# DESIGN AND CONSTRUCTION OF GEARLESS AND WITH GEARED POWER TRANSMISSION.

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DHAKA, BANGLADESH

SEPTEMBER 2022.

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DEPARTMENT OF MECHANICAL ENGINEERING

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SEPTEMBER 2022.

# CERTIFICATION OF APPROVAL

The project title “Design and construction of gearless and geared power transmission” Abdur Rahaman, Shariar Hasan, MD. Foysal Ali, Hafizur Rahman, Shorif Khan, Session:September-December, has been accepted as satisfactory in partial fulfillment of the requirements for the degree of Bachelor of Science in Mechanical Engineering on 14 September 2022.

Signature

Professor Md. Mostofa Hossain,

Supervisor and Head of the Department,

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# DECLERATION

This is to certify that this project entitled "DESIGN AND CONSTRUCTION OF GEARLESS AND WITH GEARED POWER TRANSMISSION" is done by us under supervision of Md. Mostafa Hossain, Professor and Head, Department of Mechanical Engineering, Sonargaon University. We have tried our best to make the report with accurate with information and relevant data.

We hereby ensure that, the work has been presented does not breach any existing copyright.

We further undertake to indemnify the university against any loss or damage arising from breach of the forgoing obligation.

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Finally, we are also grateful to the vice chancellor of Sonargaon University (SU) for his overall support to finish the project works.

# ABSTRACT

Gearless power transmission system transmits power from input to output shaft by means of sliding links that from revolute pair with the hub/flange. The sliding Links stay at a 90° angle inside the hole in the input & output hub/flange. When the input shaft is connected to the output shaft through 90 degree sliding links and the input shaft is rotated, the sliding link connected to the input shaft rotates and pushes the output. so that the output shaft rotates through the output sliding link. In this way power is transferred from the input shaft to the output shaft. This mechanism can be used as a replacement for bevel gear in the low cost, low torque applications. It can transmit at any angle 0° to 180°.

Most of the machines transmit power from the input to the output with the help of gears. But, the efficiency of power transmission by spur gears is less due to friction losses. From the design point of view, there is a 10% energy loss per engagement for spur gears. Also, the construction of gears is complex and, thus, costlier. The gearless elbow transmission is a very economic and efficient mechanism and has shown an efficiency of up to 92%. This paper aims at analyzing the gearless mechanism of transmitting power by Adjustable Elbow mechanism using software simulations. Most of the elbow mechanisms have a fixed position at a particular angle (60 or 90 degrees). However, we present a novel way to introduce adjustability in the system. The arrangement can work over a wide range of angles.

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- **NUMBER OF FIGUTRES**

- **NUMBER OF TABLES**

# CHAPTER - I

## INTRODUCTION

- **1.1. INTODUCTION:**

Today's world requires speed on each and every field. Hence rapidness and quick working is the most important. Now days for achieving rapidness various machine and equipment's are manufactured. Gears are costly to manufacture, its need to increase the efficiency of transmission which cannot be done using geared transmission. Gearless transmission mechanism is capable of transmitting power at any angle without any gear being manufactured.

So here we introduced a gearless power transmission system for skew shaft which reduce the losses, cost and save the time and space. This system allows to changing in the orientation of shaft during motion which is very interesting fascinating about this mechanism. Also during analysis of mechanism and working it is seen that this gearless transmission can be used for both intersecting shaft and skew shafts but here we introduce a solution for skew shafts so main attention is towards the skew shafts.

In today's world, as limited quantity of the resources available, it is necessity to utilize that resources in such way that it gives maximum of them. The major problem for the gear transmission is that the manufacturing of gear is complex process which consumes more time and takes very much precision and manufacturing cost is high. Another major problem is that the transmission having gear cause the jamming due to the backless error and produces more noise compared to other drives due to pitch mismatch. This elbow mechanism is also known as gearless transmission system, L-pin mechanism or Orbital transmission mechanism. This elbow mechanism is simple in construction and can be easily made with minor precision. This mechanism is mainly used in replacement of bevel gears where the motion is to be transmitted at $90^0$. So, in general elbow mechanism angle between rods is taken $90^0$. This mechanism can also be used to transmit power at varying angle by changing the angle of L-pins or by providing universal joint at the corner. This mechanism consists mainly 3 L-pins, further increase into L-pins will increase the smoothness of the system. Elbow Mechanism is being compact and portable equipment, which is skillful and is

having something practice in the transmitting power at right angle without any gears being manufactured. This mechanism can be used for any diameter of the driving and driven shaft.

The modern engineering aims to achieve maximum possible efficiency by reducing wastage of power as much as possible. In most automobiles and industrial machines, the power is transmitted with the help of gears. However, the power transmission by gears involves a lot of frictional losses. Also, gear mechanism involves a fixed position between the input and the output drives. Bevel gears have been used extensively to transmit power only at certain fixed angles. The proposed mechanism aims at reducing the frictional losses and increasing the degrees of freedom of power transmission. The mechanism which we have proposed in this paper shows the ability of an elbow mechanism to transmit power at any angle. We have simulated the design of a 3-pair elbow rods transmission mechanism using software simulations.

