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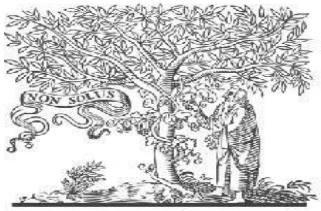

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Title GEARLESS TRANSMISSION USING ELBOW MECHANISM DESIGN AND OPERATION

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Gearless Transmission Using Elbow Mechanism Design and Operation

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Abstract

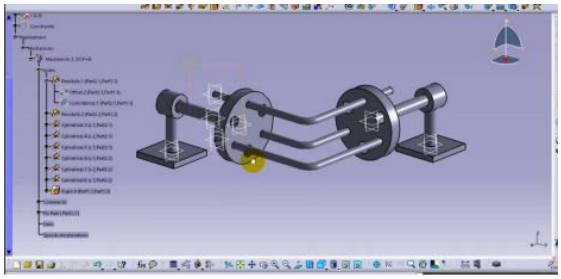
This " Gearless Transmission Using Elbow Mechanism " project could result in a small and lightweight device capable of transmitting power at various angles without the use of gears. This mechanism transfers power from the driving disc to the driven disc via rods Furthermore, senile transmission mechanisms have been shown to have efficiencies of up to - 92 percent. The output, which is linked by three bent links, has a gearless transmission that transmits the rotational speed. CATIA is used in modeling this article presents an analysis of the production model, from the scope and focus of the hub to the speed of the rotating object. Project Gearless Transmission is a device that is intelligent and has different angles of precise transmission power without changing gears. Keywords: arms, hub, gearbox, shaft.

Introduction

Gears are primarily used in various industries for precise and variable power transmission, such as aerospace, defense, automotive cutting, machining, lifting equipment, and so on. One significant disadvantage of kits is their small size. successful due to errors such as emptying, which causes vibration during operation and shortens the life of the product due to higher wear rates.

This project has been minimized and in apparatus that can and has something, train the transmission in the correct point without making gear. The majority of the information is accessible in our schools. Parts are easy to make and low price.

Figure -1:



Elbow mechanism

This company gives us knowledge, experience, knowledge, and innovative ideas about assembly. This is task and achievement certainty. This task is a

hardware aid that improves the nature of the manufactured goods and can be done in less time, so I chose this company because elbow hardware is a suitable joint sliding system and kinematic chain standard. It is also called the "no-speed component", which is very useful to send the movement at the right angle. In certain modern applications, "diagonal gearless gear" can also operate sensitively or to the mat, and can be measured with a precision point plane and mat and gear that are consistently used in business for various applications.

Bevel gears and worm and worm gears are typically used to transmit power through non-parallel shafts, while crossed helical gears are used to transmit power across non-parallel non-cross shafts. The versatility of use of these kits is constrained by their set requirements and high manufacturing costs. This switching device, thus, can transmit at any angle between 0 and 1800. The mechanism consists of input and output shafts with holes drilled axially along the P.C.D. and round links bent at an angle between the two shafts, which causes the non-standard angle between the shafts. Only the angle of inclination of the joints needs to be changed, but in the case of reverse gears, the entire gear needs to be redone. This significantly lowers this mechanism's cost and also increases its flexibility.

There are two sections to this work:

• Research into the microcar-specific gearless transmission system, including manual analysis and model building.

• Evaluation of other applications for this approach.

Because there are less resources accessible in today's world, it is important to make the best use of them. The biggest issue with the gearbox is that making the gears is a difficult operation that takes a lot of time and precision and has a high production cost [1,2,7,8]. Another significant issue is that when Devendra Patel uses a gearbox, the gearboxes stall as a result of a rear fault and make more noise than the other drives because of the pitch mismatch. Other names for this elbow mechanism are orbital gear mechanism, L-pin mechanism, and gearless gear mechanism. This elbow mechanism's simplistic design makes it simple to build with mediocre precision. When 900 rpm is utilised to transmit the motion, this mechanism is mostly used to replace spur gears. Hence, 900 degrees is typically taken as the angle between the rod and the elbow mechanism. By adjusting the angle of the L-pins or by supplying a universal joint angle, this mechanism can also be utilised to transmit power at a changeable angle. The three L-pins that make up the majority of this mechanism boost the pins' smoothness. system. Elbow Mechanism is a small, portable device that can be used to approximate right angles without the use of equipment.

