RESEARCH ARTICLE

CHAINLESS CYCLE USING GEAR DRIVE MECHANISM.

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Manuscript Info	*Abstract*
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Present days we are using cycles with chain drive mechanism and gear cycles with gear mechanism. By these cycles we are facing some problems like less speed, chain disengage from the sprocket, fluctuations in speed. We are introducing a chain less cycle having shaft drive mechanism. By this cycles we are overcome that problems.in this cycle we are using shaft drive mechanism instead of chain drive mechanism. The main objective of our project is chain less cycle using rotatable drive shaft for transferring the pedal actuated drive force from the pedal crank shaft to the rear wheel including shaft mechanism to provide different drive ratios. By this chain less cycle we increase the speed and consistent rate of efficiency than the existing ccycles.in this cycle we are using spiral bevel gear, universal joint, rotatable shaft drive, plumber blocks and bearings.

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Introduction:-
The invention relates to bicycles drive mechanism, and in particular to a chainless drive mechanism for transmitting the pedal actuated driving force to the rear wheel. Another type of multispeed drive mechanism for bicycles is known as the chainless type. This mechanism uses a shaft of a chain for transmitting the pedal actuated driving force to the rear wheel. A chain less drive mechanism for a bicycle using a rotatable drive shaft for transferring the pedal actuated driving force from the pedal crank shaft to the rear wheel including shaft mechanism to provide different drive ratios. Many of these mechanisms use expensive bevel or angled gears which intermesh with rings gear mounted on the rear wheel axle or pedal crank shaft.

The intermeshing gears on the rear wheel slip automatically upon stopping or slowing down of the rotation of the pedal crankshaft and drive shaft, permitting continued rotation of the rear wheel gear during costing of bicycle.

Working:-
Multispeed bicycles have become ever increasingly popular in the past several years and are accounting for a large portion of bicycle sales. The speed advantages and ease of operation of these multispeed bicycles are some of the main factors increasing their popularity. The most common multispeed transmission for these bicycles is the derailleur gear chain drive system. The derailleur chain drive system comprises a plurality of sprockets of various sizes mounted on the rear wheel shaft in combination with a shifting mechanism which causes the chain to move

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from one sprocket to another, together with a spring actuated device to adjust and maintain the correct tension in the chain. The various sizes of the drive sprockets provide for the selection of a desired gear ratio depending upon the particular terrain over which the bicycle is being driven.

Such derailleur systems, however, are relatively expensive, complex and are subject to substantial maintenance problems due to the use of a chain and the continual movement of the chain between sprockets to achieve the desired gear ratio.

Another type of multispeed drive mechanism for bicycles is known as the "chainless" type. This mechanism uses a shaft instead of a chain for transmitting the pedal actuated driving force to the rear wheel. Various types and arrangements of chainless bicycle drive mechanisms have been developed in the past which use such drive shafts for transmitting the driving force supplied by an operator through the pedal actuated crankshaft to the rear wheel. Many of these mechanisms use expensive bevel or angled gears which intermesh with ring gears mounted on the rear wheel axle or pedal crankshaft. Examples of such prior mechanisms are shown in U.S. Pats. Nos. 479,470, 506,685, 589,266, 614,969, 624,964, 649,878, 1,334,108 and 2,378,634.These mechanisms also are provided with means for shifting the intermeshing gears selectively into engagement with a selected ring gear to affect the gear change or speed ratio adjustment. Another known type of chainless multispeed bicycle drive mechanism is shown in U.S. Pat. No. 3,863,503, which uses an axially adjustable two piece drive shaft having gears on the ends thereof, which gears selectively engage concentric gear teeth formed on a pair of front and rear discs.

Various problems exist with such known constructions in that the concentric gear rings or teeth on the discs are expensive to produce since they require elaborate machining and manufacturing procedures. Likewise, the intermeshing gears are of the expensive bevel gears.

Chain less cycle by using shaft driven mechanism:-

Parts used in this Cycle:-
1. Sprocket gear
2. Bevel gear at pedal shaft (35 teeth)
3. Spiral bevel gear at front position of shaft (15 teeth)
4. Universal joint
5. Driven shaft
6. Bevel gear at rear position of the shaft (9 teeth)
7. Spiral bevel gear at rear wheel hub (15 teeth)
8. Plumber block
9. Bearings

Line Diagram:-
Pedal shaft --- 39th bevel gear ---- 15th spiral bevel gear ---- universal joint ---Driven shaft ---- 9 teeth bevel gear ---- 13 teeth bevel gear ---- rear wheel hub.

Spiral bevel gear Alignment:-
Have curved teeth at an angle allowing tooth contact to be gradual and smooth. Spiral bevel gears In our cycle we are used four spiral bevel gears with different teeth.

