ORIGINAL RESEARCH PAPER

Engineering

DESIGN OF TRANSMISSION SYSTEM OF GO-KART

KEY WORDS:

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ABSTRACT

The aim of this transmission paper is to emphasize the transmission system of GO-KART vehicle which was created by IIMT COLLEGE OF ENGINEERING by accumulative work of 20 student of Mechanical Engineering 4th ,3rd and second year to contend in international F-9 championship 2016-17 organised by K.K motors Bhopal.

The basic aim is to provide a transmission which is compact in size, lighter in weight, simple in design and shorter chain sprocket is used to minimize the losses in the vehicle .It would be working well and provide continuous and smooth power for vehicle rolling. Apart from that we are plan to increase the output of GO-KART in following aspect such as below:-

1. More useable power.
2. Better fuel economy.
3. Smoother driving experience.
4. Lighter engine weight.
5. Reduce power losses.

2. Introduction

The word transmission is refers to transmit power from engine output shaft to driving wheels and they provide rolling motion to vehicle. In our vehicle a mechanical linkage torque convertor and chain sprocket are used for design the transmission system of our GO KART.

We are used a torque converter in comparison of centrifugal clutch because, the torque converter belt work on under tension ,engine horse power is slightly larger than rear wheel horse power of belt under tension causes friction.

It simply tell us about the engine operate at a high RPM, and therefore were it is putting out more power. We are notice during our practical work, the centrifugal clutch gives overheating, slippage which result shows more heat is generated, and this heat can damaged the engine, Hence more power losses occurred in the transmission and efficiency of engine is not so good as compared to others. Therefore to reduce these losses a torque convertor is used.

3. Literature review

Go kart is a simplest form of vehicle which made using simple concept of physics and engineering mechanics.

The first go kart manufacturer in the year 1958, normally a go kart is in single seated, go kart can be manufacture in different shape and size according to racing requirements.

This paper provides the design of transmission system (power) which provides rolling motion of vehicle.

Transmission system is a mechanism which is consists of a torque convertor, wheel sprocket; a radial chain drives a Centrifugal clutch. A torque convertor is connected at the engine output shaft to produce motion.

And this motion is transfer through a chain drives and sprocket to the rear wheel axis.

4. METHODOLOGY

Selection of torque converter

After comparing the various parameters such as cost, fuel economy, power losses and performance of engine. We are conclude and used a mechanical linkage torque converter (works on mechanical clutch rather than a fluid coupling) in our GO-KART instead of a hydraulic torque converter. Apart from the converter is also linked to a lock-up clutch mechanism which also used in our vehicle for improving the performances of engine.

Show that the torque converter with the lock-up clutch.

Significance of mechanical linkage torque converter:-

- It allow the output shaft to be stopped without stalling the engine, and without physical disconnecting the input and output shafts.
- It is able to produce more rpm making the speed of engine transfer to the final drive increased.
- More power is transmitted to the engine because; it is directly attached to axle shaft with help of linkage.
- The power losses can be reduced by using clutch in compression of fluid flow into converter
- It is easy to connect on the engine
- It much faster speeds than Centrifugal clutch.

Mechanism of lock-up clutch

A lock-up clutch as see in figure mechanism is a concept in which the clutch is directly attached in the torque converter to connect the engine and axle shaft for reduces the power losses in the engine of a vehicle. When the vehicle reaches at a certain speed, the lock-up clutch mechanism is used to raise the power performances and fuel efficiency due to this the output of an engine can be improved. And we are getting better result in driving experience. The lock-up clutch is connected on the turbine hub, in front of turbine runner.

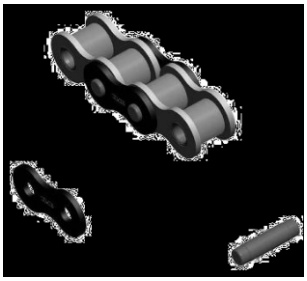
Selection of chain sprocket

Chain drives

As we know that chain sprocket is implies of two different words. It

can be consist as a chain drive and sprocket. A chain drive is the effective way to transmitting the mechanical power Between the one shaft to another shaft as comparing the other drives such as belt and gear drives. Another advantage of using chain drive with sprocket is that the positive action (engagement of tooth of sprocket is meshed with chain drive hole. And makes a compact assembly then other) is occurred between the sprocket and chain drive.

In our GO-KART vehicle a roller chain drive is used. Because in our vehicle the distances between the two axle shafts is too long, therefore a gear drive is unable to providing the power from one shaft to another shafts, also in this less frictional as well as narrow in width. For more information and detailed regarding the roller chain drive transmission we refers the Design Data Handbook for Mechanical Engineers. A single roller chain drive sees in figure below.

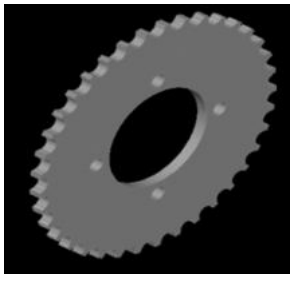


Single roller chain drive

Sprockets

Another element of chain sprocket in our vehicle is sprocket. It is implies to that a wheel having a radial projection and engaged to a chain which is passing over it. In a transmission system the sprocket are used to transmit the rotary motion between the shafts. It is differing to gears and pulley because it can never engage to each other due to this smooth power is transmitting to the vehicle engine.