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Every drive shaft diameter and drive shaft can be used with this mechanism. Despite the gearbox's maximum efficiency being only 2%, we can still attain efficiency levels of 90–92%.

SYSTEM STUDY AND COMPONENTS

This mechanism uses L-studs ranging from 3 to 8 which are inserted into the holes in the hubs. If we used less than 3 L pins it will not work and will interfere. These L-pins are placed at a 90° angle from the center of the hub

. A Gearless gearbox consists of following components: -

- L-pins
- Hub
- Shaft
- Base plates
- Bearings

This transmission system uses 3, 5, or more pins, which are put into holes drilled in the cylinder disc. If we utilise fewer than three pins, blocking will result. The simultaneous sliding and rotational motion of the L-pins transmits motion. On the spherical disc, these L-pins are positioned at an angle of 120 degrees.

The general arrangement of this mechanism is as follows

Figure- 2:-

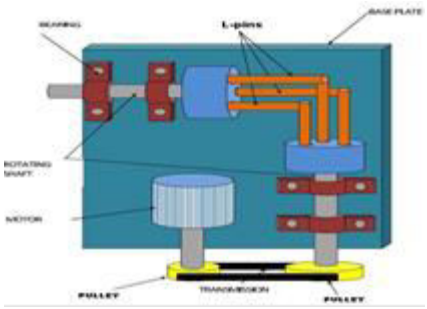

Figure- 3:-

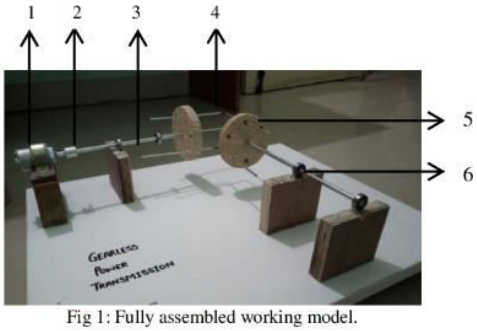

Fig 1: Fully assembled working model.

1. Motor
2. Shaft connector
3. Shaft
4. Elbow link
5. Hub
6. Bearing

Figure 2 &3 :- generic mechanism layout

Working

power transmission without gears A novel method for moving power from one place to another without requiring gears is to use an elbow mechanism. The elbow joint is used in this mechanism's basic design to transfer power between two places.

The device has two arms, one of which rotates at a fixed speed and the other of which is joined to the system's output shaft. The motor-driven input shaft, which is attached to the spinning arm, provides power. The elbow joint moves as the rotating arm rotates, which causes the other arm to spin in the opposite direction. This rotation is transmitted to the output shaft, giving the application the necessary power. Since there are fewer moving parts in the elbow mechanism than in conventional gearboxes, there are fewer energy losses and higher efficiency. By constructing the mechanism with materials that have low friction coefficients, the efficiency of the device is also increased. The system requires no

maintenance because there are no gears and no need for lubrication.

In conclusion, the gearless power transmission employing an elbow mechanism transfers power between two sites by leveraging the movement of an elbow joint. The mechanism is a potential technology for a variety of applications, such as robotics, machine tools, and vehicles due to its straightforward construction and effective operation.

