AUTOMATIC TRANSMISSION GEARBOX WITH CENTRIFUGAL CLUTCHES

Suraj S Raut[1], D.P.Mali[2]

[1]*Department of Mechanical Engineering, Sou. Venutai Chavan Polytechnic, Pune, India*
[2]*Department of Mechanical Engineering, Sou. Venutai Chavan Polytechnic, Pune, India*

Abstract

The various developments in the automobile field are going on increasing; hence we have also tried to modify the transmission system of light weight vehicles such as motorbikes for simplicity in driving the vehicle in an efficient way. The disclosure herein is concerned with an automatic transmission gearbox with centrifugal clutches which operates automatically as engine speed (RPM) goes on increasing. In this work we have designed and manufactured the automatic gearbox model which consists of gear assembly with three different gear ratios and centrifugal clutches of various spring tensions, which driven by electric motor. This gearbox overcomes disadvantages of Continuous variable Transmission (CVT) system by replacing belt and pulleys with centrifugal clutches and gear assembly, which is more compact and avoids loss of power when operating at high speed. Also it is light in weight, efficient, reliable, less time consuming and economical of manufacturing.

Keywords: *Transmission system, Centrifugal clutch, Automatic gearbox, CVT.*

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1. INTRODUCTION

The world is advancing technically in the field of Automatic and Technology is never at a standstill. In recent time it has gained greater momentum than ever before. As demand for time increases, people require something less time consuming as time is money, something more precise, something accurate, meaning something automatic which can serve the people comfortably. On this path, the science and engineering field is always under development and discoveries having come to the people and serves for their betterment and welfare. An automatic transmission or gearbox is a type of motor vehicle transmission that can automatically change gear ratios as the vehicle moves, freeing the driver from having to shift gears manually. The automatic transmission was invented in 1921 by Alfred Horner Munro of Regina, Saskatchewan, Canada, in 1923[1]. In such a way in 1977 Mr. Ray Hill an American Automobile Engineer successfully developed an Automatic Gearbox of constant-mesh transmission type working on the principle of centrifugal clutches. [3]

The present automatic gearbox is an automatic transmission in which increased rotation of the input shaft causes the engagement of a first centrifugal clutch assembly which, in turn, drives a planetary gear reduction assembly and, as speed picks up, a second centrifugal clutch assembly of similar construction comes into engagement to change the drive of the input shaft to a direct drive arrangement with the output shaft whereby the whole transmission rotates as a unit.

1.1 Centrifugal Clutch

The centrifugal clutch is very important, as there are three clutches in this gearbox. They engage one by one when centrifugal force overcomes the inward spring forces. Fig.1 shows the construction & working of centrifugal clutch.

Working principle of a centrifugal clutch as follows: 2 to 4 no. of shoes inside the rim are mounted on the hub. Only the surfaces of shoes are provided with frictional material. The shoes are free to move radially outward in guides and hold against the spider on the driving shaft by means of a spring. The spring exerts radially inward force, which is constant. Due to mass of the shoes, while they are rotating, the centrifugal force acts on the shoes. When the speed goes on increasing the centrifugal force exceeds and it overcomes the spring tension and it wedges the outer rim. With frictional grip, it starts rotating the outer rim and power is transmitted, thus the vehicle moves. [5]

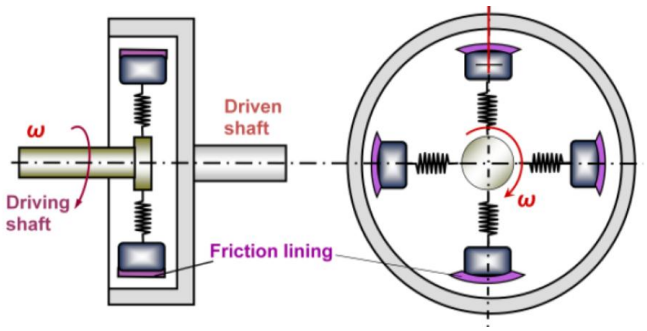

Fig-1: Construction of centrifugal clutch. [5]

1.2 Freewheel

It is the very important element of the gearbox. Freewheel is a device in a transmission that disengages the driveshaft from the driven shaft when the driven shaft rotates faster than the driveshaft. The outside surface of freewheel contain cams so designed to hold rollers in the cage between them and the

outer surface. When the shaft is driven in one direction, the roller slide up the cams the and by this wedging action force the outer race becomes the driving member. And when the shaft is driven in another direction, the rollers move down the cam to release the race from the shaft thus allowing it to move independently on the shaft so to make the entire assembly act like a roller bearing. In this way the unit runs.

