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Analysis of Chain used in Single Wheel Power Spray Pump

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A B S T R A C T

Over 0.2 billion two-wheelers are in use around the world today. The chain is modified in this work so that the driver can be placed stationary and the driven can oscillate between -45° and +45°. Stainless steel produced less stress distribution, and matching parameters were derived based on the tension acting on the Chain link. The chain drive is a fundamental part of all two-wheelers and is one of the most significant components for power transfer. The goal of this project is to build and analyze the capacity of a chain drive that will be used to drive a vehicle with precise requirements. Chain links made of various materials, including aluminum alloy and stainless steel, were subjected to structural study. In a traditional transmission system, the driver and the driven are on the same axis. The amount of torque delivered by the chain drive is a key determinant of a two-speed, wheeler's acceleration, and performance. This can be used in a variety of situations when a system with multiple drives can be replaced with a single drive. Power can be transmitted from a stationary source to some oscillating devices, such as steering, in this case. A conical tooth is employed in this design, which glides and locks automatically when the driven's axis is adjusted while keeping the driver's position stationary. If the driving axis is adjusted to 15°, the driven axis must also be changed to 15°, else the machine element will fail.

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Keywords: Chain Drive, Roller Chain, Power Transmission, Applications of Chain Drive

1. INTRODUCTION

On the basis of his balance lock, James Fussell invented a roller chain in 1800, and Hans Renold patented a bush roller chain in 1880.Roller chain, also known as bush roller chain, is the most popular type of chain drive used in residential, industrial, and agricultural machinery, such as conveyors, wire and tube-drawing machines, printing presses, automobiles, motorcycles, and bicycles. A toothed wheel called a sprocket drives it. It is made up of a set of short cylindrical rollers connected by side links. This "Gull Chain" chain is still utilized in hanging applications today. A chain with a roller bearing is depicted in sketches by Leonardo da Vinci from the 16th century. A pail of water was drawn up from a well using a chain. This early bucket chain was made up of metal rings that were joined together. Leonardo da Vinci drew designs of what looks to be the first steel chain in the 16th century. It is a straightforward, dependable, and cost-effective method of electricity transmission. When chain was first invented, it was primarily intended for water collection. Blacksmiths in England were the first to create chains. The process that was established at the time was employed until the nineteenth century, when it became outdated. In addition, stronger metals are now used in chain, making it more robust.

In September 2017, our single loop machine, for example, turned 100 years old. Handcrafting chain is no longer a task for a blacksmith; technology and automation have made the process faster and easier. In addition, stronger metals are now used in chain, making it more robust. This advancement accelerated the sector and allowed for the introduction of new technology. PCP now has a number of huge machinery and processes in place to produce the chain observed in everyday life. Steel manufacturing and processing issues had previously stymied chain manufacturing progress. When molded chain was invented, the chain industry grew once again, propelling it forward. When chain was first invented, it was primarily intended for water collection. Blacksmiths in England were the first to create chains. Chains have been used in many purposes for ages, ranging from aesthetic applications such as shops to heavy industrial applications such as maritime applications, particularly on ships. As early as 225 BC, the first metal chain was utilized. This paved the way for the production of a variety of chain types, including steel detachable chain.

Following the advancements in chain manufacturing, the steel bushing was developed, which "revolutionized steel chain." Chain was widely employed in automobiles and bicycles after the introduction of the steel bushing. The process that was established at the time was employed until the nineteenth century, when it became outdated. Many of the machines used to make PCP's chain have stood the test of time and are still as durable and dependable now

as they were when they were originally introduced.

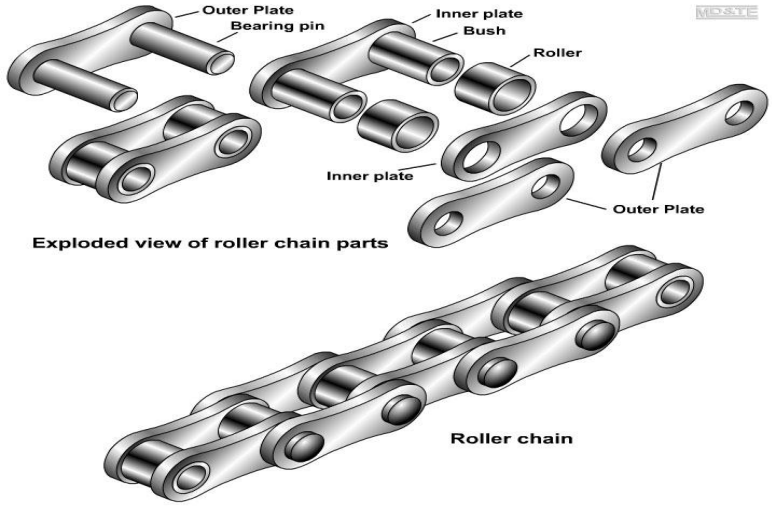

Figure 1.1: Exploded View of Roller Chain Parts

2. ROLLER CHAIN

The fatigue strength of a chain is just as significant as its tensile strength. It is made up of a set of short cylindrical rollers connected by side links. On the basis of his balance lock, James Fussell invented a roller chain in 1800, and Hans Renold patented a bush roller chain in 1880.

