

Design and Fabrication of Reverse Gear Mechanism for Handicapped People

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Abstract— In the present scenario there were no mopped vehicles equipped with reverse gear facility. So it is very difficult for a handicapped person while the vehicles front wheel gets into a trench as well as in the case of parking. Here introducing a reverse gear mechanism, with portable gear box that can be easily operated by hand. Four gears are used for obtaining reverse motion of the vehicle. In this paper, proposes and designed a gear box which will be fitted into those vehicles without much altering the existing transmission system. This reverse gear mechanism provides a simple, low cost reverse transmission system which will be helpful for handicapped people.

Index Terms— Reverse gear mechanism, Mopped vehicle, Portable gear box, handicapped people, Gear train, Transmission System, Low cost,

1. INTRODUCTION

This project aims to help the handicapped people for their easy convenience for travelling.

They are facing many problems related to their transportation. Presently, handicapped people drive two wheelers with extra support wheels. They face difficulty in reversing the vehicle while travelling. By using this mechanism the handicapped people can easily move the vehicle backward. At present, there is no system available to back the vehicle. At times when the front wheel gets into a trench it is very difficult to take the vehicle from parking. Even normal people face much problem to take the vehicle out of the parking at that time. In case of the handicapped people who drive two wheelers with extra support wheels, face much problem to take the vehicle out of the parking by pushing the vehicle with legs as we do. In order to take the vehicle out of the parking they need to seek others help or they should push it out of the parking. As a help to them we have designed a gear box which will be fit to the vehicle. It is fitted to the side of the vehicle and helping in the backing of the vehicle. When the driver wants to move the vehicle backward what he needs is just to move the rod in the newly designed gear box in one direction and when the driver wants the vehicle to move in the forward direction,

then the rod is to be moved to the earlier position. The change of direction of the vehicle is just by the movement of the gear rod.

The physically challenged persons are one of the excluded sections of the society and also they face number of problems in their daily life. In order to bring them in the main stream both the central as well as the state governments are introducing many welfare measures and schemes. To avail these welfare measures and the schemes, first of all they must aware about the same. In motor vehicles, the transmission generally is connected to the engine crankshaft via a flywheel and or partly because inter combustion engines cannot run below a particular speed. . A simple but rugged sliding-mesh or unsynchronized/non-synchronous system, where straight-cut spur gear sets spin freely, and must be synchronized by the operator matching engine revs to road speed, to avoid noisy and damaging clashing of the gears. The now common constant-mesh gearboxes, which can include non-synchronized, or synchronized/synchromesh systems, where typically diagonal cut helical (or sometimes either straight-cut, or double-helical) gear sets are constantly “meshed” together, and a dog clutch is used for changing gears. On synchromesh boxes, friction cones or “synchro-rings” are used in addition to the dog clutch to closely match the rotational speeds of the two sides of the (declutched) transmission before making a full mechanical engagement

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2. SELECTION OF MATERIALS

The gear material should have the following properties:

- High tensile strength to prevent failure against static loads
- High endurance strength to withstand dynamic loads
- Low coefficient of friction
- Good manufacturability [1]

Generally cast iron, steel, brass and bronze are preferred for manufacturing metallic gears with cut teeth. Where smooth action is not important, cast iron gears with cut teeth may be employed. Commercially cut gears have a pitch line velocity of about 5 metre/second. For velocities larger than this, gear sets with non-metallic pinions as one member are used to eliminate vibration and noise. Non-metallic materials are made of various materials such as treated cotton pressed and moulded at high-pressure, synthetic resins of the phenol type and rawhide. Moisture affects rawhide pinions. In the manufacture of mechanical parts, knowledge of material properties, cost, design concepts and their interactions is required. The large number of available materials, together with the complex relationships between the various selection parameters, often makes the selection process a difficult task. When selecting materials, a large number of factors must be taken into account. These factors are mechanical properties, physical and electrical properties, corrosion resistance, environmental friendliness and economy. In mechanical design, however, mechanical properties are the most important. The most important mechanical material properties usually encountered in material selection process are fatigue strength, tensile strength, yield point, hardness, stiffness, toughness, creep resistance and density [1].

3. DESIGN OF GEAR BOX

The design of any gearing system is a difficult, multi-faceted process. When the system includes bevel gearing, the process is further complicated by the complex nature of the bevel gears themselves.

In most cases, the design is based on an evaluation of the ratio required for the gear set, the overall envelope geometry, and the calculation of bending and contact stresses for the gear set to determine its load capacity. There are, however, a great many other parameters which must be addressed if the resultant gear system is to be truly optimum. A considerable body of data related to the optimal design of bevel gears has been developed by the aerospace gear design community in general and by the helicopter community in particular.[7]

4. SCHEMATIC DIAGRAM FOR REVERSE GEAR

MECHANISM

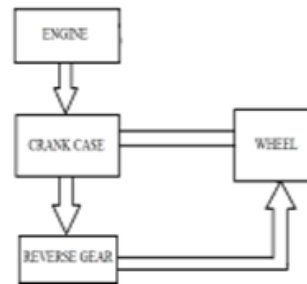


Fig. 1 Schematic Diagram of reverse gear mechanism

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5. WORKING OF REVERSE GEAR MECHANISM

A geartrain is a mechanical system formed by mounting gears on a frame so that the teeth of the gears engage.

