Literature Survey of Convertible Wheel Drives Using Chain Sprocket

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ABSTRACT

Present study is focused on convertible wheel drives using chain sprocket. This mechanism eliminates the need of gearing and rope pulley mechanism to transmit power. A two wheeler is an example of local transport. Many vehicles are designed as to transfer power to rear wheel, forward wheel or sometimes both forward and rearward wheel.in two wheeler is most common practice is to use the chain sprocket mechanism to transfer the power from engine to wheels. 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.*

1. Sprockets

A sprocket is a toothed wheel upon which a chain rides. Contrary to popular opinion, a sprocket is not a gear.

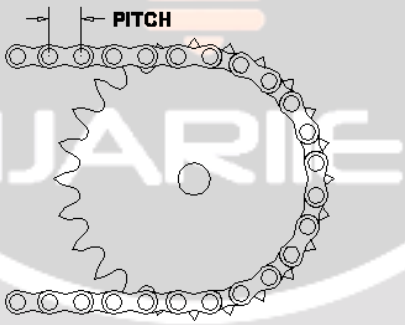

Fig-1: Chain Sprocket

1.1 Types of Sprocket

There are four types of sprocket;

- Type A: Plain Plate sprockets
- Type B: Hub on one side
- Type C: Hub on both sides
- Type D: Detachable hub

Sprockets should be as large as possible given the application. The larger a sprocket is, the less the working load for a given amount of transmitted power, allowing the use of a smaller-pitch chain. However, chain speeds should be kept less than 1200 feet per minute. The dimensions of a sprocket can be calculated as follows, where P is the pitch of the chain, and N is the number of teeth on the sprocket;

Pitch Diameter = P ÷ sin (180° ÷ N)
Outside Diameter = P × (0.6 + cot (180° ÷ N))
Sprocket thickness = 0.93 × Roller Width - 0.006"
Procedure for Laying Out a Sprocket
The first thing you need to know to lay out a sprocket is the dimensions of the chain which is to run upon it, specifically the pitch, roller diameter, and the roller width of the chain. The second thing you need to know is the number of teeth in the sprocket, which will depend entirely on your application. From these numbers, the outside diameter and thickness of the required blank can be calculated.
The sprocket teeth are usually truncated one chain pitch above the bottom of the seat; this is not shown here. Note that this shape is not the only one that will work - bicycles in particular use various tooth shapes for different circumstances.

1.3 Application

Sprockets should be accurately aligned in a common vertical plane, with their axes parallel. Chain should be kept clean and well lubricated with thin, light-bodied oil that will penetrate the small clearances between pins and bushings. Center distance should not be less than 1.5 times the diameter of the larger sprocket, nor less than 30 times the chain pitch, and should not exceed 60 times the chain pitch. Center distance should be adjustable - one chain pitch is sufficient - and failing this an idler sprocket should be used to adjust tension. A little slack is desirable, preferably on the bottom side of the drive. The chain should wrap at least 120° around the drive sprocket, which requires a ratio of no more than 3.5 to 1; for greater ratios, an idler sprocket may be required to increase wrap angle.

2. Chain Construction

Chains have a surprising number of parts. The roller turns freely on the bushing, which is attached on each end to the inner plate. A pin passes through the bushing, and is attached at each end to the outer plate. Bicycle chains omit the bushing, instead using the circular ridge formed around the pin hole of the inner plate.