Engineer is constantly conformed to the challenges of bringing ideas and design in to reality. New machine and techniques are being developed continuously to manufacture various products at cheaper rates and high quality. The project “GEARLESS TRANSMISSION” being compact and portable equipment, which is skilful and is having more practice in the transmitting power at right angle without any gears being manufactured. The parts can be easily made and price is also less. The Cylinder-piston Mechanism transmits the input power towards the output side such a way that the angular Forces produced in the slacks are simply transmitted with the help of cylinder-piston mechanism which takes up the I/P power and the angle drive is transferred towards the O/P slack and Cylinder-piston assembly. Hence very little friction plays while the power is being transmitted.

## ▪ 1.2. POWER TRANSMISSION:

Power transmission is the movement of energy from its place of generation to a location where it is applied to perform useful work. Since the development of technology transmission and storage system have been of immersed intersect to technologist and technology users.

Power defined formally as a unit of energy per unit time in SI unit. According to Newton's law we know that

$$Watt = \frac{Jule}{Second} = \frac{Newton \times meter}{Second} \quad \text{[Newton's Law]}$$

The transmission method is an engineering method that matches the power machine and the working part of the machine in terms of energy configuration, movement speed and motion form. Of the four major types of transmissions (Mechanical, Electrical, Hydraulic and Pneumatic) that are currently in use, none of the power transmissions are perfect. An efficient means to transmit power is important for the present socio-economic world. Usually, power transmission is associated with belt, chain, gear, rope, shaft etc. from the mechanical point of view. Uses of gear for transmitting power is a popular way but noise, friction, wearing, breaking of components etc.

### ▪ 1.2.1. TYPES OF POWER TRANSMISSION SYSTEM:

There are four types of power transmission:

- Mechanical power transmission system.
- Electrical power transmission system.
- Hydraulic power transmission system.
- Pneumatic power transmission system.

### ▪ 1.2.2. MECHANICAL POWER TRANSMISSION SYSTEM:

Mechanical power transmission is the transfer of energy from where it's generated to a place where I is place where it is used to perform work using simple machines, linkage mechanical power transmission elements. Nearly all machines have same kind power and motion transmission from an input source. This is usually an electric motor or an internal combustion engine which typically provides rotary driving torque via an input shafts-coupling combination.

Mechanical power may be transmitted directly using a solid structure such as a driveshaft; transmission gears can adjust the amount of torque or force vs. speed in much the same way an electrical transformer adjusts voltage vs current. Factories were fitted with overhead line shafts providing rotary power. Short line-shaft systems were described by Agricola, connecting a waterwheel to numerous ore-processing machines,[1]. While the machines described by Agricola used geared connections from the shafts to the machinery, by the 19th century, drivebelts would become the norm for linking individual machines to the line shafts. One mid-19th century factory had 1,948 feet of line shafting with 541 pulleys,[2].

#### ▪ 1.2.2.1. TYPES OF MECHANICAL POWER TRANSMISSION ELEMENTS:

In an engineering product design such as automation drives, machinery etc, power transmission and its elements make it possible to match the power source to its operating environment and condition of the working elements. Some types of Mechanical power transmission elements are following.

- Shafts & Couplings
- Power Screws
- Gears & Gear Trains
- Brakes & Clutches
- Belts, Rope & Pulleys
- Chains & Sprockets

- **1.2.2.2. ADVANTAGES OF GEARLESS POWER TRANSMISSION:**

The advantage of gearless power transmission is following.

i. Complete freedom of interchangeability
ii. more efficient than gear
iii. power could the transferred to any desired angle
iv. easy manufacturing
v. misalignment of shafts can be tolerated to some extent
vi. low cost of manufacturing
vii. portability of parts

- **1.2.2.3. DISADVANTAGES GEARLESS POWER TRANSMISSION:**

The disadvantage of gearless power transmission are following.

i. Dose not works at very low starting torque.
ii. Improper hole drilling could pose much problem.
iii. Sudden load would cause mechanical breakdown.
iv. Links are to be replaced after certain cycle time.
v. Speed ratio is always constant.

- **1.2.2.4. ADVANTAGES OF GEARED POWER TRANSMISSION:**

i. It is positive drive hence velocity remains constant.
ii. Provisions for changing velocity ratios can be made with the help of gear box.
iii. Its efficiency is very high.
iv. It can be used even for low speeds.
v. It can transmit high torque values.

- **1.2.2.5. DISADVANTAGES OF GEARED POWER TRANSMISSION:**

i. They are not suitable when shafts are distant.
ii. At high speeds noise and vibration happens.
iii. It requires lubrication.
iv. It has no flexibility.

- **1.2.2.6. APPLICATIONS GEARLESS POWER TRANSMISSION:**

The application of gearless power transmission is following.

i. Tower clock
ii. Gang Drilling
iii. Lubrication Pump for CNC lathe
iv. Angular drilling
v. Movement of periscope in submarine
vi. Used in vehicle
vii. Small and medium load transmission.
viii. The mechanism is very useful for a reaching a drive at a clumsy location.
ix. Air blower for electronic and computer machine.
x. Industrial Applications.
xi. Very useful in machine shop.
xii. Hand Drive machine.