Tensile strength is the most typical measurement of roller chain strength. A toothed wheel called a sprocket drives it. The tensile strength of a chain refers to how much weight it can withstand in a single load before breaking. The thickness of the linkplates and the design (shape) of the linkplates are two further aspects to consider. The chain load should not exceed 1/6 or 1/9 of the chain's tensile strength when using roller chain on a continuous drive, depending on the type of master links used (press-fit vs. When roller chains are operated on a continuous drive beyond these limits, linkplate fatigue failure can and does occur. It is a straightforward, dependable, and cost-effective method of electricity transmission.

A chain with a roller bearing is depicted in sketches by Leonardo da Vinci from the 16th century. [citation needed] slip-fit) Conveyors, wire-and-tube drawing machines, printing presses, vehicles, motorcycles, and bicycles are all examples of home, industrial, and agricultural machinery that use roller chains to transmit mechanical power. The quality of the steel used to manufacture the chain, the heat treatment of the chain components, the quality of the pitch hole fabrication of the linkplates, and the type of shot plus the intensity of shot peen coverage on the link plates are all important factors in the fatigue strength of the chain.

2.1 Types of Chains

A. Roller chain.

Conveyors, wire- and tube-drawing machines, printing presses, vehicles, motorcycles, and bicycles are all examples of home, industrial, and agricultural machinery that use a roller chain or bush roller chain to transmit mechanical power. It is made up of a set of short cylindrical rollers connected by side links. A toothed wheel called a sprocket drives it. It is a straightforward, dependable, and cost-effective[1] method of electricity transmission.

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Figure 2.1: Roller Chain

B. Silent chain.

A silent chain is made up of gear racks with two teeth each that are pivotally coupled to form a closed chain. The links are flat steel plates with straight teeth that are pin-connected. Silent chains are quieter than roller chains and can convey more load for the same width.

Figure 2.2: Silent Chain

C. Leaf Chain.

The simplest steel chain is the leaf chain, which is made up merely of link plates and pins. This chain, unlike roller chains, has a higher tensile strength and runs across sheaves rather than sprockets. They are excellent for applications such as hanging, balancing, or conveying motion. Machine tools, elevator and oven doors, fork lift truck masts, rotating frames, and other lifting and balancing applications frequently use leaf chains as counterweight chains

Figure 2.3: Leaf Chain

D. Flat-top Chain.

In the food, beverage, glass, pharmaceutical, and paint industries, flat top chain conveyors are perfect for feeding and interlinking bottles, cans, or tiny boxes. Alternatively, steel chain can be used to transport hot, sharp, or oily materials.

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Figure 3.4: Flat-top Chain

3. FUNCTIONS OF CHAIN PARTS

A. Plate

The plate is the component that carries the chain's tension. This is usually a series of loadings, occasionally followed with shock. As a result, the plate must not only have high static tensile strength, but also be able to withstand dynamic forces such as load and shock. Furthermore, the plate must be resistant to environmental factors (for example, corrosion, abrasion, etc.).

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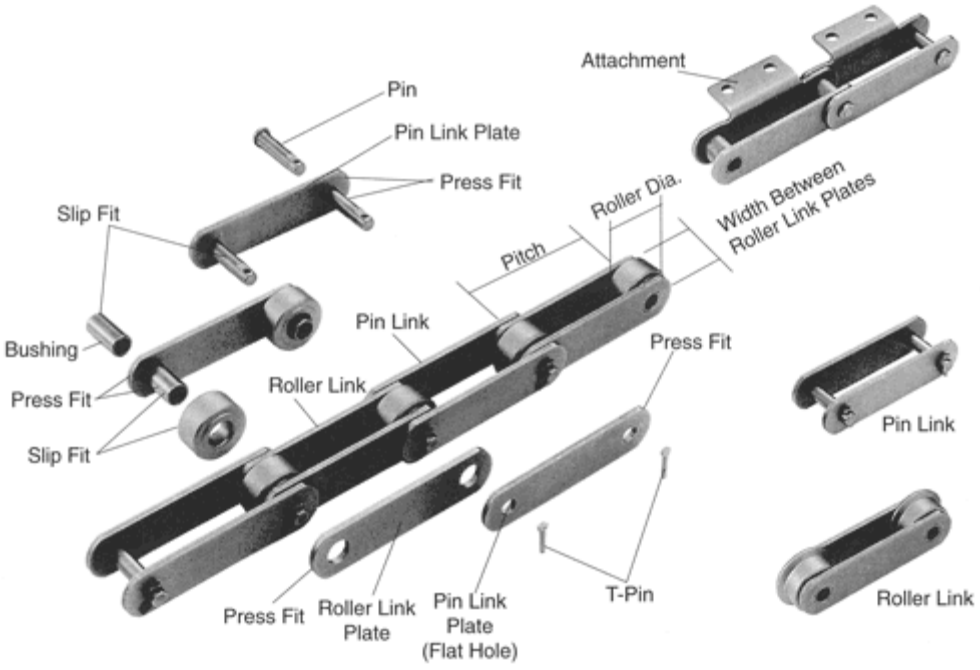