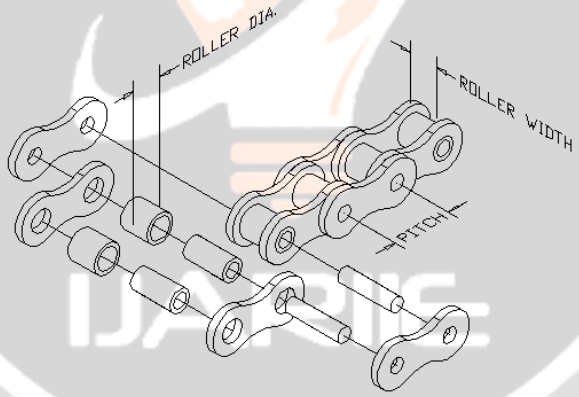

Fig-2: Construction Detail of Chain

2.1 Chain Dimensions

Chain types are identified by number; ie. a number 40 chain. The rightmost digit is 0 for chain of the standard dimensions; 1 for lightweight chain; and 5 for roller less bushing chain. The digits to the left indicate the pitch of the chain in eighths of an inch. For example, a number 40 chain would have a pitch of four-eighths of an inch, or 1/2", and would be of the standard dimensions in width, roller diameter, etc.
The roller diameter is "nearest binary fraction" (32nd of an inch) to 5/8ths of the pitch; pin diameter is half of roller diameter. The width of the chain, for "standard" (0 series) chain, is the nearest binary fraction to 5/8ths of the pitch; for narrow chains (1 series) width is 41% of the pitch. Sprocket thickness is approximately 85-90% of the roller width. Plate thickness is 1/8th of the pitch, except "extra-heavy" chain, which is designated by the suffix H, and is 1/32" thicker.

2.2 Selecting a Chain

Two factors determine the selection of a chain; the working load and the rpm of the smaller sprocket. The working load sets a lower limit on pitch, and the speed sets an upper limit.
Maximum Pitch = $(900 \div \text{rpm})^{2/3}$
The smaller the pitches, the less noise, wear, and mechanical losses will be experienced

2.2ANSI Standard Chain Dimensions

Table-1: Motorcycle Chain Dimensions

Chain No.	Pitch	Roller Diameter	Roller Width	Sprocket thickness	Working Load
25	1/4"	0.130"	1/8"	0.110"	140 lbs
35	3/8"	0.200"	3/16"	0.168"	480 lbs
40	1/2"	5/16"	5/16"	0.284"	810 lbs
41	1/2"	0.306"	1/4"	0.227"	500 lbs
50	5/8"	0.400"	3/8"	0.343"	1400 lbs
60	3/4"	15/32"	1/2"	0.459"	1950 lbs
80	1"	5/8"	5/8"	0.575"	3300 lbs

Table-2: Bicycle Chain Dimensions

Chain No.	Pitch	Roller Diameter	Roller Width	Sprocket thickness
Bicycle, with Derailleur	1/2"	5/16"	1/8"	0.110"
Bicycle, without Derailleur	1/2"	5/16"	3/32"	0.084"
420	1/2"	5/16"	1/4"	0.227"
425	1/2"	5/16"	5/16"	0.284"
428	1/2"	0.335"	5/16"	0.284"
520	5/8"	0.400"	1/4"	0.227"
525	5/8"	0.400"	5/16"	0.284"
530	5/8"	0.400"	3/8"	0.343"
630	3/4"	15/32"	3/8"	0.343"

3. Drives

There are different types of final drives used according to the type of vehicle. Normally, in four wheel vehicles there is a differential gearbox and rear axles are provided as final drive. Various in case of front wheel drive car we haven't seen any differential but instead it consists transaxle housed with engine assembly at front of the vehicle. In case of two and three wheelers like scooters, bikes and rickshaws there is chain drive used as a final drive. So from above discussion we can conclude that there are three types of final drives used in today's automobile world as listed below.

- Differential
- Chain drive
- Differential
- The differential has three jobs:
- To aim the engine power at the wheels
- To act as the final gear reduction in the vehicle, slowing the rotational speed of the transmission one
- final time before it hits the wheels
- To transmit the power to the wheels while allowing them to rotate at different speeds.

3.1 Need of Differential

Car wheels spin at different speeds, especially when turning. You can see from the Fig 5.1 that each wheel travels a different distance through the turn, and that the inside wheels travel a shorter distance than the outside wheels. Since speed is equal to the distance traveled divided by the time it takes to go that distance, the wheels that travel a shorter distance travel at a lower speed. Also note that the front wheels travel.

3.2 Chain Drive

When there is less space available and also weight of the vehicle limited then at that time we cannot use differential as final drive in the vehicle. Take example of bikes, three wheeled rickshaws and ATV's. SO for this kind of vehicles we are using chain drive as a final drive. In Chain Drive there are two sprockets and chain for the purpose of transmitting torque from engine to road wheel.

Fig -3: Chain Drive Mechanism

A small sprocket gear is connected with the engine output shaft and bigger sprocket gear is attached with road wheel of the vehicle. Both of these gears are further connected via roller chain as shown in the above.