### 1.2.2.7. APPLICATIONS GEARED POWER TRANSMISSION:

The application of geared power transmission is following.

i. Engine
ii. Lathe Machine
iii. Gear Box
iv. Milling Machine
v. Differential of Automobile
vi. Automobile Steering.
vii. Industrial Robot.
viii. Food Processing Machine.
ix. Agricultural Machinery.
x. Glass Processing Machine.

### ▪ 1.2.3. ELECTRICAL POWER TRANSMISSION SYSTEM:

Electrical power transmission involves the bulk movement of electrical energy from a generating site, such as a power station or power plant, to an electrical substation where voltage is transformed and distributed to consumers or other substations.

Electric power transmission systems are the means of transmitting power from a generating source to various load centers (i.e., where the power is being used). Generating stations generate electrical power. These generating stations are not necessarily situated where the majority of the power is being consumed (i.e., the load center). Since distance is not the only factor that determines the ideal location for a generating station, the place where the power is generated may be quite far away from where it is used. Land further from the load center (which is generally a high-density central location) can be much cheaper per square meter, and governments may not want such loud and/or polluting stations close to residential areas. Hence power transmission systems are crucial to the supply of power in electrical networks.17

Overall, electrical supply systems are the network through which consumers of electricity receive power from a generation source (such as a thermal power station). Power transmission systems – including short transmission lines, medium transmission lines, and long transmission lines – transport the power from the generation source and into a power distribution system. These distribution systems provide electricity to individual consumer premises.

### ▪ 1.2.4. HYDRAULIC POWER TRANSMISSION SYSTEM:

Hydraulic transmission is a transmission method that uses liquid as a working medium to transfer energy & control. Hydraulic power can be transported in pipelines containing a high heat capacity fluid such as oil or water as used in district heating systems, or by physically transporting material items, such as bottle cars, or in the ice trade.

Hydraulic transmissions of the hydrostatic type are combinations of hydraulic pumps and motors and are used extensively for machine tools, farm machinery, coal-mining machinery, and printing presses. The motor and pump can be widely separated and connected by piping. Such a system, using pressurized water, was built in London in 1882 and is still used to drive machinery to lift bridges and operate hoists.

- **1.2.5. PNEUMATIC POWER TRANSMISSION SYSTEM:**

The pneumatic transmission uses compressed gas as the working medium, and the fluid transmission of the power or information by the pressure of the gas. The system of transfer power is to transfer the compressed gas through the pipe & control valve to the pneumatic actuator, which can transform the pressure of the compressed gas into the work of mechanical energy. The system of transmitting information is to use the pneumatic logic element or the jet element to realize the function of logic operation, also can pneumatically control system.

While not technically power transmission, energy is commonly transported by shipping chemical or nuclear fuels. Possible artificial fuels include radioactive isotopes, wood alcohol, grain alcohol, methane, synthetic gas, hydrogen gas ($H_2$), cryogenic gas, and liquefied natural gas (LNG).

## ▪ 1.3. OBJECTIVES:

The objectives of this thesis work are following.

a) To design & construction of gearless power transmission system.
b) To save mechanical energy.
c) To know how can transfer energy without gear.

# CHAPTER II

## LITERATURE REVIEW

### ▪ 2.1. LITERATURE REVIEW OF GEARLESS POWER TRANSMISSION:

The gear drives are extensively used for accurate and variable power transmission in various sectors like automobile, aerospace, marine and defense, Industrial cutting and machine tools, lifting and hoisting devices etc. The main drawback of gear drive is less efficient due to errors like backlash, resulting in the vibrations during operations and decrement in product life due to more wear rate of components.

R. Somraj et al. [3] 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. 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.

Neeraj Patil et al. [4] 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.

Ashish Kumar et al. [5]Ashish Kumar et al. was designed the gearless power transmission system and the examination of the component was done on ANSYS. The investigation of the component was conveyed with 0.63 Moment of Inertia. Conduct of framework was plotted on various outlines for example speed versus time, acceleration versus time, angular acceleration versus time, separation distance versus time.

Solanki Nehal et al. [6]Solanki Nehal et al. used elbow mechanism instead of bevel gear with 4 number of L-type pins. They analyzed the mechanism for 50 to 200 rpm speed and concluded that it was run smoothly about 150rpm. Another, the number of pins increased, the operation would be smoother in that system.

Shiv Pratap Yadav et al. [7]Shiv Pratap Yadav et al. researched about gearless power transmission system for real time study. They used three number of elbow pins at right angle orientation. It was working between eighty to hundred rpm speed. They proposed to replace that mechanism instead of cumbersome usage gears.

Navneet Baradiya et al. [8]had analyzed gearless transmission mechanism on SOLIDWORKS software. The reaction of elbow pin and hub had been plotted with time by varying motor rpm. They were simulated elbow pin for 5 second to find out von mises stress. It was observed that the system was capable of running 120rpm for normal conditions.

Amit kumar et al. [9] Introduced 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-S links. During working on experimental 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 only for

the equal R.P.M. of driving shaft and driven shaft by employing pins or given type of links for appropriate joints for revolute pair.