Gear teeth are designed to ensure the pitch circles of engaging gears roll on each other without slipping, providing a smooth transmission of rotation from one gear to the next.

The transmission of rotation between contacting toothed wheels can be traced back to the Antikythera mechanism of Greece and the south-pointing chariot of China. Illustrations by the Renaissance scientist Georgius Agricola show gear trains with cylindrical teeth. The implementation of the involute tooth yielded a standard gear design that provides a constant speed ratio.



Fig. 2 Assembly of Reverse Gear Mechanism

Gear teeth are designed so that the number of teeth on a gear is proportional to the radius of its pitch circle, and so that the pitch circles of meshing gears roll on each other without slipping. The speed ratio for a pair of meshing gears can be computed from ratio of the radii of the pitch circles and the ratio of the number of teeth on each gear.

If the output gear of a gear train rotates more slowly than the input gear, then the gear train is called a speedreducer. In this case, because the output gear must have more teeth than the input gear, the speed reducer amplifies the input torque

6. BASIC LAW USED

Here we law of gearing as the most important law used in our project

$$v = r_A \omega_A = r_B \omega_B,$$

Where input gear A with radius r_A and angular velocity ω_A meshes with output gear B with radius r and angular velocity ω_B . Therefore,

$$\frac{\omega_A}{\omega_B} = \frac{r_B}{r_A} = \frac{N_B}{N_A}.$$

Where N_A is the number of teeth on the input gear and N_B is the number of teeth on the output gear.[5]

The mechanical advantage of a pair of meshing gears for which the input gear has N_A teeth and the output gear has N_B teeth is given by

$$MA = \frac{T_B}{T_A} = \frac{N_B}{N_A}.$$

This shows that if the output gear GB has more teeth than the input gear GA , then the gear train amplifies the input torque. And, if the output gear has fewer teeth than the input gear, then the gear train reduces the input torque. [4]

7. COMPONENTS

For the reverse gear mechanism we use different components . Following essential components are described below.

7.1 Spur gear: A gear is a rotating machine part having cut teethes, which mesh with another toothed part to transmit torque planet gear.

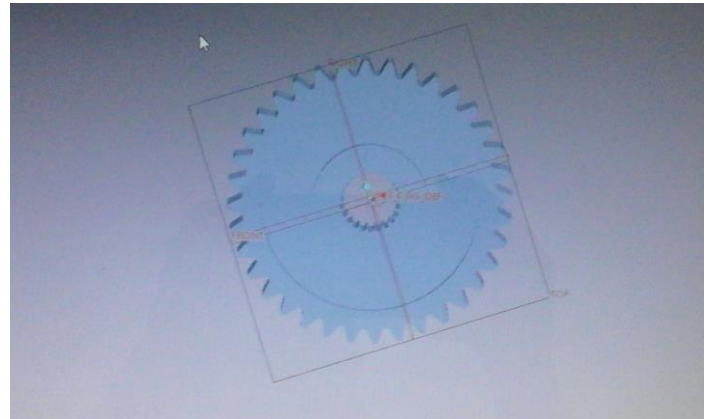


Fig. 3 Spur gear

7.2 Ball bearing ; A ball bearing is a type of balling element bearing that uses balls to maintain the separation between the bearing races

7.3 Stepped shaft : Stepped shaft carrying the power transmission from engine motor to the wheels through spur gears fitz



Fig. 4 Stepped shaft

7.4 Washer : Washer has mainly two purposes. First to distribute the pressure of the nut evenly of the surface so that surface is damaged and to ensure that the nut is pressed against the smoothed surface, reducing the chance that it will gradually loosen because it is in contact with uneven surface.

7.5 Back plate: Back plate is used to carry the gears and used to prevent malfunctioning them by dislocating.



Fig . 5 Back plate

7.6 Lever : The lever is used for engaging or disengaging of the gear mechanism. It is manually operated by the hand of driver [6]

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8. RESULTS AND DISCUSSIONS

By doing this we recognize that this mechanism will be very much helpful to the handicapped people. We have completed the Design and fabrication of reverse gear mechanism. Designed gear box is portable and easy to fix on the mopped vehicle. The reverse gear box is compatible with all mopped vehicles. Mechanism is simple and constructed according to the convenience of handicapped peoples. By this we have introduced a new idea in automobile industry with future modification favourable to physically challenged people. This mechanism will help the handicapped people for their transportation. Support wheels are provided for their secure transportation.

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