

## DESIGN AND FABRICATION OF GEARLESS TRANSMISSION

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*Abstract— The vehicle transmission system is used for power transmission. Now-a- days we are using gears for power transmission. But there is a problem faced by this technology is wear and tear. The Project is used for power transmission without gears. They are called as Gearless transmission system. It is using L-bend for power transmission. It is a simple technique but it is a more efficient method. We can use that transmission system in any angular position. It can be used in any vehicles. This is one of the effective methods for power transmission. This technology is very useful for automobile industries. It is easy to manufacture. This saves gear manufacturing time and costs along with teeth matching and gear placement issues. The elbow mechanism is an efficient design of gearless transmission technique and the kinematic system that allows for efficient power/motion transmission at right angles. It is being compact and portable equipment, which is skilful and is having something practice in the transmitting power at right angle without any gears being manufactured.*

*Key words: Gearless transmission system, Gears, L-bend, Automobiles*

### 1. INTRODUCTION

In today's world, transportation is most important. Everyone is using vehicle now-a-days. But the transmission system is very much essential in automobiles. For example, power has to be transmitted from engine to vehicles. Traditional way of transmitting power is gear box. But there is a chance of wear in this system. For that we have developed a project known as gearless transmission. It is a simple mechanism which completely replaces the gear box. We can use it in all vehicles for power transmission. It is more efficient and useful technique. It 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 saves gear manufacturing time and costs along with teeth matching and gear placement issues. The elbow mechanism is an efficient design of gearless transmission technique and the kinematic system that allows for efficient power/motion transmission at right angles. This mechanism allows for motion transmission at 90 degree angles between the driver and the driven shafts. This mechanism is for transmitting motions at any fixed angle between the driving and driven shaft. The synthesis of this mechanism would reveal that it comprises of a number of pins would be between 3 - 8 the more the pins the smoother the operation. Gearless transmission is an ingenious link mechanism of the slider and kinematic chain principle.

### 2.LITERATURE REVIEW

We have designed the mechanism for transmitting motion at right angle. However it can also be employed for transmitting motion at any angle to the driven shaft by using the pin bent to conform to the angle between the shaft (acute, obtuse or right angle) The motion study and simulation of various mechanisms has been frequently studied for several years. Elaheh Hassanzadeh Toreh, Mehdi Shahmohammadi and Nasim Khamseh performed.

Kinematic and Kinetic Study of Rescue Robot [1]. Gadhia Utsav D. given the Quarter model of Wagon-R car's rear suspension by making analysis on ADAMS software [3]. Assad Anis carried out analysis of Slider Crank Mechanism on ADAMS Software package [4]. A. A. Yazdani performed Multibody Dynamics Simulation of an Integrated Landing Gear System using MSC.ADAMS [6]. Mohammad Ranjbarkohan made use of ADAMS software package and Newton's laws for analyzing the behavior of slider crank mechanism and investigated the effect of engine rpm on connecting rod and crankshaft [7]. However, there hasn't been performed any study to sort out problems on gearless transmission mechanism. Hence, this analysis is performed.

2.1. Types of gears used for transmission of power at Right Angle!

2.1.1 Helical Gears



Fig2.1. Helical Gears

Helical or "dry fixed" gears offer a refinement over spur gears. The leading edges of the teeth are not parallel to the axis of rotation, but are set at an angle. Since the gear is curved, this angling makes the tooth shape a segment of a helix. Helical gears can be meshed in parallel or crossed orientations. The teeth on helical gears are cut at an angle to the face of the gear. When two teeth on a helical gear system engage, the contact starts at one end of the tooth and gradually spreads as the gears rotate, until the two teeth are in full engagement. This gradual engagement makes helical gears operate much more smoothly and quietly than spur gears.

### 2.1.2 Bevel & Pinion Gears



Fig2.2 Bevel & Pinion Gears

**Bevel gears** are useful when the direction of a shaft's rotation needs to be changed. They are usually mounted on shafts that are 90 degrees apart, but can be designed to work at other angles as well.

The teeth on bevel gears can be **straight, spiral** or **hypoid**. Straight bevel gear teeth actually have the same problem as straight spur gear teeth -- as each tooth engages, it impacts the corresponding tooth all at once. Bevel gears are gears where the axes of the two shafts intersect and the tooth-bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart, but can be designed to work at other angles as well. The pitch surface of bevel gears is a cone.

### 2.1.3 Worm & Worm Gears



Fig2.3 Worm & Worm Gears

Worm gears are used when large gear reductions are needed. It is common for worm gears to have reductions of 20:1, and even up to 300:1 or greater. Many worm gears have an interesting property that no other gear set has: the worm can easily turn the gear, but the gear cannot turn the worm. This is because the angle on the worm is so shallow that when the gear tries to spin it, the friction between the gear and the worm holds the worm in place. Worm drive can reduce rotational speed or allow higher torque to be transmitted.

