Design & Fabrication of Geareless Power Transmission in Any Angular Position

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Abstract— The modern gear drives has been widely applied due to excellent accuracy and reliability. However, the major downside of even the most efficient gear drive is the low efficiency due to errors like backlash and considerable vibrations. These vibrations engender noisy operation and cause more wear and tear resulting in low life span. The development of a more efficient multi-angular gearless drive has been explored relatively unsuccessfully and negligently regardless of its advantages over both gear drives and simple gearless drives. Recent advances in technologies, material, analytical modeling and simulation capabilities has opened the possibility of major advances towards the design and development of a reliable, cost effective and ultra-efficient multi-angular gearless drive.

Key words: Geareless Power Transmission

I. INTRODUCTION

Gearless mechanism is a link mechanism of sliding pair, which is also known as El-bow mechanism. The component is exceptionally valuable for cornering or transmitting movements at right points. In automobiles the bevel gears are used widely to get different speed in inner and outer wheels to attain required radius of curvatures to cross the curved areas. This mechanism may be suitable in this type of application and where the power should transmit at the edges of the places. The transmission may be done by set off elbow rods with input and output housings to get the continuous transmission efficiently. By referring standard design data books, concluded that drives always has very less efficiency. The major factor finding with under frictional forces between the mating gear teeth, the unpredictable chasing of the riggings, the reaction between the teeth can't be overcome and consequently the proficiency can't be more than 55% of late apparatuses of warm slant sort are being made in poly propylene and epoxy material where the frictional forces are similarly disposed of. Despite the fact that such devices are utilized for moderately little applications the ability is not more than 42%.The El-bow Mechanism transmits the I/P power towards the O/P side such a way that the rakish Forces created in the slacks are essentially transmitted with the assistance of connections which takes up the I/P power and the right point drive is exchanged towards the O/P slack and stick get together. Thus friction less elbow mechanism transmits the power from one end to other end. In this way, it is valued that expertise as high as 90-92% are believable in a device with gear less transmission component.

The motion transmission is relaying the same type of motion from one part of an object to another (rotational to rotational, translational to translational).Multi-Angular Gearless Drive is a motion transmitting device used for transmitting motion at multiple angles between the driving and the driven shaft. The scrutiny of this mechanism would reveal that it comprises of pins ranging from 3 to 8 pins per assembly and with increase in the number of pins operation becomes smoother. These pins slide inside symmetrically spaced holes machined on solid cylindrical disc. Thus, the sliding pairs help the shaft to revolve at various angles.

With the help of such mechanical transmission drives, power can be cornered from the driven member to the driving member in any fashion without loss of power. It is possible to have in – line power transfer, parallel drive transfers, and angular drive transfers. Gear is very costly to manufacture and the Mechanical efficiencies of the gear drives is comparatively quite poor as compared to the link motion transmission drives. In case of gear drives the power is lost due to back lash in the teeth of the gears, Chattering of the gears and hunting of gear trains. Link motion drives are simpler to manufacture, simple to operate and less costly than the gear drives.

II. CURRENT RESEARCH

In automobiles the bevel gears are used widely to get different speed in inner and outer wheels to attain required radius of curvatures to cross the curved areas. This mechanism may be suitable in this type of application and where the power should transmit at the edges of the places. The major factor finding with under frictional forces between the mating gear teeth, the unpredictable chasing of the riggings, the reaction between the teeth can't be overcome and consequently the proficiency can't be more than 55% of late apparatuses of warm slant sort are being made in poly propylene and epoxy material where the frictional forces are similarly disposed of. Despite the fact that such devices are utilized for moderately little applications the ability is not more than 42%.

R. Somraj et al. [1] Analyzed the Design and Fabrication of Gearless Transmission For Skew Shafts. 3 Nos. of L-pin rods were used. Overall mechanism is considered to be running on 0.25 HP motor with 140 RPM and Torque of 1238 N-mm. Design of Hub is done by Considering a hub of internal diameter is 32mm and outer diameter is 92mm, length is 82mm. Design of shaft was done by taking maximum tensile stress of 60 N/mm2 and maximum shear stress of 40 N/mm2. Diameter of elbow rods was 8mm. It Was Concluded that given arrangement can be used for any set of diameters with any profile of shafts A review paper on design and analysis of gearless transmission mechanism… 35 for skew shafts of any angle but the shaft's must be having the rotational motion about his own axis, transmission of motion is very smooth and desirable and used only for the equal R.P.M. of driving shaft and driven shaft by employing links or given type of links for appropriate joints for revolute pair. It was also found that successful mechanical devices function smoothly however poor fly they are made while other does this only by virtue of an accurate construction & fitting of their moving parts.

