



SPEED GEARBOX MECHANISM

Dr.Harish Harsurkar¹, Vikram Mandlik², Chavan Ajit Dadu³

¹HOD Mechanical Engineering Vidya Prasarini Sabha's College of Engineering and Technology ,Lonavala

²Student Mechanical Engineering Vidya Prasarini Sabha's College of Engineering and Technology ,Lonavala

³Student Mechanical Engineering Vidya Prasarini Sabha's College of Engineering and Technology ,Lonavala

ABSTRACT

As the world is going through a tough competitive environment scenario, the companies need to provide a wide variety of products to meet a suitable and affordable requirements. The economic success of manufacturing firms depends on their ability to identify the basic needs of customer and quickly create the product to meet the requirements of the customers that are produced at low cost. The paper is created to offer a literature review related to design and development of gear box. The paper focuses on a major aspect i.e to design and development of a gear box to overcome the problem like mass production and cost optimization with effectively to provide service to customer.

Keywords: Design & Development Of Gerbox.

1. INTRODUCTION

This stage of design and development is more and more important in today's competitive world and it has a significant impact on the company's industrial performance and profits can be boosted by careful product design & by lowering production costs .A well-designed products enables the company to achieve a higher market size. In today's market scenario, the manufacturer will provide the products based on the affordable price, adaptability i.e flexibility to suit new demands and also driving customer's satisfaction.

The gearbox is a mechanical device that is used to provide the conversion of speed and torque from the rotating power source to the output shaft. Transmission is the heart of the transportation system, and gearbox is the crucial part of the transmission unit. A machine consists of a power source and a power transmission system, which provides controlled application of the power. Merriam-Webster defines transmission as an assembly of

parts including the speed-changing gears and the propeller shaft by which the power is transmitted from an engine to a live axle. Often transmission refers simply to the gear box and gear train to provide speed and torque conversions from a rotating power source to another device. The shifting mechanism of the gearbox or gear shifter allows a quick variation in speed, thus promoting a shifting mechanism while designing a gear box will be helpful for the performance which will be satisfied by the customer & as well as smooth functioning of gears to achieve ultimate result.

The gearbox has variously used in agricultural, industrial, constructional, mining, and automotive equipment, etc. and to maximize its efficiency gearbox with 8-speed variation is used. The most important benefit is it increases in the fuel efficiency. Another benefit is a fast locking torque converter that allows for quick engagement and limited-slip. This results in less wear and tear on the clutches inside the unit and longer life. An additional benefit is that it provides smooth shifts that happen so quickly that they often sensed by the driver. In Automobiles, the gearbox is mainly used to supply the power to wheels from the engine through the differential. The differential is also a combination of gears.

2. LITERATURE REVIEW

A.Y.V. Gopi Krishna, R.V. Kiran (2019) presented a paper on Gearbox, which has a set of gears that are enclosed in a casing, the gears are mounted on shaft which rotate freely about their axis. The gears are fixed on a shaft by key, this reduces the capacity of power source required and hence less fuel consumption.

Ujjayan Magumdar, Sujitb Maity (2018) describes the study of shaft material, gear box components and types of gearing etc. Gear box is a mechanical device which is used to provide torque and its conversion from input to output shaft. Whenever there is an requirement of frequent change in speed and torque at output shaft, multispeed gear boxes are used. Gear boxes work on the principle of meshing of teeth, which result in the transmission of motion.

Francesca Cura (2017) This paper proposes a method in the ISO standard environment for calculating a single global dynamic factor, K_{av} , by replacing K_a and K_V , in the case of gears subjected to shift and load conditions and this process based on the Miner damage rule and calculate the equivalent tangential Force values, including all dynamic effects.

Muhammad Irfan (2017) A study on the mechanism modeled by the mechanical system was carried out. The full gear shifting process in stages, which gives the opportunity to capture the nature of the body, solve the complexities of the detailed kinematic description.

