Study of Convertible Wheel Drives Using Chain Sprocket

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ABSTRACT

A cycle is an example of local transport. Tricycles are usually used for commercial transportation purpo se. Various types of configurations of bicycle or tricycle are available in market. Present study is focused on convertible wheel drives using chain sprocket. Which is eliminate the need of gearing and rope pulley mechanism to transmit power. This method of transferring the power is also more suitable than the shaft drive mechanism. This paper is study and review of experimental work brought by researchers on drive mechanism of cycle in order to optimize its operating performance.

Keyword: *- Cycle1, Key Convertible wheel2, Drive mechanism3, and Chain Sprocket4*

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1. Introduction

This paper present the study of convertible wheel drives using chain sprocket this methods is generally used in bikes. In this vehicle piston engine produce the power and drives sprocket which is mounted on axle, sprocket drives the wheel by transferring the through chain.

1.1Sprocket

It is a profiled wheel which has a number of teeth on it. The teeth on this wheel are designed and placed properly based upon various calculations of the design. The main objective of this sprocket wheel is to mesh with the chain drive for the transmission of the power from one circuit to the other. There is a major difference between the gears and the sprockets. The gears can be meshed together to transmit the power, but a sprocket can never be meshed together.
The sprocket wheel which we have used has total teeth of 35. The sprocket wheel is machined perfectly to fix, it on the transmission box of the rear wheel. Then by fixing it in to the box it is welded at the joints so that it won't cramp of come off during the operation of the bicycle.
When the gears cannot be used to transfer linear motion between the shafts, the sprocket wheels are used. These kinds of sprocket wheels are widely employed in cars, motor bikes etc for the transmission of power. The main advantage of sprocket wheels are that, they can be run at very high speed and the noise produced by these sprockets is too minute for an ear to hear. This sprocket is fixed on the rear wheel and is usually welded on the transmission.

Fig-1: Sprocket wheel

1.2 Sprocket Types

There are many types of sprockets to fit the various types of chain versions, and the number of choices. In general, these sprockets have hub configurations similar to roller chain. Spokes or lightening holes are generally used to reduce the weight of these sprockets, which are generally larger and heavier than roller chain sprockets. Following are some of the specific types that are designed to handle different installation and operating conditions.
One type of sprocket is split into two the 180-deg segments, to simplify installation and removal, particularly of large sprockets those are installed between bearings. This lets a technician place them on the shaft and bolt the m together without removing disturbing the shaft alignment. Sprockets with removable rim segments enable replacing wear surfaces without removing the sprocket hubs or moving the shafts. These come in both split and non -split versions.
Wide-flange, drum-type sprockets, support the wide offset chain often used in drag conveyor applications. These sprockets are generally made of cast steel or flame-cut steel plate.

Another type of sprocket, called a traction wheel, is used in bucket elevators instead of conventional chain and sprockets. It has a smooth OD, rather than teeth, and it functions by frictional engagement with the bushings in the chain links. Elevator drive applications cause rapid tooth wear due to a scrubbing action between conventional sprocket teeth and chain rollers. Traction wheels eliminate this effect, so that they last longer. Also, many of them have segmented rims to replacing wear surfaces. In event of an obstruction, the chain slips on the OD of the traction wheel, thereby preventing damage to elevator components. Because slippage may generate heat and sparks, avoid using traction wheels in applications where an explosion may occur. The frictional grip of a traction wheel must be sufficient to transmit the required power. Therefore, make sure elevator height, material lubricity, and chain tension are within a range.

1.3 Tooth shape

Teeth come in different shapes to accommodate various types of engineered chain and operating conditions. For example, the tooth profile for engineered drive chain is approximately the same as for roller chain. But conveyor chain and engineered bar chain require different profiles.