The main advantage of this kind of final drive is that it consist simplest mechanism and also weight of the whole system is also very less. Generally, all two wheelers and some three wheeled vehicles use this type of final drive mechanism.

3.3 Chain and Sprocket Drive

Simply stated, a boundary value problem is a mathematical problem in which one or more dependent variables must satisfy a differential equation everywhere within a known domain of independent variables and satisfy specific conditions on the boundary of the domain. Boundary value problems are also sometimes called field problems. The field is the domain of interest and most often represents a physical structure.

3.4 Gear Reduction Ratio

In any type of final drive mechanism engine speed is reduced at certain level to increase torque at rear wheel, this is called "gear reduction". In chain and sprocket drive gear reduction is obtained by using small gear at front side (engine side) and large gear at rear wheel.

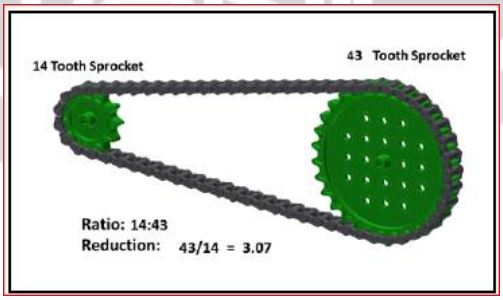

Fig -4: Chain and sprocket drive

4. Literature Survey

4.1 Glenn F. Read. A power drive unit for driving a utilization mechanism such as, for example, a road wheel of a light vehicle such as a bicycle, tricycle, or quadricycle. The utilization mechanism is driven from the output shaft of a prime mover mounted through a controllable clutch and chain drive train. Preferably, the prime mover is an internal combustion engine driven chain saw from which the saw chain and chain bar have been removed and replaced by an adapter providing a chain and belt drive from the chain saw engine output shaft to a chain wheel coupled to the utilization mechanism, for example, a bicycle conventional chain wheel such as to drive the bicycle

rear wheel through the conventional multispeed hub or multispeed sprocket cluster, or alternatively, to drive the front wheel of a bicycle through a chain wheel coupled to the front wheel hub, the front wheel hub being preferably a multi-speed hub with internal gears.

4.2 Nile E. Sawmiller, Craig S. Sawmiller. The invention relates to an improved pedal drive mechanism for a bicycle. The mechanism provides a vertically oval pedal path which provides an improvement in the thrust imparted to the driving wheel during the downward movement of the pedal. These paths are defined by two sets of sprockets disposed in parallel planes connected by a set of double strand chains. This mechanism is connected to the drive wheel by a conventional sprocket-chain linkage.

4.3 James S. Busby, Costa Mesa, Calif. A direct drive bicycle comprising a main frame. Rotatable mounted within the main frame is a variable rate transmission unit having rotatable input and output shaft. Rotatably connected to the main frame is chain wheel. The chain wheel is mechanically coupled to the input shaft of the transmission unit in a manner wherein rotation of the chain wheel facilitates the rotation of input shaft.

4.4 Patrick E. Turner and Lawrence K. O'Dell. A drive mechanism is disclosed that is selectably engage able to provide a bicycle that has normally driven and non-driven wheels with either single or dual wheel drive. The drive mechanism includes a power take of T means that has: a first power transmission mechanism mounted on said frame; a second power transmission mechanism mounted on the bicycle frame in positive drive power transmitting engagement with a normally non-driven wheel of the bicycle; and a power transfer apparatus connected to receive power from the first power transmission mechanism and transmit it to the second power transmission mechanism. A coupling mechanism is operatively connected with the power take of T and is selectively actuatable to place the first power transmission mechanism either in a drive position receiving power from the normally driven wheel or a disengaged non-power transmitting position. An actuator mechanism is mounted on the bicycle to selectively move the coupling mechanism either to the disengaged position or to the drive position to energize the power transfer apparatus and drive the normally no driven wheel.

5. Conclusion

Chain sprocket engagement used to drives the wheel, this discussion suggest the selection of various chain arrangement used for different types of vehicle. It shows the various advantages like transmits more power than belts. No slip takes place during chain drive .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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