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DESIGN AND FABRICATION OF GEARLESS POWER TRANSMISSION

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ABSTRACT

This project represents a real-time study of the gearless transmission mechanism. Today's world requires speed in every field. Hence rapidness and quick working are the most important. Nowadays for achieving rapidness, various machines and equipment are manufactured by man. This transmission system is to be analyzed in solid works software to study the reaction of elbow rods and hub and then the fabrication of the mechanism is carried out. The project GEARLESS TRANSMISSION is being compact and portable equipment, which is skillful and is having something precise in transmitting power at a right angle without any gears being manufactured. Introduced gearless power transmission arrangement used for skew shafts.In this transmission system no. of pins or links used must be odd ..., (3, 5, 7, 9, …) & centers of any two pins or links hole must not be on that line which represents the diameter of the shaft.If more pins or links are used motion will be smoother, but an increase in the. of pins or links not at the cost of the strength of the shaft.

Power transmission for skew shafts is with the help of either crossed helical gear or worm gear or hypoid gears in a machine, but the manufacturing of these gears is very complex,power loss in gears due to sliding motion and the shaft orientations is very limited means not for every shaft orientation because of standardization of gears, so the need arises for a better system. So here I introduced a gearless power transmission system for skew shafts which reduces the losses, and cost & saves time and space. This system allows the changing in the orientation of shafts during motion which is fascinating about this mechanism. Also, during the analysis of the mechanism and working it is seen that this gearless transmission can be used for both intersecting shafts and skew shafts but here we introduced a solution for skew shafts so the main attention is towards the skew shafts.

I.INTRODUCTION

Here is a wonderful mechanism that carries force through a 90º bend. Translating rotational motion around an axis usually involves gears, which can quickly become complicated, inflexible, and clumsy-looking, often ugly. So, instead of using gears, thistechnology elegantly converts rotational motion using a set of cylindrical bars, bent to 90º, in a clever, simple and smooth process that translates strong rotational force even in restricted spaces. A gearless transmission is provided for transmitting rotational velocity from an input connected to three bent links. Both the input shaft and the housing have rotational axes. The rotational axis of the input shaft is disposed at an angle of 90 degrees concerning the rotational axis of the housing. As a result, rotation of the input shaft results in a processional motion of the axis of the bent link. The rotary and reciprocating motion of bent link transmit rotation of prime mover to 90 degrees without any gear system to an output shaft without gears. The transmission includes an input shaft. T: Gearless transmission mechanism transmits power from input to output shafts using sliding links that form revolute pair with the hub. Links bent at the required angle slide inside the holes in the hub. Thus, as the holes in the input hub rotate;it pushes the links and in turn, the output hub is rotated.

This mechanism can be used as a replacement for bevel gears in low-cost, low torqueapplications. It can transmit at any angle from 0 to 1800. In this paper, the mechanism is studied anda possible go-kart transmission layout is fabricated and a few future applications are suggested. The mechanism is made of SRRS pair (sliding revolute sliding) sliding pair between the input hub hole and the link; revolute pair between link and input hub; revolute pair betweenlink and output hub; sliding pair between holes in output hub and the link. The rotational motionof the input shaft is converted into the sliding motion of links which is then converted t the rotational motion of the output shaft. In this paper, we have focused on transmission through nonparallel shafts only. View of the Shafts: -Below diagram shows a different view of the shaft arrangement which is skewed and the angle between them is 90 degrees, which helps us in understanding the arrangement of shafts.

II.LITERATURE REVIEW

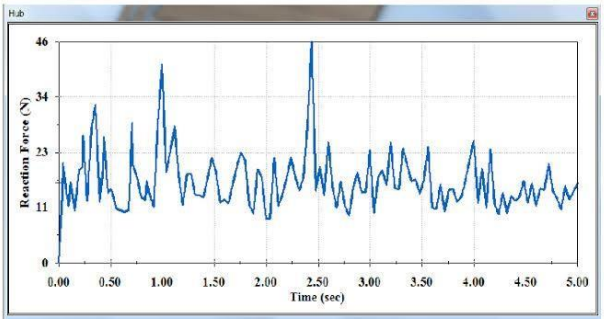
R. Somraj et al. [1] Analyzed the Design and Fabrication of Gearless Transmission for Skew Shafts. 3 Nos. of L-pin rods were used. The overall mechanism is considered to be running on a 0.25 HP motor with 140 RPM and a Torque of 1238 N-mm. Design of Hub is done by Considering a hub of internal diameter is 32mm and outer diameter is 92mm, length is 82mm. The design of the shaft was done by taking maximum tensile stress of 60 N/mm2 and maximumshear stress of 40 N/mm2. The diameter of the elbow rods was 8mm. It Was Concluded that the given arrangement can be used for any set of diameters with any profile of shafts. A review paper ondesign and analysis of gearless transmission mechanism… 35 for skew shafts of any angle butthe shafts must be having the rotational motion about his axis, the transmission of motion isvery smooth and desirable and used only for the equal rpm of the 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 by of an accurate construction & fitting of their moving parts.