Neeraj Patil et al. [2] Researched on Gearless Transmission Mechanism and its Applications. Link of C-45 was used. Links bent at required angle slide inside the holes in the hub Mechanism can transmit at any angle 0 to 180.The mechanism is studied and a possible go-kart transmission layout is fabricated and few future applications are suggested. Into This weight of model along with rider Assumed 1500 N. Kart was loaded with 4 Nos. of tires each with 375 N of load. Coefficient of friction between road and tire was Considered 0.7. Tire of radius 0.1778m Taken. Torque required to move Was 46.67 N-m with Torque on each link 15.55 N-m Tangential force of 311.15N was acting on links. Diameter of each link was 10mm. After study of the mechanism it was concluded that this mechanism is mainly applicable to low cost applications where torque is low to medium. With future development in low friction materials (graphene coating) and stronger composite materials, the efficiency and capacity of this mechanism can be increased. Also if instead of bent links, bolted links or links held by universal joints are used then transmission is possible even when angle changes on the go.

Ashish Kumar et al. [3] performed study on Multi Angular Gearless Drive. The mechanism was loaded with 3 Nos. of L-pins. Parts of mechanism were modeled on Solid Works and the analysis of the mechanism was carried out on ANSYS. The study of mechanism was carried with 0.63 Moment of Inertia (Provided by Solid Works). Behavior of system is plotted on different charts i.e. Velocity vs. Time, Acceleration vs. Time, Angular Acceleration vs. Time, Separation Distance vs. Time. From this it was concluded that the final design thus obtained is capable of transmitting torque and power at varied angles depending on the angular limitation of the hooks joint. With further research and advanced analysis in the design wide-ranging applications of the drive can be discovered.

Mahantesh Tanodi et al. [4] Researched about Gearless Power Transmission Offset Parallel Shaft Coupling. 4 holes were drilled into the shafts and Z-links were inserted into the each hole on shafts. This paper was part of a study investigating the Gearless power transmission for parallel shafts. Gearless Transmission which is compact and portable equipment, which is skillful and is having something practice in the transmitting power between parallel shafts without any gears being used. This Couplings for parallel shaft gives variety of displacement and torque from a minimum of 1 to 500 mm and from 5.4 to 80000 Nm respectively. Analysis of Z-pins done for the different angles and variation in length of pins is checked. By the geometric analysis of configuration it was analyzed that the size of the Z-link connector decreases, as the off-set to shift ratio increases. And hence the strength of the connector comes down. Hence it is advisable to maintain smaller offset to shift ratio for the rigid and stronger Z-link connector. By this study they have concluded that hat the proposed conceptual design can be applied for the transmission of power between two parallel shafts having proper shift and off-set by employing different geometries of Z-pins.

Anand C. Mattikalli et al. [5] researched on Gearless Power Transmission- L Pin Coupling. 4 pins are used for each 45º , 90º , 135º .The design was checked by varying the Nos. of pins from 1 to 4 and to find out the optimum Nos. of pins used for better transmission. Analysis is done in CATIA V5. Analysis is done only for two intersecting shafts. At the end of the study By CATIA® analysis, it can be concluded from the results that the proposed conceptual design can be applied for the transmission of power between two Intersecting shafts having proper angular misalignment by employing different geometries of L-pins and it is found that minimum number of L-Pins required are 3, for continuous smooth power transmission.

Atish Lahu Patil et al. [6] had studied Gearless Mechanism in Right Angle. The mechanism was consisting 3 pins bent equally at 90º . It was found from study that the more the Nos. of link will make the operation smoother. The pins were made up of bright bar with an excellent surface finish. The wood cutter was mounted on the output shaft which can cut up to 250mm width of wooden sheet. By working on experimental setup and after a long Study it is Concluded that proposed arrangement used for any set of diameters with any profile of shafts for skew shafts of any angle but the shaft's must be having the rotational motion about his own axis, transmission of motion is very smooth and desirable and used 38 Yasarkhan, S.Raihan, P.Pankil, P.Hiren and Devendra Patel only for the equal R.P.M. of driving shaft and driven shaft by employing links or given type of links for appropriate joints for revolute pair.