2.5:- Number of teeth:

At front roll: 39
At front position of the driving shaft: 9
At rear position of the driving shaft: 15
At rear wheel hub: 18

Geometry of Bevel Gear:-
List of Drawing Symbols:-
- **Np** - Number of teeth on pinion
- **Ng** - Number of teeth on given gear
- **Dg** - Pitch diameter of given gear
- **Dp** - Pitch diameter of given pinion
- **F** - Face width (length of single tooth)
- **γ** - Pinion pitch angle (radians)
- **Γ** - Gear pitch angle (radians)
- **Ao** - Cone distance (distance from pitch circle to intersection of shaft axes)
- **rb** - Back-cone radius
- **P** - Diametrical pitch (teeth per inch of pitch diameter (N/D))
- **p** - Circular pitch (inches of circumference per tooth (Π/P))

Mean Radius:-
Hp=Tx n/63000 → T = Hp x 63000/n
T = Rpm x Wt → Wt = Hp x 63000/ n x Rpm

Advantages:-
- This gear makes it possible to change the operating angle.
- Differing of the number of teeth (effectively diameter) on each wheel allows mechanical advantage to be changed. By increasing or decreasing the ratio of teeth between the drive and driven wheels one may change the ratio of rotations between the two, meaning that the rotational drive and torque of the second wheel can be changed in relation to the first, with speed increasing and torque decreasing, or speed decreasing and torque increasing.

Disadvantages:-
- One wheel of such gear is designed to work with its complementary wheel and no other.
- Must be precisely mounted.
- The shafts' bearings must be capable of supporting significant forces

Universal joint:-

Universal joints are available in steel or in thermoplastic body members. Universal joints made of steel have maximum load-carrying capacity for a given size. Universal joints with thermoplastic body members are used in light industrial applications in which their self-lubricating feature, light weight, negligible backlash, corrosion resistance and capability forhigh-speed.

Universal joints of special construction, such as ball-jointed universals are also available. These are used for high-speed operation and for carrying large torques. They are available both in miniature and standard sizes.

Advantages:-
Low side thrust on bearings, large angular displacements are possible, high torsional stiffness, High torque capacity.

Disadvantages:-
Velocity and acceleration fluctuation increases with operating angle, Lubrication is required to reduce wear, Shafts must lie in precisely the same plane, Backlash difficult to control.

Drive shaft parts:-

Pillow block:-

Theoritical proof:-
Here we can prove the shaft drive cycles will transmit more power than the chain drive cycles by this method. By given same load at both cycles.

Chain Drives:-
Given load   W = 1000 N
Teeth at pinion sprocket T1 = 18
Teeth at larger sprocket T2 = 44
Rpm at pinion sprocket N1 = 2300 (from the table)
Rpm at larger sprocket N2 =**?**

We know that
T2/T1 = N1/N2
N2 = (T1/T2) (N1**)** = 18/44 (2300)
N2 = 1000.2 rpm
Diameter of the pinion sprocket D1 = p cosec (180/T)
= 8 cosec (180/18
D1   = 4.6 mm

Diameter of the larger sprocket D2   = p cosec (180/T2)
= p cosec (180/44) = 112.14 mm
Load W = Rated power/pitch line velocity
1000   = p/πd1n1
P   = 1000 × 5.611
Rated power   = 5611 N
Design power   = Rated power × service facto
 = 5611 N × 1.25 × 1
Design power   = 7 KN

In shafts drives if u give the 1000 N load at pedal shaft, 7 KN power will be transmitted from larger sprocket to pinion sprocket.

Shaft Drives:-
Here the power is transmitted through the two bevel gears and one rotatable shaft
Design transmitted load = (P× 1000× C0)/ (V)
Here, P = power to be transmitted
C0 = service factor
V = pitch line velocity
Where   V = π× (Dp/60) ×N
Dp = pitch diameter
N1 = rev/min
Given Load Ft = 1000 N
Service factor C0 = 1.2
We know that
Load = (1000 ×P× C0) / (V)
V = π × (Dp/60) ×N1 = π × (0.06 / 60) × 2500
Pitch line velocity V = 4.39 m/s
Design transmitted power = (load × V) / (1000 × 1.25) the power transmitted in shaft drives = 10.47 KN
Hence we proved the power transmitted in the shaft drive mechanism is 3.47 KN more than the chin drive.

Table 1:- Maximum Allowable Speed For Chains In Rpm.

Typeofchain	Numberof Teeth On the smaller Sprocket [T1]	Chain Pitch [P] In mm				
		12	15	20	25	30
Roller Chain	15	2300	1900	1350	1150	1100
Roller Chain	19	2400	2000	1450	1200	1050
Roller Chain	23	2500	2150	1550	1300	1100
Roller Chain	27	2550	2150	1550	1300	1100
Silent Chain	17-35	3300	2650	2200	1650	

Conclusion:-

A fundamental issue with bicycle shaft-drive systems is the requirement to transmit the torque of the rider through bevel gears with much smaller radii than typical bicycle sprockets. This requires both high quality gears and heavier frame construction.Since shaft-drives require gear hub for shifting, they gain the benefit that gears can be shifted while the bicycle is at a complete stop or moving in reverse, but internal hub geared bikes typically have a more restricted gear range than comparable derailleur-equipped bikes.Most of the advantages claimed for a shaft drive can be realized by using a fully enclosed chain case. Some of the other issues addressed by the shaft drive, such as protection for clothing.

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