DISCUSSION

There are several research papers that discusses design & development standards, design parameters and design specifications related to the gearbox. The overall literature shows redesign, standardization and optimization of the gearbox , which is an advantage for various components of gears. The main purpose of

these standards is to prepare products to reach in every corner of the world, with the same specifications without a single change.

WORKING PRINCIPLE OF THE GEAR BOX

-Generally there are two sets of the gears in gear box i.e input and output.

-The input gears are fixed on the countershaft making it a single unit.

-It drives the individual gears on the shaft which rotates freely on the bearings.

-Thus , the gearbox passes the drive to the wheels depending upon the gear which engages on the main shaft.- When you push the shifter sleeve towards the desired gear , that locks onto the main shaft and rotates it.-Thus , the main shaft rotates the speed of the engaged gear and



Fig 1. Gear meshed to each other.

provides the output as per the engaged gear's ratio

Neutral Gear Position

With a gears in a neutral and the car or the vehicle is stationary, the transmission main shaft is not turning. When the clutch is engaged then the engine is running, the clutch shaft gear helps to drives the counter shaft driven gear. This turns the counter shaft and the other gears on the counter shaft. In neutral position, the power is transmitted from engine output passes through the clutch shaft or input shaft of transmission and then directly through fourth gear or main drive gear on counter shaft.

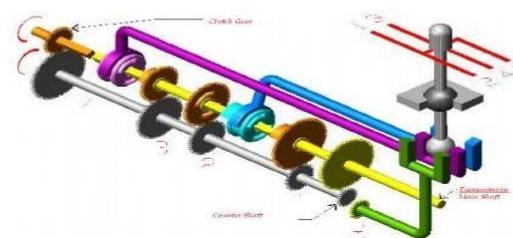
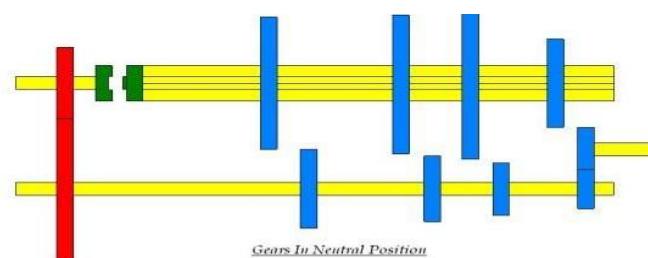


Fig 2. Neutral gear position.

First Gear Position

When the clutch is disengaged, the clutch disc is released and the gear shift lever is moved into 1st position. Movement of the gear shift lever results in the linkage to select the 1st -2nd synchronizer sleeve and move it to the right. When the clutch is engaged, the power flows through transmission, the power trends in first gear position, the transmitted power is passed through the main drive gear of input shaft and constant mesh counter gear to the first gear on counter shaft and then to first gear on main shaft.

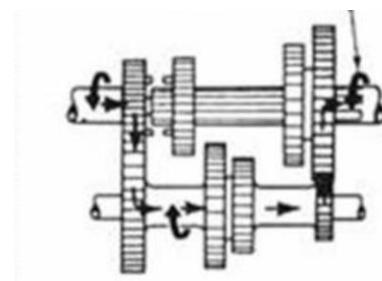


Fig 3. First gear position.

Second Gear Position

The 1st -2nd synchronizer sleeve has been shifted to the left so that its internal teeth engage the external teeth on the 2nd speed gear. This results, the power flows through the clutch gear to drive the counter gear assembly. The medium size gear on the counter shaft drives the second speed gear through the synchronizer to the second speed gear on the main shaft.

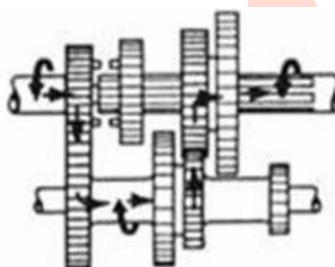


Fig 4. Second gear position.

