



A REVIEW PAPER ON DESIGN AND ANALYSIS OF GEARLESS TRANSMISSION MECHANISM USING ELBOW MECHANISM

Kiran¹, Ashish Kumar Shrivastava²

¹Student, M.Tech of Mechanical Engineering, Goel Institute of Technology and Management, Utter Pradesh, India

²Assistant professor, Faculty of Mechanical Dept. Goel Institute of Technology and Management

Abstract

This review paper offers data approximately the Strength, Speed, Torque Transmissibility of Elbow mechanism as this are very a lot crucial phrases in defining programs of the mechanism in substitute of gears. It especially targeted at the theoretical, analytical and FEA technique. Computation of diverse parameters like Number of pins, Material used Dimensional distinction of elements, Speed, Torque. Many preceding method have been made to discover the ideal layout with the intention to make this mechanism higher then antique mechanism through the usage of extraordinary evaluation software. It consist Theoretical & Analytical technique for the layout of elbow mechanism.

Index Terms: Transmission System, Gearless Transmission, Elbow Mechanism, Orbital transmission.

1. INTRODUCTION

In today's world, as constrained amount of the sources available, it's miles necessity to make use of that sources in such manner that it offers most of them. The essential trouble for the tools transmission is that the producing of tools is complicated procedure which consumes extra time and takes very a great deal precision and production value is high .[1,2,4,7,8] The any other essential trouble is that the transmission having tools reason the jamming because of the backless blunders and produces extra noise as compared to different drives because of pitch mismatch.[3] This elbow mechanism is likewise referred to as Gearless transmission system, L-pin mechanism or Orbital transmission mechanism. This elbow mechanism is straightforward in creation and may be effortlessly made with minor precision. This mechanism is specifically utilized in substitute of bevel gears wherein the movement is to be transmitted at 90°. So, in widespread elbow mechanism attitude among rod is taken 90°. [1,2,4,5,6,7,8,11,12,14] This mechanism also can be used to transmit energy at various attitude with the aid of using converting the attitude of L-pins or with the aid of using imparting typical joint on the corner.[3,9,10,13] This mechanism consist specifically three L-pins, in addition growth into L-pins will growth the smoothness of the system.[8] Elbow Mechanism is being compact and transportable equipment, that is skilful and is having something exercise within side the transmitting energy at proper attitude with none gears being manufactured. This mechanism may be used for any diameter of the riding and pushed shaft.[13] Maximum performance of tools power is handiest as much as 42% but, with the aid of using this mechanism we will stand up to ninety to 92% of performance.[12]

2. SYSTEM STUDY

In this transmission gadget Nos. of pins used are among three,4,5,...which have been inserted into the hollow drilled at the cylindrical disc. If we use much less than three pins then it'll now no longer paintings and could motive jamming.

The movement is transmitted through sliding and rotating motion of the L-pins simultaneously.

These L-pins are inserted into identical angular distance of 120° at the cylindrical disc. The Elbow mechanism consists of the subsequent part:

- L-pins
- Cylindrical Discs
- Shaft
- Base Plates

- Arm Supports (Bearing)

General layout of this mechanism is as under :