Jagushte G. S et al. [10] had done research about Design, 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 12.6mm. part modeling was done in Solid Works and Analysis is carried on Autodesk Inventor (2016). It Was Concluded after analysis and Fabrication 140rpm to 160rpm is safe for 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 in power transmission and Further advancement in this technology can be made.

Mahantesh Tanodi et al. [11]Mahantesh Tanodi et al. analyzed about Z-links. When the size of Z-link decreased, off-set to shaft ratio increased. But it was concluded to maintain small off-set to shaft ratio to get more strong and rigid Z-link connector.

Anand C. Mattikalli et al. [12] researched on Gearless Power Transmission- L Pin Coupling. 4 pins are used for each $45^0$ , $90^0$ , $135^0$.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.

Atish Lahu Patil et al. [13] had studied Gearless Mechanism in Right Angle . The mechanism was consisting 3 pins bent equally at $90^0$ . 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 a excellent surface finish. The wood cutter was mounted on the output shaft which can cut up to 250mm width of wooden sheet.

M. Lokesh et al. [14]had been expressed that the gearless power transmission mechanism with 6 L-type of pins to twisted at 90-degree angle could transmit power with 92 percent of efficiency. The pump and compressor were introduced to that paper. When the link rotates and reciprocates inside the drilled hole, it gave compression and pumping effect.

Amit Kumar et al. [15] 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.

# CHAPTER III

## THEORETICAL OVERVIEW

- **3.1. THEORETICAL OVERVIEW OF GEARLESS POWER TRANSMISSION:**

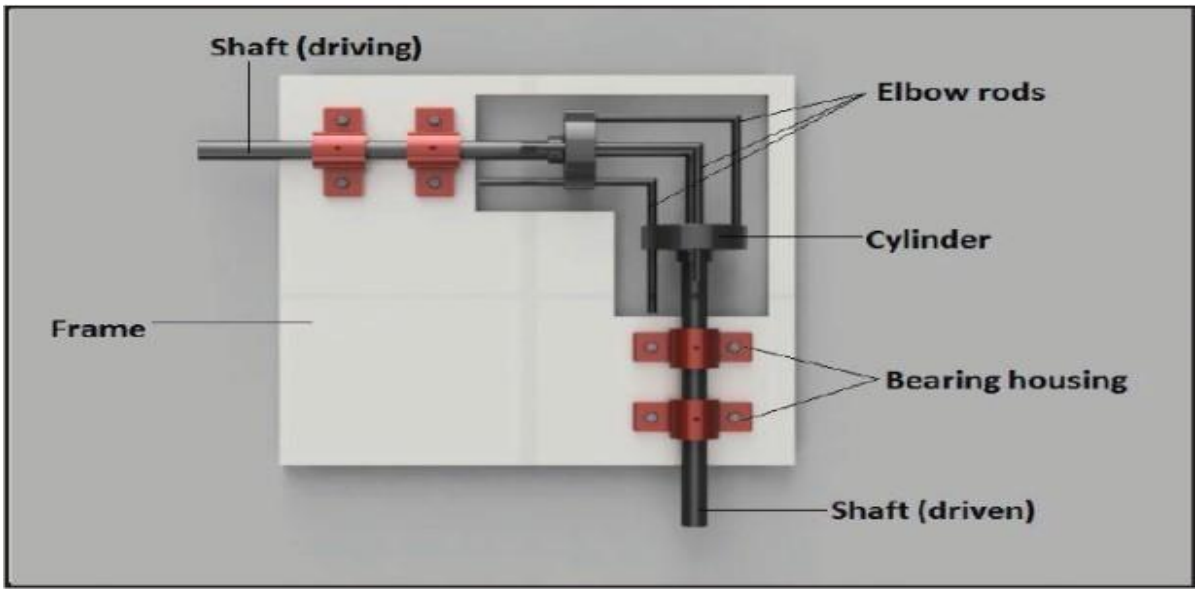


***Fig. 1:*** *Concept drawing of gearless power transmission system*

The Gearless transmission or El-bow mechanism is a device for transmitting motions at any fixed angle between the driving and driven shaft. The working of the mechanism is understood by the diagram. An unused form of transmission of power on shaft located at an angle.

The Gearless transmission or Cylinder-piston mechanism is a device for transmitting Motions at any angle between the driving and driven shaft. The synthesis of this mechanism would reveal that it comprises of a number of Cylinder-piston would be between 3 to 8, the more the Cylinder piston the smoother the operation. These Cylinder-piston slide inside hollow cylinders thus formatting a sliding pair. Our mechanism has 3 such sliding pairs. These cylinders are placed in a Hollow pipe and are fastened at 120˚ to each other. This whole assembly is mounted on welded MS base. The working of the mechanism is understood by the diagram. An unused

***Fig. 2:*** *Structure drawing of gearless power transmission system*

form of transmission of power on shaft located at an angle. Motion is transmitted from driving to the driven shaft through the roads which are bent to conform to the angles between the shafts. These roads are located at in the holes equally spaced around a circle and they are free to slide in & out as the shaft revolves. This type of drive is especially suitable where quite operation at high speed is essential but only recommended for high duty. The operation of this transmission will be apparent by the action of one rod. In making this transmission, it is essential to have the holes for a given rod located accurately in the same holes must be equally spaced in radial and circumferential directions, be parallel to each rod should be bent to at angle at which the shaft is to be located. If the holes drilled in the ends of the shafts have "blind" or closed ends, there ought to be a small vent at the bottom of each rod hole for the escape of air compressed by the Cylinder-piston action of the rods. This transmission may be provided centrally and in line with the axis of each shaft and provided with a circular groove at each rod or a cross-Cylinder-piston to permit rotation of the shaft about the rod simply active as a retaining device.