Neeraj Patil et al. [2] Researched Gearless Transmission Mechanism and its Applications. link of C-45 was used. Links bent at the required angle slide inside the holes in the hub Mechanism can transmit at any angle from 0 to 180. The mechanism is studied and a possible go-kart transmission layout is fabricated and a 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. The coefficient of friction between road and tire was Considered 0.7. Tire of radius 0.1778m Taken. The 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. The diameter of each link was 10mm. After a 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 frictionmaterials (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 the transmission is possible even when the angle changes on the go.

Ashish Kumar et al. [3] performed a study on Multi Angular Gearless Drive. The mechanism was loaded with 3 Nos. of L-pins. Parts of the mechanism were modeled on Solid Works and the analysis of the mechanism was carried out on ANSYS. The study of the mechanism was carried with 0.63 Moment of Inertia (Provided by Solid Works).

The behavior of the 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 thusobtained 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.

Force(N)	41	47	38	46	37



Solanki Nehal et al. [4] studied the Design and Analysis of Gearless Transmission Through Elbow Mechanism which can be into the replacement of the bevel gears. 4 Nos. of L-pins was used in this fabricated model. With the input of a 1HP motor. Links of 10mm diameter were used of S.S, M.S material. Shafts are rotating with a speed of 1440 RPM and 4947.066 N.mm of Torque. Stimulation is done by the ANSYS 16.2 and analysis of the mechanism was done at 50,100,150,200 RPM for both the material. It is been concluded from that analysis that the 36 Yasarkhan, S.Raihan, P.Pankil, P.Hiren and Devendra Patel mechanism with 6 elbow rods made up of mild steel material works perfectly. The mechanism runs smoothly when it is kept at 150 RPM Also it can be concluded that as the no of elbow rods increases smoother the operation would be.

Shiv Pratap Yadav et al. [5] performed Real-time Study for the Design, Analysis, and Fabrication of Gearless Power Transmission by using Elbow Mechanism. They used 3 Nos. Of elbow rods inclined to the 90º.Modeling and rendering of the mechanism are done into the CATIA V5 and the analysis was carried out on ANSYS. The mechanism was working between 80 to 100 RPM. after this it was concluded that It has a high scope in future to replace the cumbersome usage of gears which will be replaced with simple, elegant usage of the shafts that will change the overall cost management of the industries using gear technology presently to gain more profits.

Navneet Baradiya et al. [6] had done Analysis and Simulation of the Gearless Transmission Mechanism. The system is to be analyzed in Solid Works package software to watch the response of the elbow rods and also the hub (coupled with the shaft). Motion analysisis performed by running the mechanism at 15 revolutions per minute and higher speeds, reaction forces, and reaction moments are plotted against a clock run of 5 seconds by using a post-processor. Theoretical calculations are made to obtain allowable stress by making use of designdata values. As a result, the response of the elbow rod and hub is investigated to find the permissible speed of the mechanism. Elbow rods of a diameter of 7.55mm of stainless steel were used. It is concluded that for the smooth and safe running of the mechanism it should be kept below 140 ppm. With this study, it is concluded that the gearless transmission mechanism is capable of running up to 120 rpm under normal conditions. Further fatigue analysis is recommended for gearless transmission mechanisms.

Amit Kumar et al. [7] Introduced a gearless power transmission arrangement used for skew shafts. 3 Nos. of L-pins were used and the elbow mechanism was compared with S-R-R- Slinks. During working on experimental it is concluded that the proposed arrangement used for any set of diameters with any profile of shafts for skew shafts of any angle but shafts must be having the rotational motion about his axis, the transmission of motion is very smooth and desirable and used only for the equal R.P.M. of the driving shaft and driven shaft by employing pins or given type of links for appropriate joints for revolute pair.