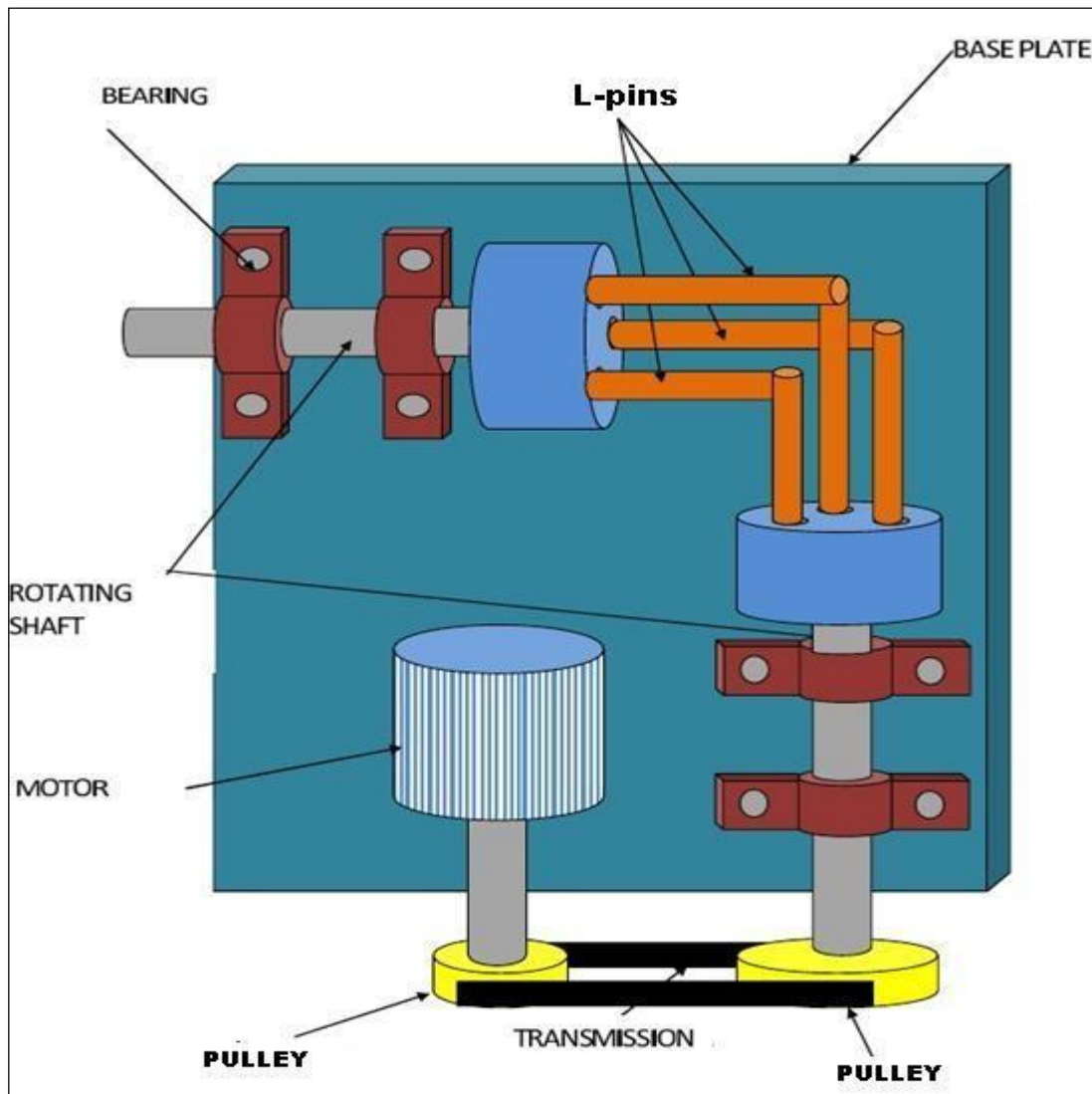


Figure 1: General Layout Of Mechanism

3. WORKING

After analyzing synthesis of mechanism it get discovered that this gadget encompass 3,4,...up to eight pins and growing the Nos. of pins mechanism will paintings extra smoothly. Power to this mechanism is provided with motor. Motion is transmitted from riding to pressure shaft with the assist of L-pins. This L-pins begins offevolved TO and FRO movement whilst energy is supplied. The movement is transmitted thru the S-R- R-S pair made with the aid of using L-pins and cylindrical disc.

