

Design and Fabrication of Cycloidal Gearbox

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Abstract – The word Cycloid, with its modifier Cycloidal, is gotten from Hypocycloid which portrays the bend followed by a point on the periphery of a littler hover pivoting inside the outline of a bigger settled circle. Much the same as words, for example, helical, worm, goad, and incline, cycloidal is a nonexclusive descriptor; it only depicts the adapting component inside the speed reducer.

A cycloid speed reducer is one of the rotational speed direction gadgets of the hardware. It has favorable circumstances of the higher decrease proportion, the higher exactness, the less demanding modification of the transmission proportion, high stun stack assimilation limit and the littler workspace than some other sorts of the reducer. This paper proposes a basic and correct approach for the projection profile outline of the cycloid plate adapt, which is a fundamental piece of the cycloid reducer.

Key Words: Cycloid, Cycloidal, Hypocycloid, Portrays, Cycloidal Reducer, Higher exactness

1. INTRODUCTION

Speed reducers are utilized generally in different applications for speed and torque transformation purposes. Among them, a cycloid reducer has been utilized for a considerable length of time attributable to their smooth and superior, high unwavering quality, long administration life, smallness, extraordinary over-burden limit, low to zero backfires through moving tooth engagement in the contact system, and different points of interest. In this way it makes an alluring contender for restricted space applications today.

A cycloid plate outfit, which is a primary piece of the cycloid reducer, networks in all teeth or flaps at any one time with the roller rigging (or ring gear) comprised of a few rollers on the roundabout pitch line. For the most part, it is arranged into four kinds of the cycloid drives by the flap profile of the cycloid plate outfit and the roller gears movement: the stationary ring gear compose epicycloid reducer, the pivoting ring gear write epicycloid reducer, the stationary ring gear compose hypocycloid reducer and the turning ring gear write hypocycloid reducer.

1.1 WORKING

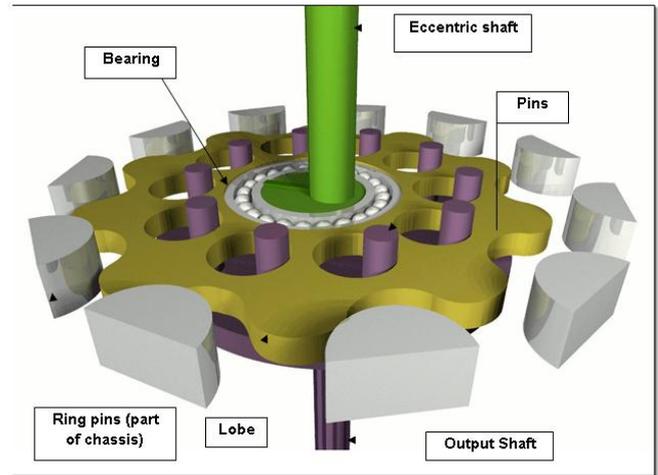


Fig-1: Animated view of cycloidal reducer

In Fig-1: Animated view of cycloidal reducer shows the actual construction of cycloidal reducer. The green shaft in Fig-1 is the eccentric shaft or also known as input shaft. The input shaft is connected to the motor. When the motor rotates it turns the input shaft which in turn rotates the bearing. On the bearing a cycloidal lobe is mounted which as shown in yellow colour in Fig-1. The lobe has teeth like structure on its periphery and it meshes with the pins on the casing shown in white colour in Fig-1. When the bearing rotates, it rotates the cycloidal lobe with it. The pins white in colour as shown in Fig-1, mounted on the casing of the reducer itself restricts the motion of the cycloidal lobe. The lobe has hole in it as shown in Fig-1 which has pins (purple coloured in Fig-1) inserted in it. When the lobe rotates and its motion is restricted by the pins (white coloured) on the casing the speed of lobe reduces. As the pins (purple coloured) are inserted in cycloidal lobe the speed of output shaft (shown in purple coloured in fig no.1) is reduced. Thus we get desired reduction ratio on output shaft.