Jagushte G. S et al. [8] had researched Desthe ign, Analysis, and Fabrication of Gearless Transmission by Elbow Mechanism. This system was loaded with 3 L-pins each at 1200 of the cylindrical disc. The L-pins are made up of the Stainless Steel (X6cr17). The rod diameter was taken at 12.6mm. part modeling was done in Solid Works and Analysis is carried out n Autodesk Inventor (2016). It was A review paper on the design and analysis of gearless transmission mechanism… 37 Concluded after analysis

and Fabrication 140rpm to 160rpm is safe for the gearless transmission system. Thus, simulation results satisfy motion analysis results. Also, the model works correctly as per the design. With the help of this system, we can efficiently reduce the cost of power transmission and Further advancements in this technology can be made.

Mahantesh Tanodi et al. [9] Researched Gearless Power Transmission Offset Parallel Shaft Coupling. 4 holes were drilled into the shafts and Z-links were inserted into each hole on the shafts. This paper was part of a study investigating the Gearless power transmission for parallel shafts. Gearless Transmission is compact and portable equipment, which is skillful and is having something to practice in the transmitting power betweenparallel shafts without any gears being used. These Couplings for parallel shafts give a 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 the length of pins ischecked. By the geometric analysis of configuration, it was analyzed that the size of the Z-linkconnector decreases, as the off-set to shift ratio increases. And hence the strength of the connector comes down. Hence it is advisable to maintain a 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 offset by employing different geometries of Z-pins.

Anand C. Mattikalli et al. [10] researched 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 to find out the optimum Nos. of pins used for better transmission. The analysis is done in CATIA V5. The 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 is 3, for continuous smooth power transmission.

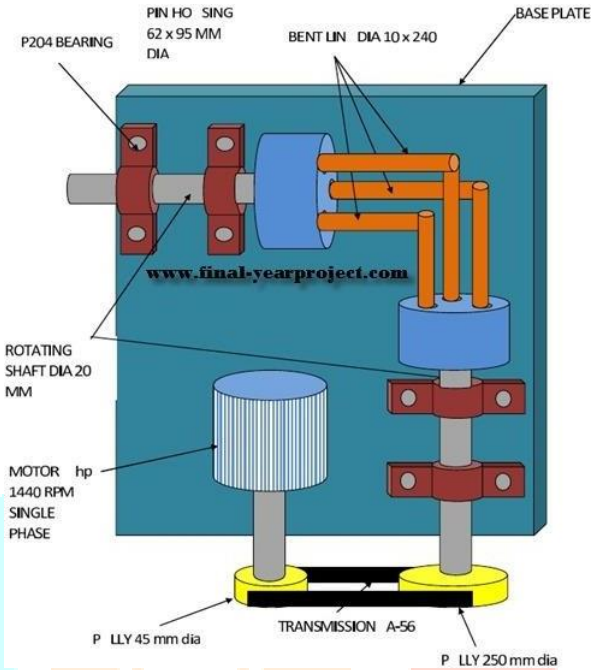
Atish Lahu Patil et al. [11] studied Gearless Mechanism in the Right Angle. Themechanism was consisting 3 pins bent equally at 90º. It was found from the study that the more the Nos. of the link will make the operation smoother.

The pins were made up of a bright bar with anexcellent surface finish. The woodcutter was mounted on the output shaft which can cut up to250mm width of the wooden sheet. By working on the experimental setup and after a long Study it isConcluded that the proposed arrangement used for any set of diameters with any profile of shafts for skew shafts of any angle but the shafts must be having the rotational motion about their axis, the 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 the driving shaft and driven shaft by employing links or given type of links for appropriate joints for revolute pair.

M. Lokesh et al. [12] had fabricated a 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 are also introduced into the project when the links insidethe drilled holes reciprocate as well rotate inside the cylinder. It gives a pumping and compression effect. Among the 6 links first pin goes at the inner dead center which sucks the air and starts moving the outer dead center when further revolving. After the study, it was concluded that the Elbow transmission mechanism is possible almost for short lengths and also it is suitable for medium lengths by increasing the housing diameter the setup indicates that by increasing the elbow a rod in the account increases the smoothness of the transmission also the absence of friction ultimately raises the efficiency of the mechanism.