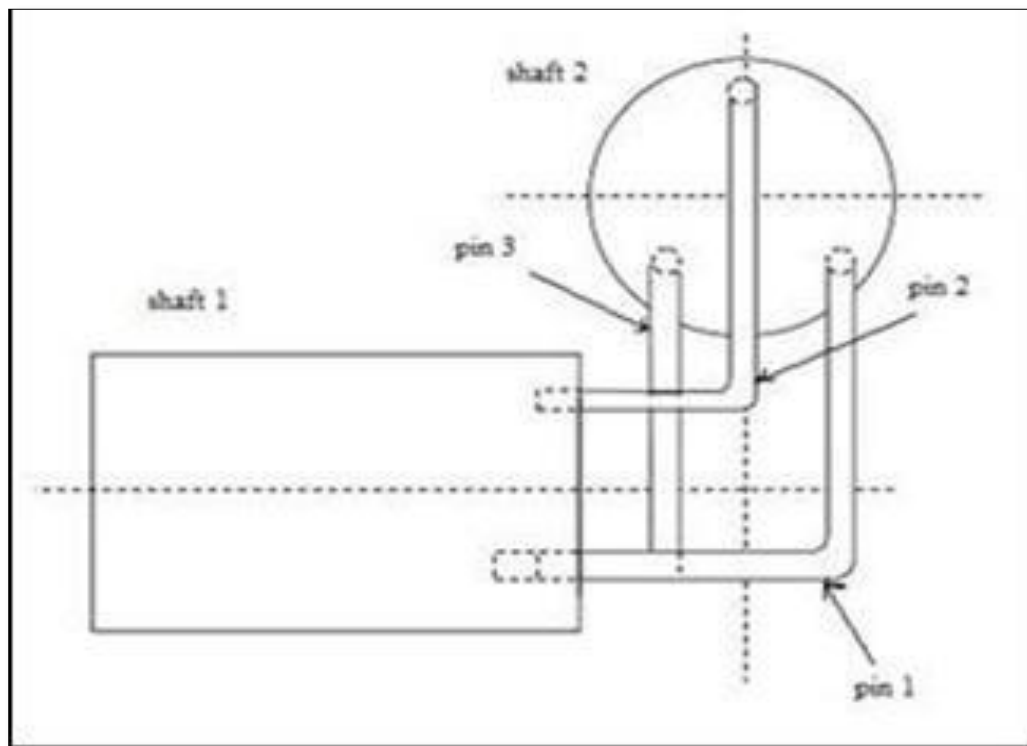


Figure 2: Setup of L-pins

Let on the beginning immediately shaft 1 begins offevolved rotation with three pins in anticlockwise path and a response pressure evolved on the pin floor which in touch with the shaft and this pressure transferred to the opposite quit of the pin that's within side the shaft and making use of at the shaft 2 because of which shaft 2 begins offevolved rotating within side the identical path as shaft 1, after one hundred twenty diploma rotation pin 1 comes on the vicinity of pin 2 & pin 2 comes on the vicinity of pin three & pin three comes on the vicinity of pin 1 with the aid of using sliding in shaft and self-adjusting. This movement repeated for subsequent one hundred twenty tiers and in addition for subsequent one hundred twenty tiers and pins are changing the placement in successive order.

4. LITERATURE STUDY

R. Somraj et al. [1] Analyzed the Design and Fabrication of Gearless Transmission For Skew Shafts. three Nos. of L-pin rods had been used. Overall mechanism is taken into consideration to be jogging on 0.25 HP motor with a hundred and forty RPM and Torque of 1238 N-mm. Design of Hub is executed via way of means of Considering a hub of inner diameter is 32mm and outer diameter is 92mm, duration is 82mm. Design of shaft become executed via way of means of taking most tensile pressure of 60 N/mm² and most shear pressure of forty N/mm². Diameter of elbow rods become 8mm. It Was Concluded that given association may be used for any set of diameters with any profile of shafts for skew shafts of any attitude however the shaft's should be having the rotational movement approximately his very own axis, transmission of movement may be very clean and appropriate and used handiest for the same R.P.M. of using shaft and pushed shaft via way of means of using hyperlinks or given form of hyperlinks for suitable joints for revolute pair. It become additionally determined that a success mechanical gadgets feature easily but bad fly they're made even as different does this handiest via way of means of distinctive feature of an correct construction & becoming in their transferring parts.

Neeraj Patil et al. [2] Researched on Gearless Transmission Mechanism and its Applications. hyperlink of C-forty five changed into used. Links bent at required attitude slide in the holes withinside the hub Mechanism can transmit at any attitude zero to 180.The mechanism is studied and a likely go-kart transmission format is fabricated and few destiny packages are suggested. Into This weight of version in conjunction with rider Assumed 1500 N. Kart changed into loaded with four Nos. of tires every with 375 N of load. Co-green of friction among street and tire changed into Considered zero.7. Tire of radius zero.1778m Taken. Torque required to transport Was 46.sixty seven N-m with Torque on every hyperlink 15.fifty five N-m Tangential pressure of 311.15N changed into appearing on hyperlinks. Diameter of every hyperlink changed into 10mm. After examine of the mechanism it changed into concluded that this mechanism is particularly relevant to low price packages in which torque is low to medium. With destiny improvement in low friction materials (graphene coating) and more potent composite materials, the performance and potential of this mechanism may be increased. Also if as opposed to bent hyperlinks, bolted hyperlinks or hyperlinks held through customary joints are used then transmission is feasible even if attitude adjustments at the go.