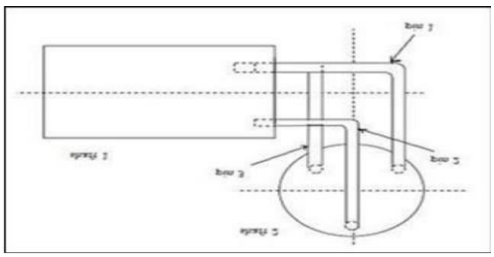

Figure 4: L-pin configuration

Working principle

Elbow mechanisms, also known as gearless gearing, is a device that transmits motion between the driven and the drive shaft at some fixed angle. A synthesis of this mechanism shows that it has pin counts ranging from, three to eight, with more pins indicating a smoother process. Sliding inside the hollow cylinders, these pins form sliding pairs. Our mechanism has three such sliding pairs. In the hollow container, the cylinders are attached. Brackets with a cast iron frame support the entire assembly. The electric motor provides the necessary power. The operation of the mechanism is illustrated in the diagram. The movement is transmitted to the drive shaft on the drive shaft by rods bent along the angles of the shaft. These rods can slide in and out of holes that are evenly distributed around the circle as the shaft spins. Although many mechanics have doubts about how this gear works, it is also useful. Even so, many applications where the drive is intended for constant-angle shafts have found it to be sufficient. Axles with centers between 30° and 150° can also be employed for traction. The holes of each rod must be properly aligned with one another, radially spaced apart, parallel to one another, and bent at an angle at the location of the axis in order to permit transmission. There is a small vent at the bottom of each hole in the rod to allow pressurized air to escape when the rods are pumped if the holes drilled in the shaft end have "blind" or closed ends.

MODELING ANALYSIS

Introduction to CATIA

A computer-aided three-dimensional interactive application is a design that helps create, alter, research, or optimize. In order to increase productivity, enhance designer design quality, enhance designer design quality in design and communication through documentation, and create a manufacturing database, CATIA software was installed.

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Diagram of model

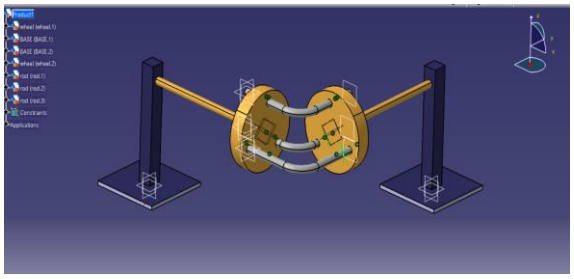

Figure- 5.CATIA assembled product

Methodology

The two pins need not be the same diameter, according to an analysis of the mechanism. When this occurs, the two links' motion overlaps because it is disrupted. Hence, the angle between two pins is not 1800; the number of links along the PCD must be odd and evenly distributed.

Mechanism manufacturing: -

The suggested model uses a karting gearbox, with two mechanisms for each wheel. A single motor cross belt or two separate motors, one for each input shaft, can drive both input shafts. Both motors must rotate in opposing directions. Front view; to move the output wheels, the left shaft must rotate anticlockwise and the right input shaft must rotate clockwise. The cross belt causes the rotation of a single motor to be in the opposite direction. The model was created using the modelling program EO PARAMETRIC 3.0 Student Edition M070" Depending on the equipment and materials on hand in the workshop, the sizes of the various model components were established. A top and 3D view of the model is shown below.

The initial change system is in Part 1.

2- The second mechanism location is Part 2.

The engine mounting position is covered in Part 3. The motor shaft is attached to either the first or second transmission depending on which way the motor rotates. To change the belt tension, shift the motor to the left or right using the supplied preset

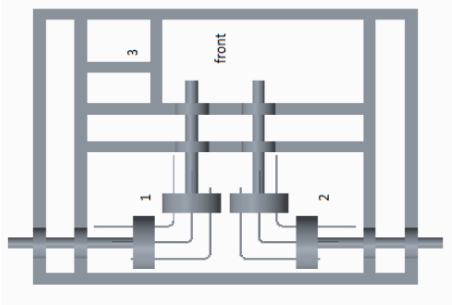

Figure -6 shows the model's top view.