Sprocket does not have any flange; therefore no problem of slippage is occurred. Due to this more mechanical power is used for working. It can be run at very high speed at very less noise. For more about the detailed and designed of sprocket chain drives we are refers to the Design Data Handbook for Mechanical Engineers (written by K.Mahadevan and K.Balaveera Reddy) and can seen to page no.300 and figure no.14.11(a) and 14.11(b). A sprocket wheel sees in figure below.



Sprocket wheel

5. CALCULATION

Design a transmission system of our GO-KART

Chain(SKF)	06C-1
Small sprocket	PHS06B1A15
Large sprocket	PHS06B1B60
Engagement method	Keyway
Locking rpm	800

Pinion rpm= 3000
Chain skf 35-1(06c-1)
Pitch circle=63.91mm, 9.525mm
Maximum power=5.07kw
Power to be transmitted

STEP (1): Here k_1=1, k_2=1.26, k_3=1.4(coefficient)
Power transmission of sprocket

$$P = \frac{5.7 \times k_3}{k_1 \times k_2}$$

Calculated value at different number of teeth

1) If Z1=15, Z2=60(number of teeth)

$D_1 = \frac{9.53}{SIN\frac{180}{15}}$ = 45.83mm (diameter of large sprocket)

$D_2 = \frac{9.53}{SIN\frac{180}{60}}$ = 182.09mm (diameter of small sprocket)

Put the value of number of teeth in equation 1

a =30P (standard formula) =30×9.53= 285.9mm=11.25"

Here a= centre distance

$$l_n = 2\frac{a}{p} + \frac{z_1+z_2}{2} + \left(\frac{z_2-z_1}{2\pi}\right) 2 \times \frac{p}{a} \quad \text{.....(1)}$$

$l_n = 2\left(\frac{285.9}{9.81}\right) + 37.5 + 1.70$

$l_n = 97.49 \sim 98$

Centre distance

$l_n - \frac{z_1+z_2}{2} = 60.5$

Put the value of equation 1 in equation 2

$$a = \frac{p}{4}\left((z_n - (z_1+z_2 \div 2) + \sqrt{(ln - \frac{z_1+z_2}{2})sq. - 8\left(\frac{z_2-z_1}{2\pi}\right)sq}\right)$$

$$= (60.5 + \sqrt{60.5sq - 410.35})\frac{p}{4} \quad \text{.....(2)}$$

=279.96mm=11.022''

Assumption

P=9.525mm (pitch), width between inner plates ($b_{1\ min}$=5.72)
Roller diameter (d_1=6.35),
Bearing pin body diameter ($d_{2\ min}$=3.28)
Chain path depth (h_{1min}=8.52)
Inner plate depth (h_{2min}=8.26)

Measuring load (8kg)
Breaking load (910kg)
Service factor (k_s=1.20)
Minimum centre distance coefficient (k_1=1.2)
Factor of safety k_1=14.8
Coefficient of drag=6(horizontal)

STEP (2): Average speed of chain

$v = \frac{pzn}{1000}$

Here p=pitch
Z=no of teeth on sprocket
N=rps=rpm/60

$V = \frac{9.525 \times 15 \times 4000}{1000 \times 60}$

$V = 9.525 \frac{m}{s}$

STEP (3): Tangential force

$F = \frac{1000 \times p}{v}$

$F = \frac{1000 \times 5.58}{9.525}$ =585.82N

STEP (4) Allowable working load per strand

$= \frac{1000 \times 5.58}{9.525}$

Here F_s=factor of safety
K_s=service factor
F_u=ultimate strength or braking load of chain

STEP (5): FOS (F_s) = $= \frac{F_u}{F+F_c+F_S}$

$\mathbf{F_c=M}$ x $\boldsymbol{vsq}$ here m=mass

F_c=2 x 9.525sq here sq =square

F_c=181.45N

$F_s=k_2 x w x a$ here k_2=coefficient, a=centre distance (m)

F_s=6 x 2x 9. 81 x 279.96 =32.84

F_u=910kg
FOS (F_s) = $= \frac{910 \times 9.81}{585.82+181.45+32.84}$ =11.15

STEP (6): Allowable work load

Fw= $\frac{297.57}{11.15 \times 1.2}$ =22.23N

STEP (7): Power transmitted by chain

P= $\frac{F_U \times V}{F_S \times K_S} = \frac{910 \times 9.81 \times 9.525}{11.15 \times 1.2}$ = =6.35kw

6. Result

The above manual calculation is satisfied to over vehicle.
1. Locking RPM of torque converter is 800rpm.
2. Total weight at rear is considered as 60kg
3. Gear ratio selected is = 4.1
4. Efficiency of engine = 57.3% L= length of chain
a = centre distance of shafts T = torque (N-m)
N = RPM
5. Torque generated at 800 rpm is 97.4 Nm
6. Tractive force
F = m x g x μ x
= 60 x 9.81 x 0.7 x 0.127
= 52.32 Nm

7. Conclusion

Hereby we conclude that all the above analysis and data is verified and calculated up to the best of my knowledge.

8. Acknowledgments

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9. References

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