Ashish Kumar et al. [3] carried out look at on Multi Angular Gearless Drive. The mechanism turned into loaded with three Nos. of L-pins. Parts of mechanism have been modeled on Solid Works and The evaluation of the mechanism turned into accomplished on ANSYS. The look at of mechanism turned into carried with 0.sixty three Moment of Inertia (Provided with the aid of using Solid

Works). Behavior of device is plotted on special charts i.e. Velocity vs. Time, Acceleration vs. Time, Angular Acceleration vs. Time, Separation Distance vs. Time. From This it turned into concluded that The very last layout as a result received is able to transmitting torque and strength at various angles relying at the angular hassle of the hooks joint. With similarly studies and superior evaluation within side the layout wide-ranging programs of the force may be discovered.

Solanki Nehal et al. [4] studied Design And Analysis Of Gearless Transmission Through Elbow Mechanism which may be used into the substitute of the bevel gears. four Nos. of L-pins become used into this fabricated model. With enter of 1HP motor. Links of 10mm diameter had been used of S.S , M.S fabric. Shafts are rotating with pace of 1440 RPM and 4947.066 N.mm of Torque. Stimulation is performed through the ANSYS 16.2 and evaluation of mechanism become performed at 50,100,a hundred and fifty,two hundred RPM for each the fabric. It is been concluded from that evaluation that the mechanism with 6 elbow rods made from slight metallic fabric is works perfectly. The mechanism runs easily whilst it's miles stored at a hundred and fifty RPM Also it is able to be concluded that because the no of elbow rods will increase smoother the operation might be.

Shiv Pratap Yadav et al. [5] finished Real time Study for Design, Analysis and Fabrication of Gearless Power Transmission with the aid of using the use of Elbow Mechanism. They used three Nos. Of elbow rods willing to the 90° . Modeling and rendering of mechanism is completed into the CATIA V5 and the evaluation become carried on ANSYS. The mechanism become running among eighty to a hundred RPM. after this it become concluded that It has a excessive scope in destiny to update the bulky utilization of gears in an effort to get replaced simple, stylish utilization of the shafts as a way to alternate the general value control of the industries the use of equipment generation currently to benefit extra profits.

Navneet Baradiya et al. [6] had completed Analysis and Simulation of Gearless Transmission Mechanism. The gadget is to be analyzed in Solid Works package deal software program to look at the reaction of the elbow rods and the additionally the hub (coupled with shaft). Motion evaluation is achieved through strolling the mechanism at 15 revolutions consistent with minute and better speeds, response forces and response second are plotted towards clock run of five seconds through the use of publish processor. Theoretical calculations are made to reap allowable strain through utilizing layout statistics values. As a result, reaction of elbow rod and hub is investigated to locate the permissible pace of mechanism. Elbow rods of diameter 7.55mm of stainless-steel had been used. It is Concluded that for easy and secure strolling of mechanism it have to be stored beneathneath one hundred forty rpm. With this have a look at it's miles concluded that gearless transmission mechanism is able to strolling as much as one hundred twenty rpm beneathneath ordinary conditions. Further fatigue evaluation are encouraged for gearless transmission mechanism.

Amit kumar et al. [7] introduced gearless strength transmission association used for skew shafts. three Nos. of L-pins have been used and the elbow mechanism turned into in comparison with S-R-R-S hyperlinks. During running on experimental it's far concluded that proposed association used for any set of diameters with any profile of shafts for skew shafts of any attitude however the shaft's ought to be having the rotational movement approximately his very own axis, transmission of movement could be very easy and perfect and used best for the same R.P.M. of using shaft and pushed shaft with the aid of using using pins or given kind of hyperlinks for suitable joints for revolute pair.

Jagushte G. S et al. [8] Had achieved studies approximately Design, Analysis and Fabrication of Gearless Transmission through Elbow Mechanism. This gadget become loaded with three L-pins every at 1200 of the cylindrical disc. The L-pins are made from the Stainless Steel (X6cr17). The rod diameter become taken 12.6mm. element modeling become achieved in Solid Works and Analysis is carried on Autodesk Inventor (2016).It Was Concluded after evaluation and Fabrication 140rpm to 160rpm is secure for gearless transmission gadget. Thus simulation consequences fulfill movement evaluation consequences. Also The version works successfully as in line with the design. With the assist of this gadget, we are able to effectively lessen the price in strength transmission and Further development on this era may be made.