Amit Kumar et al. [13] Presented an Arrangement for Power Transmission Between Co-Axial Shafts of Different Diameters. In that arrangement, motion is transmitted between the co-axial 18 shafts of different diameters. Up to 8 Nos. of pins were used. If more pins are used motion will be smoother, but an increase in the. of pins, not at the cost of the strength of the shaft. Holes were drilled very accurately & the axis of both the shafts was co-axial. The designed arrangement can 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 shafts must be co-axial and have rotational motion along the common axis, transmission of motion is very smooth and desirable and used only for the equal R.P.M. of the driving shaft and driven shaft by employing different geometries of Z-pins and Elbow pins or link.



III.METHODS

Mechanical Power Transmission:

Power transmission is a process required in almost every piece of machinery. From the tiny motors in pop-up selfie cameras to the innovative transmission lines of the Large Hadron Collider, power transmission applications are all around us. We use power transmission methods to transmit power from the prime mover to the driven machinery for its function. There are four main types of power transmission – mechanical, electric, hydraulic, and pneumatic. In this article, we shall learn about mechanical power transmission, its type,s and the pros and cons of each type. Mechanical power transmission refers to the transfer of mechanical energy (physical motion) from one component to another in machines. Most machines need some form of mechanical power transmission. Common examples include electric shavers, water pumps, turbines and automobiles. In most cases, the rotational movement of the prime mover is converted into the rotational movement of the driven machinery. However, the speed, torque, and direction may change. Occasionally, they may convert rotational motion into translational motion (back and forth movement) depending on the application's functional requirements. Such change may be carried out using linkages or other machine elements.

Types of Mechanical Power Transmission:

Different machine elements can transmit power between shafts in machinery. The most common mechanical power transmission methods in use in the engineering industry todayare:

- Shaft couplings
- Chain drives
- Gear drives
- Belt drives
- Power screws
- Shaft couplings

Shaft couplings connect two shafts and transmit torque between them. The shafts may be in line, intersecting but not parallel, or non-intersecting and non-parallel. To cater to the needs of various applications and environments, many different types and sizes ofcouplings are produced. Broadly, there are two types of shaft couplings- rigid and flexible. Rigid couplings do not permit relative motion between shafts, whereas flexible couplings do. Hence, flexible couplings can handle some shaft misalignment. Some couplings, such as the split muff couplings, can be fixed onto shafts without moving them. In contrast, most others require shaft movement for installation/removal.

IV.RESULTS

The final design thus obtained is capable of transmitting torque and power at variedangles 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. Themodel works correctly as per the design. With the help of this system, we can efficiently reducethe cost of power transmission and further advancements in this technology can be made. There is clear in design and Fabrication of our project is safe at 140rpm to 260rpm for a gearlesstransmission system.

V.CONCLUSION

This research work has provided us with an excellent opportunity and experience, to use our limited knowledge. We picked up a great deal of down-to-earth learning in regards to, arranging, obtaining, collecting, and machining while doing this venture work. We feel that theventure work is a decent answer for scaffolding the entryways among establishments sent and businesses. We are glad that we have finished the work with the restricted time effectively. The FABRICATION OF GEARLESS TRANSMISSION is working with satisfactory conditions. We can comprehend the troubles in keeping up the resilience furthermore quality. We have done to our capacity and aptitude making the most extreme utilization of accessible offices. In conclusion comments on our venture work, let us include a couple of more lines about our impression extend work.

Thus, we have developed a FABRICATION OF GEARLESS TRANSMISSION" which helps to know how to achieve low-cost automation. During working on the experimental setup and after a long discussion it is observed that the proposed arrangement used for any set of diameters with any profile of shafts for skew shafts of any angle but the shafts must be having the rotational motion about their axis, the transmission of motion is very smoothand desirable and used only for the equal R.P.M. of the driving shaft and driven shaft by employing links or given type of links for appropriate joints for revolute pair. Some successful mechanicaldevices function smoothly however poor fly they are made while other does this only by an accurate construction & fitting of their moving parts. This project which looks very simple & easy to construct was very difficult to conceive & imagine without seeing an actual one in practice. Motions demands to be studied first & we have done that very thing. We find that while acceptable analysis for existing mechanisms can often be Made quite easily, we cannot without insight & imagination make an effective synthesis of a new mechanism hence we are mold to present our project gearless transmission at 90 degrees (El-bow mechanism) which we have managed to successfully devise after long & hard input in conceiving its working principle.

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