2. AUTOMATIC TRANSMISSION WITH CENTRIFUGAL CLUTCHES

2.1 Field of the Work

The automatic gearbox with centrifugal clutches relates to an automatic transmission; more particularly, the invention describes a transmission for producing a variable speed drive to light-weight vehicles, such as motorbikes.

2.2 Background

The presently known automatic transmissions provided on such type of light-weight vehicles are composed of a variable speed drive including a drive pulley and a driven pulley, each pulley consisting of movable flanges on which a transmission belt is mounted; these pulleys have a variable effective diameter responsive to the speed of rotation, the effective diameter increasing with an increase in speed. [7]
In such transmission system, there are several disadvantages. First, an intermediate support is usually provided for the driven pulley resulting in additional space being required on the small vehicle. Also, under certain atmospheric conditions which cause the formation of frost on the pulley flanges and on the transmission belt, the latter will slide over rather than engage the pulleys. Further, a small misalignment on the pulleys inevitably results in a premature wear of the transmission belt and a considerable loss of power.

2.3 Statement of the Work

It is an objective of this work is to provide an automatic transmission which overcomes the above described disadvantages in light-weight vehicles. It is another object of the work to provide in light-weight vehicles a transmission system where the transmission belt and pulleys are substituted with a centrifugal clutch and planetary gear assembly which is more compact and which avoids loss of power when operating at high speed. A further object of the present work is to provide an automatic transmission which is light in weight, compact and economical of manufacture.
The automatic transmission gearbox with centrifugal clutches is efficient, reliable and less time consuming. It provides ease for driving a two wheeler. Hence any one can easily drive the geared two wheeler without clutch lever and gear pedal hence concentration on driving is more, which reduces the chances of accidents. So it will prove very useful in coming modern two wheelers in the present decade.

3. CONSTRUCTION AND WORKING

Fig.2 shows the Schematic diagram of Automatic Gearbox with centrifugal clutches. The A & B are the two shafts which are parallel to each other and are driving and driven shafts respectively. These two shafts are carrying all the rotating elements, which we will see in details. Firstly the main principle of automatic gearbox depends upon the centrifugal clutch. There are three clutch drums C1, C2 & C3. On hub of clutch drum D1 Pinion P1 is fitted, on the hub of clutch drum D2 pinion P2 is fitted and on hub of clutch drum D3 the Pinion P3 is fitted. These three drums are mounted on shaft A which is free to rotate on it. Inside all the clutch drums centrifugal clutch spiders are fitted on the shaft and rotates with it. The clutch springs are so designed that the clutch spiders fly apart when rpm reaches to 500, 1000, and 1600 respectively. The Pinions are in constant mesh with gears, which are mounted on freewheels which are fitted on driven shaft.

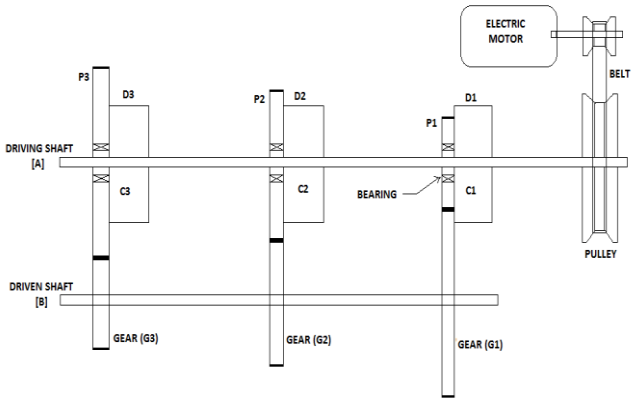

Fig-2: Schematic diagram of Automatic Gearbox with centrifugal clutches.