Mahantesh Tanodi et al. [9] Researched approximately Gearless Power Transmission- Offset Parallel Shaft Coupling. four holes had been drilled into the shafts and Z-hyperlinks had been inserted into the every hollow on shafts. This paper turned into a part of a have a look at investigating the Gearless electricity transmission for parallel shafts. Gearless Transmission that is compact and transportable equipment, that is skillful and is having some thing exercise withinside the transmitting electricity among parallel shafts with none gears being used. This Couplings for parallel shaft offers form of displacement and torque from no less than 1 to 500 mm and from 5.four to 80000 Nm respectively. Analysis of Z-pins performed for the extraordinary angles and version in duration of pins is checked. By the geometric evaluation of configuration it turned into analyzed that the dimensions of the Z-hyperlink connector decreases, because the off-set to shift ratio increases. And for this reason the power of the connector comes down. Hence it's miles beneficial to preserve smaller offset to shift ratio for the inflexible and more potent Z-hyperlink connector. By this have a look at they have got concluded that hat the proposed conceptual layout may be carried out for the transmission of electricity among parallel shafts having right shift and off-set through using extraordinary geometries of Z-pins.

Anand C. Mattikalli et al. [10] Researched on Gearless Power Transmission- L Pin Coupling. four pins are used for every 45° , 90° , 135° . The layout turned into checked with the aid of using various the Nos. of pins from 1 to four and to discover the most efficient Nos. of pins used for higher transmission. Analysis is finished in CATIA V5. Analysis is finished handiest for 2 intersecting shafts. At the stop of the look at By CATIA® analysis, It may be concluded from the consequences that the proposed conceptual layout may be implemented for the transmission of energy among Intersecting shafts having right angular misalignment with the aid of using using

extraordinary geometries of L-pins and it's miles discovered that minimal variety of L-Pins required are 3, for non-stop easy energy transmission.

Atish Lahu Patil et al. [11] Had studied Gearless Mechanism in Right Angle . The mechanism become consisting three pins bent similarly at 90° . It become discovered from observe that the greater the Nos. of hyperlink will make the operation smoother. The pins had been made from shiny bar with a extremely good floor finish. The timber cutter become installed at the output shaft which could break up to 250mm width of timber sheet. By running on experimental setup and after an extended Study it's far Concluded that proposed association used for any set of diameters with any profile of shafts for skew shafts of any attitude however the shaft's should be having the rotational movement approximately his very own axis, transmission of movement could be very clean and perfect and used simplest for the same R.P.M. of riding shaft and pushed shaft via way of means of using hyperlinks or given sort of hyperlinks for suitable joints for revolute pair.

M. Lokesh et al. [12] Had fabricated version for Gearless Power Transmission Mechanism the use of 6 Elbow Rods. From the take a look at it's far been said that this mechanism can transmit the strength with 92% of performance. The mechanism changed into consisting 6 Nos. of L pins bent similarly at 90° . The compressor and pump additionally brought into venture whilst the hyperlinks in the drilled holes reciprocates as nicely rotate internal cylinder. It offers pumping and compression effect. Among the 6 hyperlinks first pin is going at internal lifeless middle it sucks the air and begin transferring outer lifeless middle whilst in addition revolving. After take a look at it changed into concluded that Elbow transmission mechanism is feasible in nearly for brief lengths and additionally it's far appropriate for medium duration with the aid of using growing the housing diameter and The setup suggests that with the aid of using growing the elbow a rod in account will increase the smoothness of the transmission additionally The absence of friction in the end increases the performance of the mechanism.

Amit Kumar et al. [13] presented An Arrangement for Power Transmission Between Co-Axial Shafts of Different Diameter. In that association movement is transmitted among the co-axial 18 shafts of various diameters. Up to eight Nos. of pins changed into used. If greater pins used movement could be smoother, however boom in no. of pins now no longer on the price of energy of shaft. Holes drilled very accurately & the axis of each the shafts changed into co-axial. The designed association may be paintings for parallel shaft displacement as much as 500 mm and torque capacities from 5.four to 80000 Nm. It changed into concluded that the Proposed association may be used for any set of diameters with any profile of shafts however the shaft's have to be co-axial and having rotational movement alongside the not unusualplace axis, transmission of movement could be very clean and appropriate and used simplest for the same R.P.M. of using shaft and pushed shaft with the aid of using using exceptional geometries of Z-pins and Elbow pins or link.

5. CONCLUSION

- Any set of Diameter with any profile and skew shaft too may be used, however it must have rotation approximately it's very own axis.
- Both the using and pushed shaft must run at the equal RPM.
- The rods must be similarly radially spaced at the cylindrical disc. (If three pins then $360/\text{three}=1200$ every rod).
- The mechanism transmits the movement successfully as much as one hundred fifty RPM.
- Generally Stainless Still is used because the Rod material.
- Minimum three Nos. of pins must be used for to make transmission possible.
- This mechanism can surrender to 92% of efficiency (Gears can supply most 42% of efficiency).
- The hyperlinks are bent to 90° , however it is able to additionally be numerous via way of means of the usage of the frequent joint.
- General Diameter of Rod used is eight to ten mm.
- General duration of the rod used is 250mm.