Some sprockets used with long pitch conveyor chains resemble bar chain sprockets but include pockets at the tooth corners to accommodate the chain rollers. Conveyor chains normally have attachments on the top side, which, if used with a drive chain sprocket, would interfere with the tops of the teeth. Therefore, make sure the sprocket matches the chain type. Engineered chain drives often operate in contaminated environments, which require a modified tooth form to accommodate foreign elements that get between the chain and sprocket teeth. Unlike a roller chain sprocket tooth, which has minimal pitch line clearance, the sprocket tooth for engineered chain is narrower to provide more clearance.

1.4 Chain

A chain is series of connected links which is generally made of metal it may be two or more link.

Terms used inn chain

Pitch of chain. It is the distance between the hinge centre of a link and the corresponding hinge centre of the adjacent link, as shown in

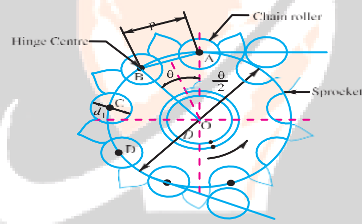


Fig-2: Terms used in chain

Pitch circle diameter of chain sprocket. It is the diameter of the circle on which the hinge centers of the chain lie, when the chain is wrapped round a sprocket as shown above Fig-2

The chains are mostly used to transmit motion and power from one shaft to another, when the centre distance between their shafts is short such as in bicycles, motorcycles, agricultural machinery, conveyors, rolling mills, road rollers etc.

1.5 Classification of Chains

The chains, on the basis of their use, are classified in to the following three groups:

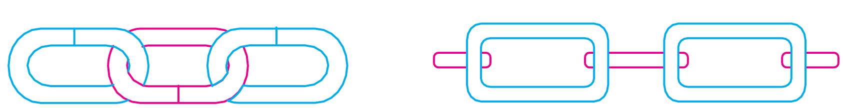
- Hoisting and hauling (or crane)chains,
- Conveyor (or tractive) chains, and
- Power transmitting (or driving) chains.

1.5.1. Hoisting and Hauling Chains

These chains are used for hoisting and hauling purposes and operate at a maximum velocity of m / s.The hoisting and hauling chains are of the following two types:

1.5.1.1 Chain with oval links

The links of this type of chain are of oval shape, as shown in Fig-3The joint of each link is welded. The sprockets which are used for this type of chain have receptacles to receive the links. Such type of chains is used only at low speeds such as in chain hoists and in anchors for marine works.



(*a*) Chain with oval links. (*b*) Chain with square links.

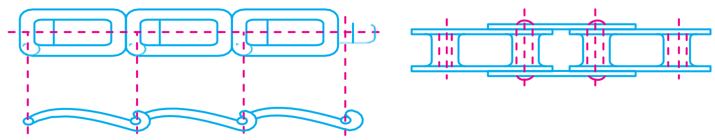
Fig-3 Hoisting and hauling chains

1.5.1.2Chain with square links

The links of this type of chain are of square shape, as shown in Fig-4Such types of chains are used in hoists, cranes. The manufacturing cost of this type of chain is less than that of chain with oval links, but in these chains, the kinking occurs easily on overloading.

1.5.2 Convey or Chains

These chains are used for elevating and conveying the materials continuously at a speed up to 2m / s.The conveyor chains are of the following two types:



(*a*) Detachable or hook joint type chain. (*b*) Closed joint type chain.

Fig-4: Convey or chains.

Conveyors chains are usually made of malleable cast iron. These chains do not have smooth running qualities. The conveyor chains run at slow speeds of about 0.8 to 3m/s.

1.5.3 Power Transmitting Chains

These chains are used for transmission of power, when the distance between the centers of shafts is short. These chains have provision for efficient lubrication. The power transmitting chains are of the following three types.

Block or bush chain. A block or bush chain is shown in Fig-5 this type of chain was used in the early stages of development in the power transmission.