# CHAPTER - IV

## DESIGN & CONSTRUCTION

### ▪ 4.1. DESIGN SELECTION:

Firstly, we have selected a design which will satisfy our project experimentally and economically. We have designed the necessary parts of Gearless power Transmission Machine. We knew that a perfect design will help us to make our project perfect. According to residential use we have selected the part's properties.

### ▪ 4.2. COMPONENTS OF THE MODEL AND OPERATIONS:

In this section different view of the arrangement and the components used for arrangement are shown which is necessary for understanding the proper working and setup of the arrangement.

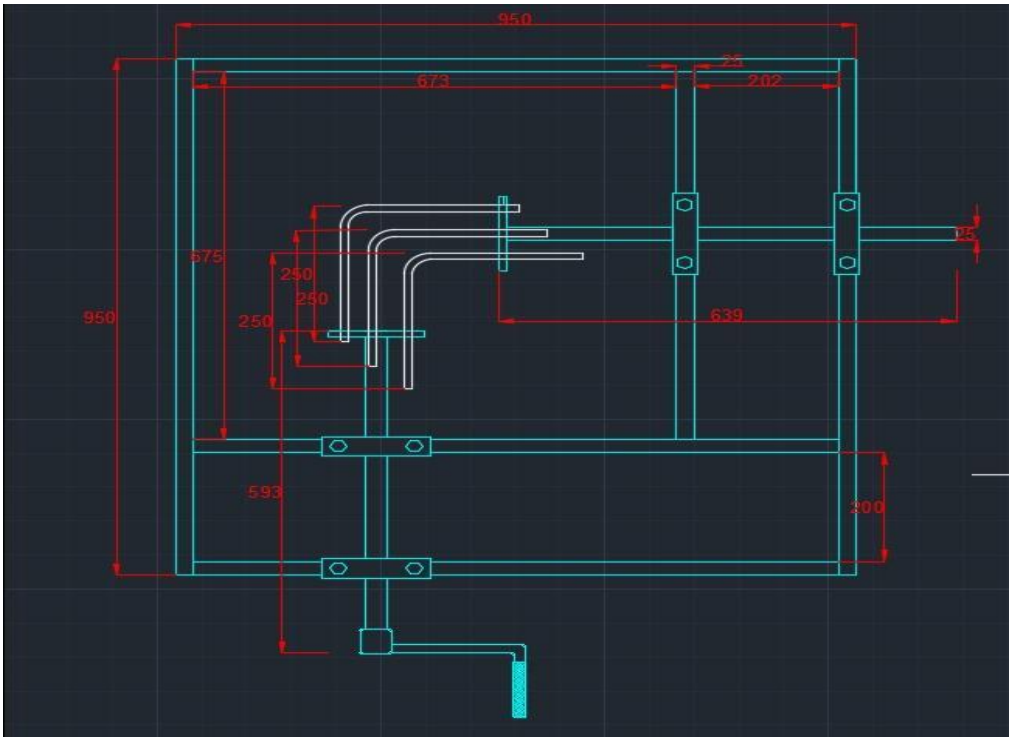


***Fig. 3 :*** *CAD design of gearless power transmission system*

- **4.2.1. VIEW OF THE SHAFTS:**

Below diagram shows different view of the shaft arrangement which is skew angle between them 90 degrees, which help us in the understanding of shafts, in the figure