REFERENCES

1. Prof R. Somraj, B. Sailesh , “DESIGN AND FABRICATION OF GEARLESS POWER TRANSMISSION FOR SKEW SHAFTS”, International Research Journal of Engineering and Technology (IRJET) ,Volume: 04 Issue: 04 | Apr -2017
2. Neeraj Patil , Jayesh Gaikwad , Mayur Patil , Chandrakant Sonawane , Shital Patel, “Gearless Transmission Mechanism and its Applications” International Journal of Innovative Research in Science, Engineering and Technology, Vol. 6, Issue 3, March 2017
3. Ashish Kumar, Puneet Pawar, Sagar Rana, Shishir Bist, “Multi-Angular Gearless Drive” International Journal of Scientific & Engineering Research, Volume 6, Issue 7, July-2015
4. Solanki Nehal Pramesh, Patel Harshil K, Singh Montu, Rajwani Avesh, “DESIGN AND ANALYSIS OF GEARLESS TRANSMISSION THROUGH ELBOW MECHANISM” International Journal of Scientific Research in Engineering (IJSRE) Vol. 1 (3), March 2017
5. Shiv Pratap Singh Yadav, Sandeep G M, Rudra Naik, G C Keerthi Prakash, Gaurav Kulkarni, Hemanth Kumar S, Thalanki G Vamsi Krishna, “Design, Analysis and Fabrication of Gearless Power Transmission by using Elbow Mechanism” International Journal of Engineering Research & Technology (IJERT) Vol. 6 Issue 04, April-2017
6. Prof. B. Naveen Bardiya, T. karthik, L Bhaskara Rao “Analysis and Simulation of Gearless Transmission Mechanism”, International Journal Of Core Engineering & Management (IJCEM) ,Volume 1, Issue 6, September 2014, Page.no: 136-142.
7. Amit Kumar and Mukesh Kumar, “Gearless Power Transmission for Skew Shafts (A SRRS Mechanism)”International Journal of Advanced Science and Technology Vol.79 (2015), pp.61-72
8. Jagushte G. S, Kudalkar Hrishikesh, Patil Vikas, Varak Vishal, “Design, Analysis and Fabrication of Gearless Transmission by Elbow Mechanism”IJSRD - International Journal for Scientific Research & Development| Vol. 4, Issue 02, 2016
9. Prof. Mahantesh Tanodi, “Gearless power transmission-offset parallel shaft coupling”, International Journal of engineering Research and Technology (IJERT), volume 3, Issue 3, March 2014, Page.no.129-132
10. Mahantesh Tanodi, S. B. Yapalaparvi, Anand C. Mattikalli, D. N. Inamdar, “Gearless Power Transmission- L Pin Coupling” International Journal of Ethics in Engineering & Management Education Volume 1, Issue 5, May2014
11. Prof. Pavan Nikam, Atish Lahu Patil, Vinay Prabhakar Jadhav, Sagar Padmakar Patil, Roshan Suresh Shelar, ” Gearless Mechanism in Right Angle” International Journal on Recent and Innovation Trends in Computing and Communication Volume: 4 Issue: 4
12. M. Lokesh, R. Ranjith Kumar, R. Revanth, K. Renugadevi and S. Ramesh, “Gearless Power Transmission Mechanism using 6 Elbow Rods” International Advanced Research Journal in Science, Engineering and Technology Vol. 4, Issue 6, June 2017
13. Prof. A. Kumar and S. Das, “An arrangement for power transmission between co-axial shafts of different diameter”, International Journal of Engineering Research and Technology (IJERT), ISSN: 2278-0181, Volume 2, Issue 2, March 2013, Page .no: 338-347.
14. “LIMITED ANGLE UNIVERSAL JOINT”United States Patent, Patent No; US 6,287,206 B1, Inventor: Jack W. Stage, 100 Mt. Lyell Dr., SanRafael, CA (US) 94903
15. United States Patent, Patent No. 2938415, Pin And Slot “ANGLE-DRIVE WRENCH” Charles Kostka, Bronx, N.Y. (4 Dock St., Mount Vernon, N.Y.) Filed May 14, 1958, Ser. No. 735,276 Patented May 31, 1960