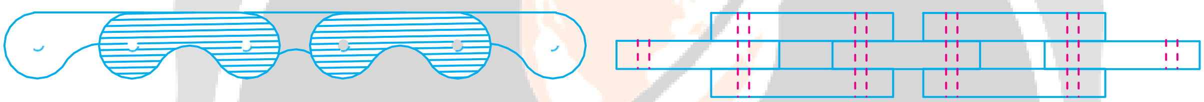


Fig-5: Block or bush chain

It produces noise when approaching or leaving the teeth of the sprocket because of rubbing between the teeth and the links. Such type of chains is used to some extent as conveyor chain at small speed.

1.6 Chain Drives

Power has to be generated from one device and should be transmitted to another in any kind of mechanical system. Only then the system will be working in order. The most common types of transmission used are belt and chain drive systems. In this project we have used chain drive transmission system for power transmission. The chain drives are a kind of hybrid between the belt drives and the gear drives. The advantages of both the drives are present in this chain drive system. The nominal velocity between which the chain drives are employed are between 10m/s to up to 30m/s. in this transportation industries, the importance of the chain drive is colossal. These chain drives find its application in bicycle, automobiles, machinery, bikes, material handling machineries etc.

In many systems, a continuously variable transmission system can also be used. In this kind, the chain ratio and the radius change accordingly to transmit the power. The chain drive is chosen due to its high performance and efficiency in transferring power. In this project we have employed a chain drive that has around 125 teeth in it. We have added some more teeth to the conventional chain drive. Two chain drives are used for the transmission of power between the wheel and pedal and also between the rear end sprockets to the flywheel.

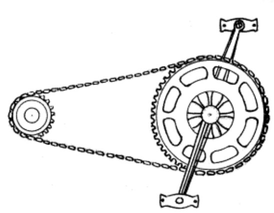


Fig-5: Chain drive

2. Literature Survey

2.1 James B. Spicer et al. [1] have performed experimental study on the efficiency of bicycle chain drives under a variety of operating conditions and to explore the factors that govern chain drive efficiency. The efficiencies of bicycle chain drives was investigated both experimentally and theoretically to provide quantitative measurements of chain drive efficiency and to present models for power loss. These models for drive losses have been used to interpret experimental results. Assuming that the losses in the chain drive result from friction between contacting components that execute motion relative to one another, there are three significant sources for loss as follows:

- Inner link bushing and chain pin
- Chain line offset
- Sprocket tooth, link roller and inner link bushing.

Tests of efficiency for the derailleur-type chain drive indicate that the overall efficiencies for the transfer of power from the front drive sprocket to the rear sprocket range from 80.9% to 98.6%. Primary factors affecting the efficiency include the sizes of the sprockets in the drive and the tension in the chain. It was found that larger sprockets provide more efficient transfer of power while smaller sprockets proved to be less efficient. In frictional loss models a 2–5% loss difference was measured between the 52–11 and the 52–21 sprocket combinations depending on the drive operating conditions. Experimental results indicated that the efficiency varied linearly with the reciprocal of the average chain tension with the highest efficiencies occurring at high chain tensions and lowest at low chain tensions. It was found that chain line offset and chain lubrication has a negligible effect on efficiency under laboratory conditions. Infrared measurements of drive components indicate that frictional losses in the chain cause the chain temperature to rise during operation