3.1 First Gear

When engine starts the shaft 'A' starts rotating. It doesn't transmit any power till 500 rpm. As soon as rpm goes beyond 500 the centrifugal force build up in clutch spiders of 1st clutch C1 and it overcomes the spring tension pulling it inward and wedges the drum and drum starts rotating on which pinion P1 is mounted as it meshes to gear G1 so the power is transmitted to gear G1. As freewheel locks the clockwise motion it directly transmits the power to shaft B Which starts rotating with sprocket chain and rear wheel in this way vehicle starts moving on first gear with high torque, same time the clutch drum D2, D3 and remaining Pinions and Gears remains idle.

3.2 Second Gear

As engine rpm goes on increasing from 500 to 1000 spiders of second clutch C2 fly apart and wedges to clutch drum. It start rotating the Pinion and Gear and via freewheel power is transmitted to shaft B. Previously shaft A was rotating with the speed of gear G1 Now it will rotate faster than before not only because of increase of engine rpm but also the lower gear ratio. The higher speed of shaft B will not affect the gear G1 because of the freewheel which start spinning in anti-clockwise direction and gear G1 will rotate in its own speed and will not transfer any power. At this time only, drums D3 and gears G3 and Pinion P3 remain idle.

3.3 Third Gear

Now as on further increase of engine rpm from 1000 to 1600 the clutch spiders of third clutch C3 flies apart and wedges to clutch drum D3 which rotate the Pinion P3 and Gear G3 and shaft B rotates with higher velocity than before. The gears G1 and G2 rotate with their own rpm only. And do not transmit any power. Now our vehicle is in third gear.

3.4 Reversal of Gear

When load on the engine increase or when it starts climbing the hill the engine rpm decreases. Say from 1600 to 1000 so that the spiders of third clutch C3 contracts as spring tension or pull becomes more than centrifugal force development by it. Ultimately the load of the vehicle switches to highest torque capacity which fulfills the requirement of vehicle. When more torque is required it goes from second to first in above manner.

4. DESIGN AND CONSTRUCTION DETAILS OF AUTOMATIC GEARBOX

The automatic gearbox consists of gear assembly and centrifugal clutches. In this work automatic gearbox with centrifugal clutches has been designed and manufactured. Fig.3 shows the actual model of automatic transmission gearbox with centrifugal clutches.

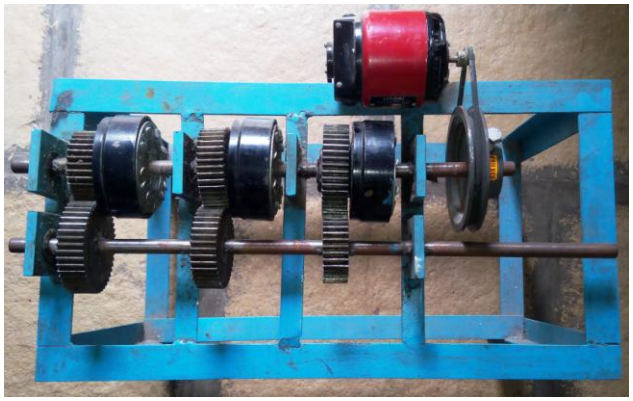

Fig-3: Actual model of Automatic Transmission Gearbox.

In this gearbox spur gears are used as they are easy to manufacture and economical, for high speeds helical gears can also be used. Gear ratios are: First 2.22, Second 1.63 and Third 1.32. The electric motor with pedal and speed indicator has been used in this model to drive the input or driving shaft of automatic gearbox.

5. CONCLUSION

The following benefits have been concluded from this project work:

1. The automatic transmission gearbox with centrifugal clutches is efficient and reliable. It provides ease for driving a two wheeler. Hence any one can easily drive the geared two wheeler.
2. Time required for shifting gears is less; due to complicated gear shifting mechanism is not used.
3. Positive engagement of gears during shifting is achieved.
4. There is no jerkiness during shifting, no temporary loss of power and shifting can be known by digital gear indicator.
5. There are no belts, pulleys, fluid torque converter or any other parts associated with automatic transmission.
6. Gear clashes are avoided.
7. Design of gearbox casing becomes simple.

6. FUTURE SCOPE

As we all know there are no limits for improvements in any kind of work . There is always scope for improvements in present work. In this automatic gearbox, further modifications that can be carried out are as listed below:

1. Button operated gear shifting mechanism can be employed with automatic gearbox.
2. The mechanism can be hydraulically operated.
3. Just touch button can be used instead of push button.
4. Gear indicator i.e. Visual representation of gear in which the vehicle is presently been driven, can be employed.

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