M. Lokesh et al. [7] had fabricated model for Gearless Power Transmission Mechanism using 6 Elbow Rods. From the study it is been stated that this mechanism can transmit the power with 92% of efficiency. The mechanism was consisting 6 Nos. of L pins bent equally at 90º . The compressor and pump also introduced into project when the links inside the drilled holes reciprocates as well rotate inside cylinder. It gives pumping and compression effect. Among the 6 links first pin goes at inner dead center it sucks the air and start moving outer dead center when further revolving. After study it was concluded that Elbow transmission mechanism is possible in almost for short lengths and also it is suitable for medium length by increasing the housing diameter and the setup indicates that by increasing the elbow a rod in account increases the smoothness of the transmission also the absence of friction ultimately raises the efficiency of the mechanism.

Amit Kumar et al. [8] Presented An Arrangement for Power Transmission Between Co-Axial Shafts of Different Diameter. In that arrangement motion is transmitted between the co-axial 18 shafts of different diameters. Up to 8 Nos. of pins was used. If more pins used motion will be smoother, but increase in no. of pins not at the cost of strength of shaft. Holes drilled very accurately & the axis of both the shafts was co-axial. The designed arrangement can be work for parallel shaft displacement up to 500 mm and torque capacities from 5.4 to 80000 Nm. It was concluded that the Proposed arrangement can be used for any set of diameters with any profile of shafts but the shaft's must be co-axial and having rotational motion along the common axis, transmission of motion is very smooth and desirable and used only for the equal R.P.M. of driving shaft and driven shaft by employing different geometries of Z-pins and Elbow pins or link.

III. ASSEMBLY

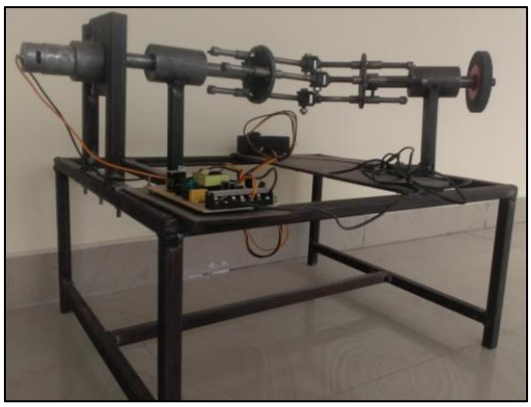

Fig. 1:

A. Components

- Circular Plates
- DC Motor
- Rods
- Shaft
- Bearing
- Nut
- Bolt
- Transformer

B. Construction

- It consists of links or rods that are bend exactly at 90 degree (right angle).
- The number of links required would be 3 to 8.
- The more the links, the smoother will be the operation.
- Links are made up of bright bars as the bright bar material has good surface finish.
- These links slides inside the through and through drilled cylinder.
- Thus forming a sliding pair.
- These cylinders are coupled to the input and output shaft with help of key.
- Power is supplied by electric motor.

IV. ADVANTAGES

1) High Efficiency between input and output power shafts.
2) This coupling enables a variable parallel offset between two shafts. They provide constant speed velocity with extremely low backlash, and their compact designs provide large floor space savings.
3) Easy manufacturing of links and links in comparison of crossed helical and worm gear.
4) Very little friction.
5) Hunting and backlash is absent.
6) Backlash-free shaft securement and torque transmission.
7) This is a very smooth-acting device, and the power loss is minimum.
8) It can be run at nearly any speed, even at high speed and is very quiet.

V. LIMITATIONS

- Does not work at very low starting torque.
- Improper hole drilling could pose much problem.
- Sudden load would cause mechanism breakdown.
- Links are to be replaced after certain cycle time.
- Speed ratio is always constant 1:1.

VI. FUTURE SCOPE

1) Torque bearing capacity can be improved.
2) Flexible bent links can be used.
3) Has a bright future in automation and robotics.
4) Can be used in automobile industry in near future.

VII. CONCLUSION

Designing of Any-angular gearless drive instigated with assumptions and random dimensions because no significant development has been done before in this unchartered territory. With software support and assiduous endeavour the final optimal design has been obtained. The final design thus obtained is capable of transmitting torque and power at varied angles depending on the angular limitation of the hooks joint. With further research and advanced analysis in the design wide-ranging applications of the drive can be discovered.

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