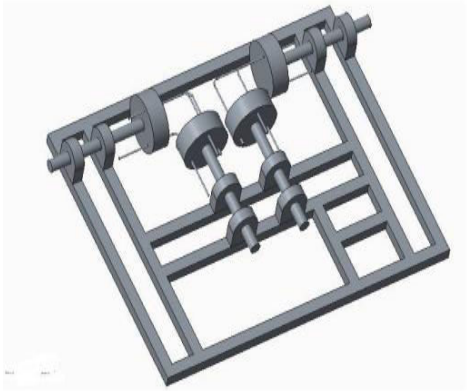

Figure -7. Model view

Details

Frame square pipe 50*50

- 100mm*2 pipes
- 900 mm*4 pipes
- 700mm*2 pipes
- 600mm*200mm

Links:-20mm diameter of rods *6

Hub:-150 mm diameter,60mm thickness& holes at p.c.d 120mm*2

Bearings:- 30mm pedestal bearings*8

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Calculations and results

Considering total model weight along with rider =200kg

Therefore model weight =200×g=2000N

Each tyre weight =2000÷4=500N

Taking into account the 0.8 coefficient of friction between the road and the tire.Frictional force on each wheel then equals 500×0.8=400N

Consider this to be the bare minimum force necessary to move the tire.

Using a 15-inch tire, a 0.18-meter radius

The torque needed to move the tire is equal to 400 x 0.18, or 72 N-m.

The hub's three links supply this torque.

Hence, torque on each link equals 72/3=24N-m.

Links are on a 120mm diameter p.c.d. with a 0.06m radius.

Tangential force equals 24/0.06 = 400 N

Diameter of each link: 20 mm = 0.02 m

A link under shear force

$$\tau = \frac{force}{crosssectionl\ area}$$

$= 400/\pi/4 \times 0.02^2$

$= 1273239.54$ N/mm2

$=1.27\times10^6$ N/mm^2

utilizing C-45 as a connection material [7] (PSG data book 1.9)

45 N/mm2 is equal to 106 N/mm2.

Hence, the minimal stress caused is within the range of the maximum stress, which is 45 106 N/mm2

$[\tau]_{maximum} = 3.14/16 \times \tau \times d^3 = 1.9939$N-m

Circumference of the wheel $=2\pi r=2\times3.14\times0.18=1.1309$m

For 1 revolution per second are 1.1309m/s

Power (H.P)	Torque (N-m)	Max speed (RPM)
1	1.9939	2623(17.79km/h)
2	1.9939	5248.3(35.61km/h)

Table 1. Results

Comparison between geared and gearless mechanism

Gear	*Gearless*
It is expensive and has complex calculations.	It is cheaper and has less computation.
Production requires , special machines	No special machinery is needed to make
It is not possible to change	Can be changed
• *Reason for failure: -*	• *Reason for failure: -*
Contains stinging, rust, Incense, and rust.	Stains, rust, erosion, and fatigue are strictly reduced here.
The entire gear set needs to be replaced.	Only the L pins need to be replaced
• *Lubrication and cooling*: -	• *Lubrication and cooling: -*
This is a complex system	It's easy.
Cooling is a big problem.	Cooling is easy

Applications

Being a crucial addition, the featured product has the tightest applicability. The plan is made to make it easier to get fasteners for tasks involving mechanics and cars, where direct access to screws and bolts is frequently restricted. Yet, take into account a variety of industries.

Just consider the various powertrain possibilities for toys, scooters, hand-turned transmissions, and field badges.

- A drive is necessary for all varieties of four-sided tower clocks. The crank mechanism was made from the four-bell "Big Ben Clock" at the Tower of London. This timepiece was positioned in1630 AD. and is still in good working order.
- The system is sometimes used for group drilling, which is multi-spindle drilling.
- Used to drill angles from 0 to 90 degrees.
- Pump C.N.C. lathes
- The mechanism is handy when trying to hit a puller in an awkward position.
- Electronic and electronic system blower.
- The device has a wide range of applications in electronics and computing.
- Submarines use an elbow mechanism to move the periscope.
- Can be used in a tower clock.
- Can be used in wood carving.
- It can be used in trolley vehicles.
- It can be used in robotics and artificial intelligence.
- Can also be used in pumping and pressure equipment

Advantages

Design permits a range of shaft diameters, standard and non-standard, which isn't achievable with the current gear arrangement due to the difficulty of gear production for skew shafts and the fact that Only shafts with a specified diameter are usable thanks to standardization.