1.2 OBJECTIVE

Compactness-Unlike helical speed reducers which require extra stages to accomplish higher diminishment proportion (expanded size/weight, diminished effectiveness, more orientation and apparatuses to keep up), changing the proportion of cycloidal Reducers (up to 87:1) includes just the changing of ring gear rollers, cycloidal plate flaps, and capricious bearing. The physical measurements of speed reducers continue as before.

Performance Criterion-Rolling movement makes insignificant rubbing. Insignificant grating adds to negligible wear and insignificant warmth age. Worm equip reducers execution is greatly limited by thermal rating. Cycloidal Reducers with rolling components internally, appreciate negligible warmth misfortune. The warm capacity of each casing size and proportion of cycloidal reducers surpass its mechanical ability. Worm equip reducers are described by bring down effectiveness; you can choose a littler size cycloidal reducer and still appreciate bigger yield control. The final product is longer administration life and enormous vitality sparing.

2. QUICK AND SELECTION PROCEDURE

How to determine the reduction ratio of a cycloidal reducer?

$$\text{Ratio} = (P-L) / L$$

Where P = Number of ring gear pins/rollers

L = Number of lobes on a cycloidal disc

For example, the number of ring gear pins/rollers (P) equals 12, and the number of lobes (L) on the cycloidal disc equals 12:1

$$\text{Ratio} = (13-12) / 12 = 1 / 12 = 12:1$$

2.1 BEARING SELECTION PROCEDURE

Force exerted due to cycloidal disc on bearing (F) = $mr\omega^2$

$$= 0.5 * 42 * 1473.04$$

$$= 30.933 \text{ KN}$$

Calculation for equivalent load (P_{eq})

$$= (VX F_r + Y F_a) * S * K_t$$

Where, X = Radial load factor

Y= Axial load Factor

S= Service Factor

F_r = Radial load

F_a = Axial load

K_t = Temperature coefficient.

V= Rotation Factor

$$= (1 * 1.2 * 3100 + 0) * 1.2 * 1$$

$$= 4464 \text{ kgf}$$

Calculation of required dynamic load capacity (C)

$$= (L/L_{10})^{1/3.33} * P$$

$$= (100/1)^{1/3.33} * 4464$$

$$= 17771 \text{ kgf}$$

Selecting NU316 ECJ of dynamic capacity 22000 kgf



Fig-2: Bearing

The rollers of bearing as shown in Fig-2 will act as the pins on casing.

3. CONCLUSIONS

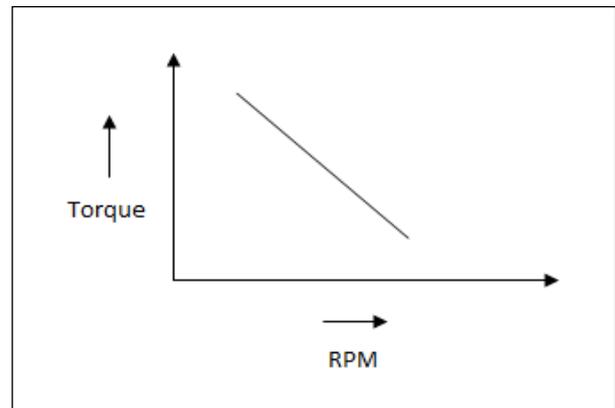


Fig-3: RPM vs Torque

Phenomenal execution against worm outfit reducers - Rolling movement makes negligible rubbing. Negligible erosion adds to insignificant wear and negligible warmth age. Worm outfit reducer's exhibitions are enormously restricted by warm appraising. Cycloidal Reducers with moving parts inside, appreciate insignificant warmth misfortune. The warm ability of each edge size and proportion of Cycloidal Reducers surpass its mechanical capacity. Worm outfit reducers are described by bring down productivity; you can choose a littler size Cycloidal Reducer and still appreciate bigger yield control. The final product is longer administration life and enormous vitality sparing. The contact in case of cycloidal gears is between the concave and convex flank. This resulted in less wear and tear.

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