Figure 4.1: Basic Structure of Large Pitch Conveyor Chain

B. Pin

The pin is subjected to the plate's shearing and bending stresses. When the chain flexes during sprocket contact, it produces a load-bearing component with the bushing at the same time. As a result, the pin must have strong tensile and shear strength, as well as bending resistance and shock and wear resistance.

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C. Bushing

When the chain engages the sprocket, the bushing is subjected to shearing and bending forces transferred by the plate and roller, as well as shock loads. In addition, as the chain articulates, the inner surface, along with the pin, forms a load-bearing portion. When the roller rotates on the rail or engages the sprocket, the outer surface forms a load-bearing component with the inner surface. As a result, it must have high tensile strength, as well as resistance to dynamic shock and wear.

D. Roller

During chain engagement with the sprocket, the roller is subjected to impact load as it strikes the sprocket teeth. The roller's point of contact and balance shift after engagement. It travels on the tooth face when receiving a compression force and is held between the sprocket teeth and bushing.

E. Cotter Pin, Spring Clip, T-Pin

These are the components that keep the outer plate from slipping off the pin at the connecting location. They may wear out during high-speed operation, hence heat treatment is required for this application

3.1 Characteristics of roller chain

Attachment chain, double pitch, giant roller, rollerless, offset link, heavy duty, self-lubricating, corrosion resistant, and flexible are all common features of roller chain. Stainless steel is employed in food processing machinery and other areas where lubrication is an issue, while nylon or brass is occasionally found for the same reason. The size of most roller chain is stamped straight into the side plates. The industry number that represents the chain size may be stamped in, such as "40", "C2080H", or "10B". To see the size of an old chain, it will almost certainly need to be cleaned. Over time, these chains have been modified to minimize overall friction, improve power transfer, and boost endurance. Food service, printing, transportation, agricultural, and other industries have evolved a variety of sizes and designs of chains over the years to help serve their specialized needs. A silent chain is made up of gear racks with two teeth each that are pivotally coupled to form a closed chain. The links are flat steel plates with straight teeth that are pin-connected. Silent chains

are quieter than roller chains, can go faster, and can transmit more information.

3.2 Geometry of Chain

When compared to simpler designs, the roller chain design lowers friction, resulting in improved efficiency and less wear. Both the inner and outer plates were held by pins that directly contacted the sprocket teeth in the original power transmission chain variations; however, this arrangement demonstrated exceptionally rapid wear of both the sprocket teeth and the plates where they pivoted on the pins. Bushed chains were developed to partially alleviate this difficulty, with the pins holding the outer plates going through bushings or sleeves connecting the inner plates. Because of the sliding friction against the bushings, the teeth of the sprockets still wore more quickly than is acceptable. The addition of rollers encircling the chain's bushing sleeves and providing rolling contact with the teeth of the sprockets resulted in exceptional sprocket and chain wear resistance. As long as the chain is suitably lubricated, there is even very low friction. Roller chains require constant, clean lubrication as well as proper tensioning in order to operate efficiently. The bush roller chain has two types of links that alternate. Inner links are the first type, with two inner plates held connected by two sleeves or bushings that rotate two rollers. Inner links alternate with outer links, which are made up of two exterior plates held together by pins that pass through the inner links' bushings. An oil bath should be utilized in conjunction with chains that operate at high speeds similar to those found on motorbikes. This is not possible with modern motorcycles, and most motorbike chains are unprotected. As a result, motorbike chains wear down far faster than other types of chains. They are subjected to harsh conditions such as rain, dirt, sand, and road salt. Motorcycle chains are used to transmit power from the engine to the rear wheel. In the gearbox, properly greased chains can achieve a 98 percent efficiency or more. Chains that aren't oiled will degrade performance and increase chain and sprocket wear. Oil drip feed systems lube the chain continuously and use a light oil that does not adhere to it. Oil drip feed systems, according to research, give the best wear prevention and power savings.

4. Conclusion

Chain drives offer a minimal cost of maintenance. When compared to belt drives, they put less strain on the shafts. When compared to belts, chain drives are more efficient and provide more power. Chain mechanisms are one of the most commonly utilized power transfer techniques in mechanical engineering. They can transfer power from one location to another with or without torque or angular velocity changes. It can be utilized for center distances of both small and large sizes. In addition, when compared to belt drives, chain drives transmit greater power. Chain drive transmissions have a significant benefit over gear drive transmissions in that, unlike gear drive transmissions, power can be transported over a longer distance with chain drive. They provide up to 98 percent transmission efficiency.

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