2.2 Paola Zamparo et al. [3] have performed experimental study on the mechanical efficiency of cycling with a new pedal–crank prototype (PP) using stationary cycloergo meter. The efficiency values were compared with those obtained, in the same experimental conditions and with the same subjects, by using a standard pedal–crank system (SP). The main feature of this prototype is that its pedal–crank length changes as a function of the crank angle being maximal during the pushing phase and minimal during the recovery one. This variability was expected to lead to a decrease in the energy requirement of cycling since, for any given thrust; the torque exerted by the pushing leg is increased while the counter-torque exerted by the contra-lateral one is decreased.
A schematic representation of the pedal-crank prototype (PP) tested in this study is shown in figure (11) (1: crank; 2: pedal). The length of crank arm (R), defined as the distance between the centre of the ‘‘bottom bracket’’ pedal pivot, is normally fixed. However, on this prototype, the pedal pivot centre (3)/bottom bracket centre (4) distance changes continuously during the crank circumference. This is achieved by the use of a sun (6) and sun–wheel (5) gear type arrangement; the pedal pivot is attached the sun–wheel on roller bearings (7) to minimize pedaling resistance. In addition, the pedal and pivot are captive as one face of the enclosure (8) is open. Finally, the length of the pedal–crank system (distance 3–4) varies as a function of the crank angle.

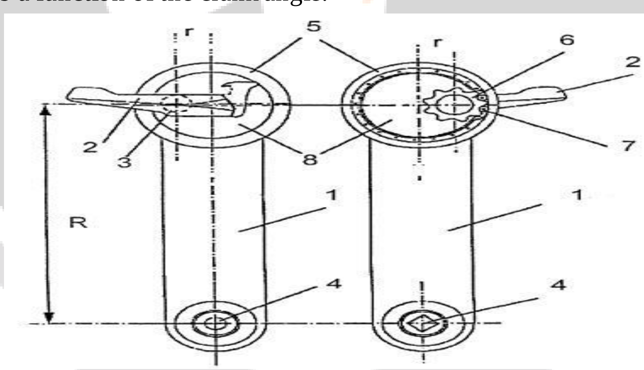


Fig-6: Pedal Cranck

Fig-8: Schematic representation of pedal crank system adopted in this study (front view on the left, rear view on the right). In the result of experiment, differences in radius and angular velocity between the two pedals are reported as a function of the crank angle. Even if the pedal–crank forces the motion of the lower limbs along a different path, the spanned angle changes accordingly, so that the angular speed during the crank revolution turned out to be almost the same as that of a standard, circular, pedal–crank system. Finally, to accelerate the limbs in respect to the body.

2.3 J.C. Martin et al. [2] have performed experimental study to determine the effects of cycle crank length on maximum cycling power, optimal pedaling rate, and optimal pedal speed, and to determine the optimal crank length to leg length ratio for maximal power production. The experiment has been performed using crank lengths of 120, 145, 170, 195, and 220 mm. The results obtained from experiment are shown in graph plots below.

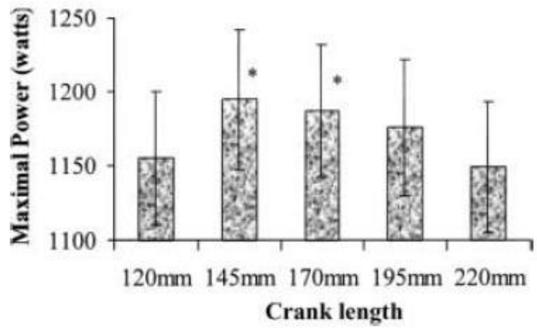


Fig- 6: Maximum power versus crank length.

3. Application

Convertible Wheel Drives Using Chain Sprocket Used in bicycle and tricycle to transfer the power to wheel. In various industries the people using to supply the goods to demand and from demand to supply as conveyor. Simple way to understand this method is used in bike to transfer the power from chain sprocket to wheels.

4. Conclusion

This method shows the various advantages like it give fewer loads on shaft and it transmits more power than belts. As no slip takes place during chain drive, hence perfect velocity ratio is obtained and its good for long as well as short distance. Production cost is relatively high and the chain drive has velocity fluctuations especially when unduly stretched. It has the ability to transmit motion to several shafts by one chain only. The chain drive needs accurate mounting and careful maintenance, particularly lubrication and slack adjustment. It gives high transmission efficiency (upto98percent).It can be operated under adverse temperature and atmospheric conditions. It permits high speed ratio of 8 to 10 in one step.

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