The recommended gearless transmission with pins can handle extraordinarily high speeds and weights in comparison to crossed helical gears. Since the mechanism doesn't have a similar sliding and point of contact as crossed helical gears, there is very little power loss in the suggested design, allowing it to be used for heavy loads with enough shaft and pin strength. A large reduction in machine size is feasible since any part dimension that doesn't go beyond the maximum dimensions of the shaft can be employed. Simply put a tonne of space can be saved. Any broken element can be fixed at a very modest price. Setup expenses are quite little. Installation of the setup is quick and easy. Links and pins may be produced more easily than across-helical worm gear. In most cases, setup takes little technical knowledge.

- Due to the value addition process, this mechanism is quite straightforward.
- Minimum mechanism.
- There is no need for a crank and crankshaft.
- By adjusting the linkage, slow and quick operations can be easily accomplished.
- Lower manufacturing costs.
- Better than gears at efficiency.
- Simple to maintain and fix.
- The components are transportable.
- An easy-to-use cooling system.

- It is possible to operate continuously without pausing.

Limitations

With a gearless transmission, also known as a direct drive system, one gear is employed to transmit power from the engine to the wheels. While gearless transmissions provide some benefits, such as increased effectiveness and decreased maintenance, they also have significant drawbacks, such as Size and weight: Gearless transmissions often take up more space and weigh more than conventional gearboxes, which might be problematic in some situations, including those involving smaller cars. Restricted torque range: Because gearless gearboxes typically have a small range of torque, they may not be able to handle heavy loads or high-performance applications.Cost: For some applications, gearless gearboxes may be much less advantageous than conventional transmissions since they are more expensive to construct and maintain While gearless transmissions provide several benefits, such as increased effectiveness and decreased maintenance, they also have significant drawbacks, such as Size and weight: Gearless transmissions often take up more space and weigh more than conventional gearboxes, which might be problematic in some situations, including those involving smaller cars.Restricted torque range: Because gearless gearboxes typically have a small range of torque, they may not be able to handle heavy loads or high-performance applications

For some applications, gearless gearboxes may be much less advantageous than conventional transmissions since they are more expensive to construct and maintain.

Restricted speed range: Because gearless gearboxes are designed for a specific speed range, they may not be as flexible or adaptable in all situations.

Complexity: While having a simpler construction than conventional transmissions, gearless transmissions are nevertheless

1. Cannot start up with very little torque.
2. Drilling holes incorrectly could result in numerous issues.
3. A sudden load damages a mechanism.
4. After a predetermined cycle period, L-Pins must be changed.

Future Aims

- Has a promising future in automation and robotics; employs bendable flexible linkages; increases torque-bearing power.
- It might be applied to the automotive industry soon.
- Stress focus exercises are advised.
- You might utiutilizendable, flexible links.
- You can increase the torque bearing capability.
- Has a promising future in robotics and automation.

- Applicable to the auto industry

CONCLUSIONS

Any diameter, shape, and shaft can be employed, but they all need to revolve around their own axes. The same RPM should be used for both the driving and driven shafts.

The rods on the cylindrical disc should be similarly spaced apart in all directions. For each rod, 360/3=1200 (if there are three pins). Up to 150 RPM can be effectively transmitted through the mechanism.

Stainless steel is frequently used to make rods. To enable transmission, a minimum of three pins should be used.

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This mechanism has a maximum efficiency of 92% (Gears have a maximum efficiency of 42%).

The links are bent to 900, but this can be changed.

SOLIDWORKS software has been used to study gearless transmission.

1) Based on efficiency, we may state that a mechanism's load efficiency is inversely correlated with the number of L-pins.

2) The natural materials utilized to manufacture the components of a mechanism have an impact on its efficiency.

Due to its low manufacturing costs, this mechanism has a promising future in the industrial sector.

4) The system between the hub and L pins experiences some slowness as a result of friction and clearance. Giving the surface a sufficient polish and using lubrication can help to reduce this.

5) The system's low cost and high degree of interchangeability are its key benefits.

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