high propeller efficiency by avoiding the tips speeds reaching Mach 1

GEAR RATIO

Gear ratio is the number of teeth each gear represents when two gears are used in an .aircraft component

the pinion gear has 8 teeth and the spur gear has 28 teeth. The gear ration is 8:28 or 2:7

Example: A pinion gear with 10 teeth is driving a spur gear with 40 teeth. The spur gear is rotating at 160 revolutions per minute (rpm). Determine the speed of the pinion gear

$$\frac{\text{Teeth in Pinion Gear}}{\text{Teeth in Spur Gear}} = \frac{\text{Speed of Spur Gear}}{\text{Speed of Pinion Gear}}$$

$$\frac{10 \text{ teeth}}{40 \text{ teeth}} = \frac{160 \text{ rpm}}{S_P \text{ (speed of pinion gear)}}$$

To solve for SP, multiply 40 × 160, then divide by 10. The speed of the pinion gear is 640 rpm

Example: If the cruising speed of an airplane is 400 km/h and its maximum speed is 500 km/h, what is the ratio of cruising speed to maximum speed? First, express the cruising speed as the numerator of a fraction whose denominator is the maximum speed

Next, reduce the resulting fraction to its lowest terms

$$Ratio = \frac{400}{500}$$

therefore, the ratio of cruising speed to maximum speed is 4:5

$$Ratio = \frac{400}{500} = \frac{4}{5}$$