a. Front view
b. Side view
c. Top view

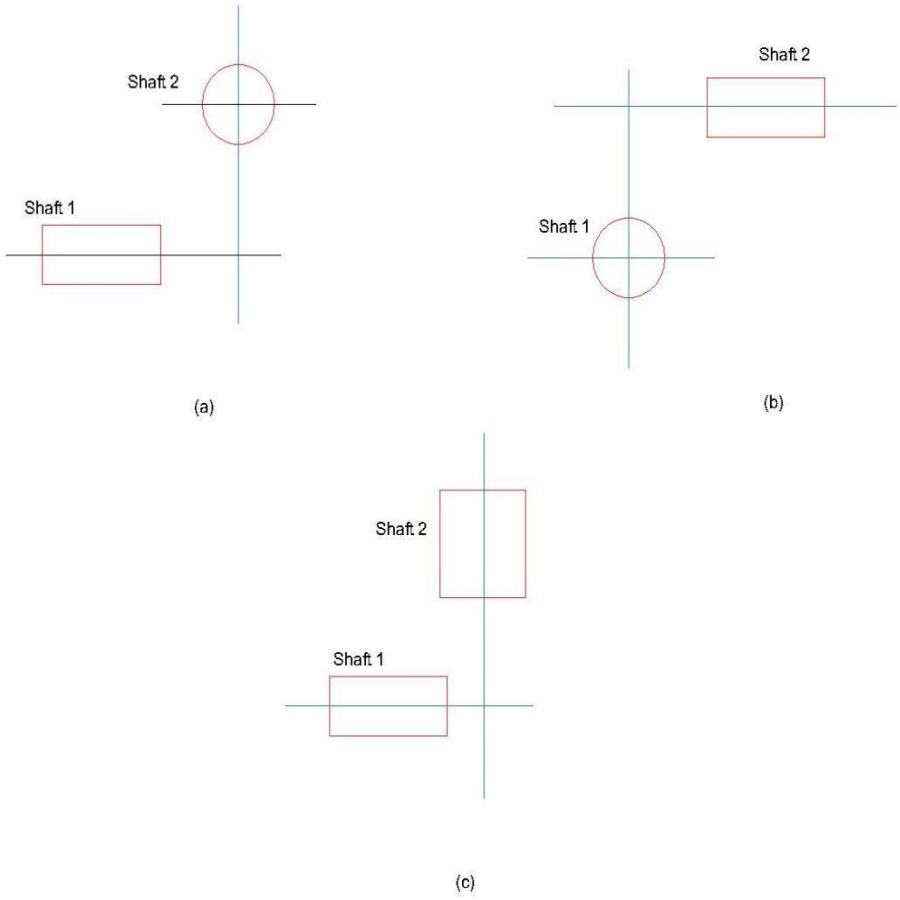


***Fig. 4:*** *Views of shafts arrangement*

- **4.2.2. VIEW OF THE SETUP:**

Different views of the setups are shown in the figure

a. Front view
b. Side view
c. Top view

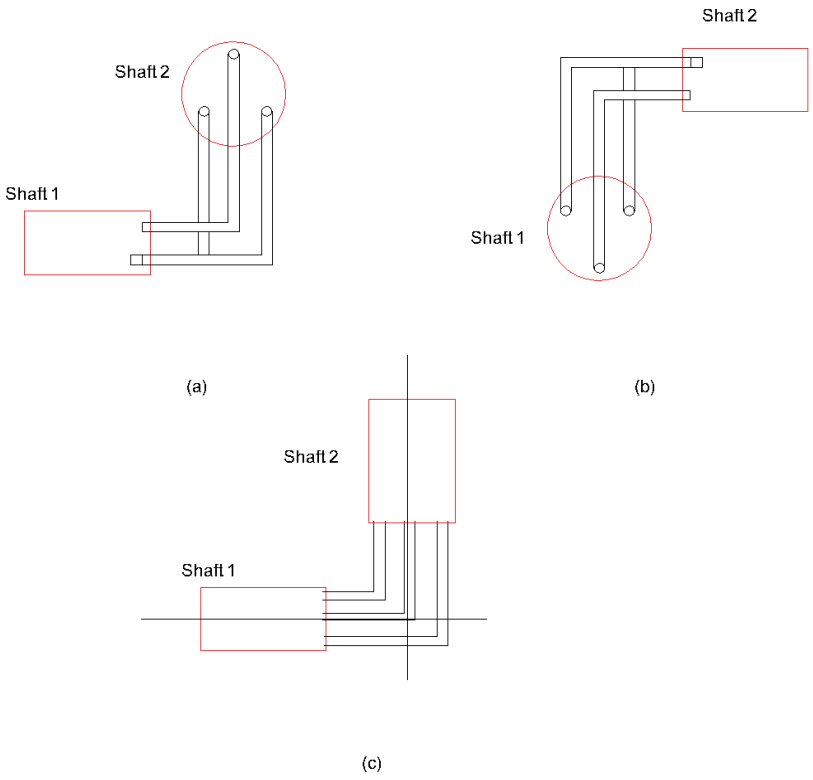


***Fig. 5:*** *Views of Setup.*

- **4.2.3. VIEW OF THE PINS:**

Here different views of the pins according to the setup are shown:

a. Front view
b. Side view
c. Top view

These pins are used for transmitting the power where there is no change in orientation of the shafts during motion.