Third Gear Position

When the gear shift lever is moved into 3rd position, it leads to the movement of the gear shift lever causes the linkage to select the 3rd synchronizer sleeve and move it to the right. The 1st -2nd synchronizer sleeve must be moved to its center position. The power flows through the main drive gear of the input shaft, constant mesh counter gear and then to the third gear on the counter shaft, finally it is transmitted to the main shaft.



Fig 5. Third gear position

Fourth Gear Position

In forth gear position, the 3rd -4th synchronizer sleeve has been moved to the left side so its internal teeth engages the external teeth of the clutch gear. The power is transmitted directly to the drive shaft and there is no speed reduction in this case.

Fifth Gear Position

The fifth gear position is actually an overdrive. In this the output shaft turns faster or overdrives, than the input shaft. The overdrive actually helps to reduce engine wear, engine noise and fuel consumption. The main advantage of overdrive is that it reduces engine speed around 30 percent while still maintaining the same road speed. When the transmission is shifted into fifth gear position or overdrive, the clutch synchronizer sleeve locks the overdrive gear to the main shaft. The 5th speed gear on counter shaft is larger than the overdrive gear on the main shaft. Thus, increased gear ratio can be provided.

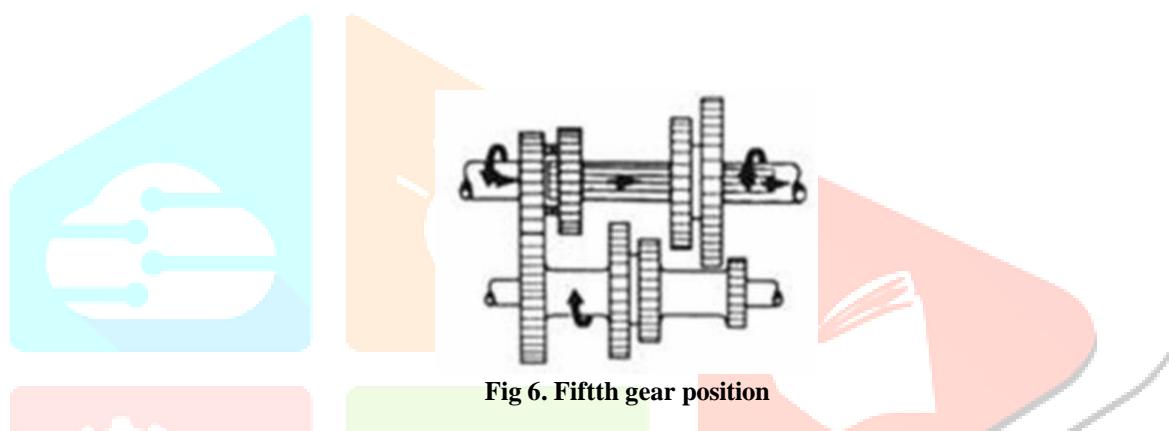


Fig 6. Fifth gear position

FUTURE SCOPE

The Gearbox designed is lightweight, compact and gives more performance than the present Reduction Gearboxes. However, there still scope for better and more precise design in the following areas. For this Reduction Gearbox, the differential should be connected externally through a chain drive. This will still make the power train assembly little complicated. Assembling the Differential inside the Gearbox itself will make the Power train assembly simpler. The Factor of Safety of the output Gear is too high. This is done because the output shaft is connected to the wheel with the help of a Knuckle Joint. Since the wheel is subjected to various loads from the road condition it is believed that the loads may be transmitted to the out gear also. Considering the loads from the drive shaft will result in better design. The brackets should re-designed in such a way that they do not have to protrude outside completely. This reduces the height and makes the Gearbox look aesthetically pleasing.

CONCLUSION

In order to reduce problems such as mass production and cost optimization, essential methods to reduce problems to effectively provide services to customers have been adopted from the above literature surveys and the methods used for the design and development of gear box, & in order to improve the application area, the design of gear box is based on customer satisfaction and affordable cost . The gearbox must be lightweight and compact in accordance with design standards. Shifting mechanism with gear boxes are effective on Vario aspects such as mass production, cost savings and overall performance.

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