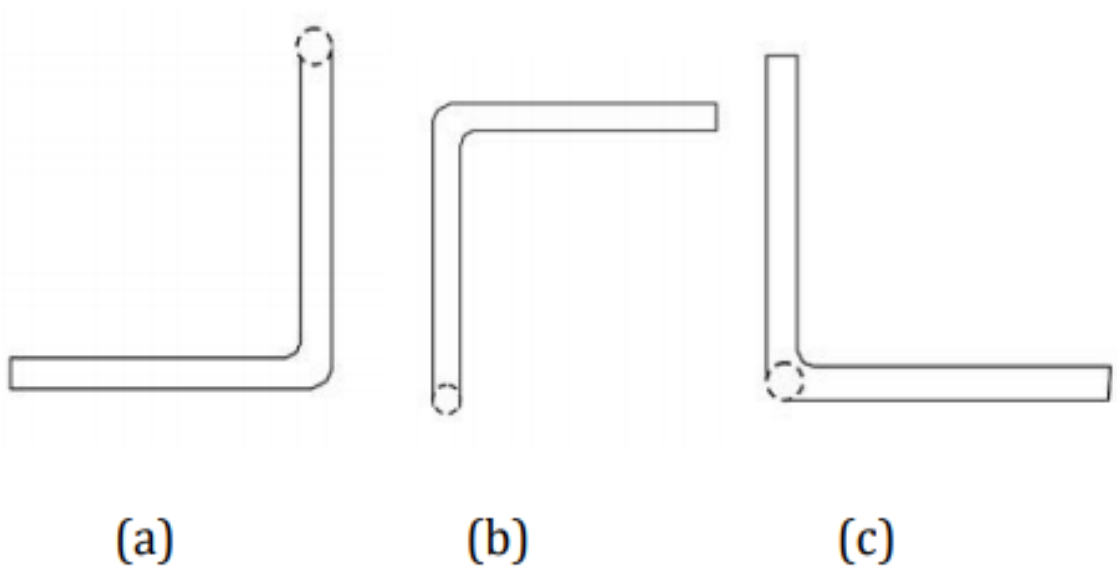


***Fig. 6:*** *Views of Pins.*

- **4.3. RAW MATERIALS LIST OF GEARLESS POWER TRANSMISSION:**

| SL. NO. | MATERIALS | PROPERTIES | QTY | DESCRIPTIONS |
|---|---|---|---|---|
| 01 | GI SQUARE BOX (10' LENGTH) | GI | 03 - NOS | Dia – 1'' & Thickness – 2 mm. |
| 02 | SHAFT | MS | 02 - NOS | Length – 475 mm to 510 mm & Dia – 30 mm to 25 mm. |
| 03 | HUB / HOUSING / FLANGE | MS | 02 - NOS | Hole – 3 nos, Hole Dia – 22 mm & Flange Thickness – 12 mm. |
| 04 | BENT LINK | SS TUBE | 03 - NOS | Length – 510 mm, Dia – 12 mm & Thickness – 2 mm. |
| 05 | HANDLE | MS | 01 - NOS | Length – 400 mm, Dia – 25 mm. |
| 06 | PEDESTAL BEARING | CI | 04 - NOS | UCP205, Length – 2 inch & Dia – 1 inch. |
| 07 | NUTT, BOLT & WASHER | MS | 14 - NOS | M10 |
| 08 | ELECTRODE | MS | 02 - BOX | E - 6013 |
| 09 | PAINT | WHEATHER CODED | 02 - LITRES | N/A |

- **4.4. RAW MATERIALS LIST OF GEARED POWER TRANSMISSION:**

| | | | | |
|---|---|---|---|---|
| 01 | MS PLATE | MS | 02-NOS | Length- 6", Width-6", Thickness-5mm |
| 02 | MS PLATE | MS | 03-NOS | Length-7" & Width-6", Thickness-5mm |
| 03 | Gear | Plastic | 02-NOS | Out Dia-90mm, In dia-25mm |
| 04 | Gear | Plastic | 03-NOS | Out Dia-70mm, in dia-25mm |
| 05 | Gear | Plastic | 01-NOS | Out Dia-50mm, In Dia-25mm |
| 06 | MS Shaft | MS | 01-NOS | Dia-25mm, Length-800mm |
| 07 | Bearing | Brass | 04-NOS | 6205 2Z |
| 08 | Bearing | Brass | 01-NOS | 6203 2Z |

## ▪ 4.5. CONSTRUCTION PROCESS OF GEARLESS POWER TRANSMISSION:

After collecting all the necessary items, we have started our construction process. Firstly, we have cut the GI Square Box (1'' dia & 2 mm thickness) by hand cutter machine as per required measurement. This GI Square Box Finishing by hand grinder & joining by Arc welding. Then we constructed a standing square frame (915 mm x 915 mm) by these GI Square Box as per Design & required measurements.

***Fig. 7:*** *Welding GI Square Frame.*

Then by the Lathe machine we made & finished the Two MS Shaft(Length – 510 mm & outer Dia – 30 mm & inner Dia – 25 mm ). One MS shaft horizontally set up the frame in input side.

Then input bearing (UCP205, Length – 2''/50 mm & Dia – 1''/25 mm) set up the frame & horizontally connected by the input MS shaft.

***Fig. 8:*** *Set-up Bearing & MS Shaft.*

The input MS shaft connected the input Hub/Housing. Constructed MS Plate Two Hub/Housing (Dia – 30 mm) by lathe Machine.

***Fig. 9:*** *MS Plate Hub/Housing.*

Both of the Hub/Housing are constructed 3 Hole. The Hole are made by the drilling machine. Every hole Dia – 22 mm.

Then we cut by the hand cutter Machine. the SS Tube (Length – 510 mm, Dia – 12 mm & Thickness – 2 mm) for Constructed Sliding link/Bent link. The Bent link bent the bending Machine. We are bending the benting link 90 degree angle. This bent link are connected the Housing 3 Hole & this bent link are connected input to output shaft. Similarly we constructed the output side of the same process.

***Fig. 10:*** *Made the Bent Link.*

Now, we constructed rotating Handle at input side & connected the input shaft. When we rotating the handle, the output shaft rotate through from the input shaft. After that the power transfer from input to output shaft.

Finally we constructed the whole process & constructed the gearless power transmission machine. Then we successfully tested by the powe transferring from input to output shaft.

***Fig. 11:*** *Complete Construction.*

- **4.6. CONSTRUCTION PROCESS OF GEARED POWER TRANSMISSION:**

After collecting all the necessary items, we have started our construction process. Firstly, we have cut the MS Plate (7" *6" *6" Length*Width*Hight) by hand cutter machine as per required measurements. MS plate joined by welding.

*Fig 12: Gear Box Welding*

We used total six gear in gear box, two is turning gear & three is idle gear and other one output gear. Every gear connected with shaft (3Nos, Dia 17mm). We used gear lever for turning gear change position.

*Fig 13: Complete Gear Box*

# CHAPTER - V

## EXPERIMENTAL RESULT

### ▪ 5.1. RESULTS:

Finally, we have success in made the project for the purpose. Gearless power transmission system is very easy to Made and operate and Geared transmission system is to complicated made and operate.

There are two types of Gearless and geared power transmission systems, Manually & Automatically. Here we have worked manually. We can automatic it. This will require electric motors, pulleys, belts and electric power.

The constructed model works well as per the design but because of friction in the hub and vibration of the system some speed losses are found in gearless power transfer system but it's output we get better from geared transmission system. The speed loss varies with changing of power because of vibration of the system varies with speed. The vibration is the result of unskilled workmanship and also the clearance between the hub and links was more. with the help of this system, one could efficiently reduce the cost in power transmission.

When we rotate it manually for 30 minutes. Result mentioned below

| Rotation Type | RPM | Average RPM | Efficiency |
|---|---|---|---|
| Manually | 56 | 51 | 90~92% |
| Manually | 52 | 33 | 60~65% |

# DISCUSSION

- **5.2 DISCUSSION:**

After studying synthesis of mechanism it get revealed that this system consist of 3, 4,…up to 8 pins and increasing the Nos. of pins mechanism will work more smoothly. Power to this mechanism is supplied with automatically(motor) or Manually. Motion is transmitted from driving to driven shaft with the help of L-pins. This L-pins starts TO and FRO motion when power is supplied. The motion is transmitted through the S-RR-S pair made by L-pins and cylindrical disc. Let at the starting instant shaft 1 starts rotation with 3 pins in anticlockwise direction and a reaction force developed at the pin surface which in contact with the shaft and this force transferred to the other end of the pin which is in the shaft and applying on the shaft 2 due to which shaft 2 starts rotating in the same direction as shaft 1, after 120 degree rotation pin 1 comes at the place of pin 2 & pin 2 comes at the place of pin 3 & pin 3 comes at the place of pin 1 by sliding in shaft and self-adjusting. This motion repeated for next 120 degrees and further for next 120 degrees and pins are exchanging the position in successive order.

The present work mainly focuses on finding an alternate option of gear drives for various power transmitting applications in different sectors. In this study, the gearless power transmission mechanism created to transmit the power at various angles between the driving shaft and driven shaft, ranging from 0° to 180°. The system is modeled and analyzed in CREO5.0 to check the feasibility of the system. The speed analysis revealed that the speed ratio of the output shaft to the input shaft remained 1:1 during operation. The von mises stress analysis indicated that the design is safe under specific loading criteria. It observed from deformation analysis that the maximum displacement has occurred at the corner of the elbow link. The failure index analysis of the elbow link revealed that the inner curvature of a link is subjected to the maximum possibility of failure. In gearless power transmission system, the power can be transmitted at varied angle. But these are depending upon the angular limitation of the elbow joints. With more analysis and advanced analysis within the style wide-ranging applications of the drive may be discovered.

# CHAPTER - VI

## FUTURE ASPECTS

- **6.1. FUTURE ASPECTS:**

  - Torque bearing capacity can be improved.
  - Flexible bent links may be used.
  - Has a bright future in automation and robotics.
  - Can be used in automobile industry.

Note: By attaching bushes with drum then the chances of vibration may reduce and also overall weight of the mechanism is also reduced (by using drum with less thickness). The proper operation of bent links may obtain.

# CHAPTER - VII

## CONCLUSIONS

- **7.1. CONCLUSIONS:**

During working on experimental setup and after a long discussion it is observed 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 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. Some 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. This projects which looks very simple & easy to construct was actually 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 mechanism can often be Made quite easily we cannot without insight & imagination make effective synthesis of new mechanism hence we are mould to present this our project gear less transmission at 90 degree (El-bow mechanism) which we have managed to successfully device after long & hard input in conceiving its working principle.

The proposed adjustable rod gearless transmission mechanism is an effective mechanism for transmitting powers for short lengths over a wide range of angles between two shafts. The design can effectively reduce the costs and increase the efficiency of power transmission. Advancements in the material and setup can further increase the efficiency.

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