### 2.1.4 Hypoid gears



Fig2.4. Hypoid gears

A bevel wheel with teeth engaging with a spiral pinion mounted at right angles to the wheel's axis, used to connect non-intersecting shafts in vehicle transmissions and other mechanisms. Hypoid gears look like winding slope gears with the exception of the pole tomahawks don't cross. The pitch surfaces seem cone shaped yet, to make up for the balance shaft, are truths being told hyperboloids of insurgency. Hypoid riggings are quite often intended to work with shafts at 90 degrees. The result is that apparatus proportions of 60:1 and higher are achievable utilizing a solitary arrangement of hypoid apparatuses. This style of apparatus is most regular in driving mechanical differentials, which are typically straight cut incline gears, in engine vehicle axles.

### 3. DESCRIPTION OF COMPONENTS

#### 3.1. COMPONENTS OF SYSTEM

FRAME OR BED

2. FOUR "L" RODS DRIVE TRANSMISSION

3. V BELT DRIVE TRANSMISSION

4. AC INDUCTION MOTOR

5. PLUMMER BLOCK

6. PULLEYS

#### 3.2. DEFINITION

This is a self – assessment test on the part of the students to assess his competency in creativity.

During the course of study, the student is put on a sound theoretical foundation of various mechanical engineering subjects and of course, to a satisfactory extent. Opportunities are made available to him to work on different kinds of machines, so that he is exposed to various kinds of manufacturing process.

As a students learn more and more his hold on production technology becomes stronger. He attains a stage of perfection, when he himself is able to design and fabricate the devices.

This is the project work. That is the testimony for the strenuous training, which the student had in the institute. This assures that he is no more a student, he is an engineer.

#### 3.3. DESIGN AND DRAWING

Having decided about the project to be manufactured at must be designed. Design work should be done very considering all the relevant factors. After design the project detailed drawing are prepared. Detailed Specification for raw material and finished products should be decided carefully along with the specification of the machine required for the manufacture.

##### 3.3.1. MATERIAL REQUIREMENTS

The list of material required for manufacture is prepared from the drawing. The list is known as "Bill

of materials". Availability of these materials is surveyed and purchased from the market.

##### 3.3.2. OPERATION PLANNING

Next work of planning is to "select the best method" manufacture the product, so that the wastage of materials, labour, machines and time can be eliminated by considering various methods. The best method is to be selected for fabrication and other works.

The proper method and proper person and the purposes of operation, necessity operation, proper machine planning. The best method is the developed and is applied to fabricate the project.

##### 3.3.3. MACHINE LOADING

While planning proper care should be taken to find the machining time for the operation as correct as possible. So that arrangement of full use of machines can be made and the machine loading program can be decided.

##### 3.3.4. PURCHASE CONSIDERATION

It is difficult to manufacture all the components needed for the project in the machine shop. In each case, we should decide whether to make or buy about a particular item. It is decided during the planning after making a complete study of relative merits and demerits.

##### 3.3.5. EQUIPMENT PROCEDURE

Results obtained from "operation planning" and machine loading help in calculating the equipment require Specification of the equipment should be laid down 9000by considering then drawings. Drawings will also help in deciding the necessary requirement of tools and accessories

#### 3.4. FABRICATION OF PARTS DETAILS

3.4.1. BED It is made up of mild steel L angle channel material. The motor is engaged with base plate. All the parts for drive this mechanism are mounted on base plate or bed.

##### 3.4.2. FOUR "L" RODS DRIVE TRANSMISSION

The power is transmitted from the motor, V belt drive to the grinding wheel through these four L shaped rods having 8mm diameter. These rods transmit the power in perpendicular directions and sliding in two cylinders.



Fig3.1 L-Bend

##### 3.4.3. V BELT DRIVE TRANSMISSION

A belt is a loop of flexible material used to link two or more rotating shafts mechanically. Belts may be used as a source of motion, to transmit power efficiently, or to track relative movement. Belts are looped over pulleys. In a two pulley system, the belt can either drive the pulleys in the same direction, or the belt may be crossed, so that the direction of the shafts is opposite. As a source of motion, a belt is one application where the belt is adapted to continuously carry a load between two points. The power is transmitted from the motor to the grinding wheel through four L shaped rods and V belt drive. The belt is a V belt of B 45. The driving pulley is made in cast iron material of 25 mm diameter and the driven is made in cast iron material having 100 mm diameter. The purpose of this V belt drive is to reduce the speed from the motor.

#### V-belts

Vee belts (also known as V-belt or wedge rope) solved the slippage and alignment problem. It is now the basic belt for power transmission. They provide the best combination of traction, speed of movement, load of the bearings, and long service life. They are generally endless, and their general cross-section shape is trapezoidal (hence the name "V"). The "V" shape of the belt tracks in a mating groove in the pulley (or sheave), with the result that the belt cannot slip off. The belt also tends to wedge into the groove as the load increases—the greater the load, the greater the wedging action—improving torque transmission and making the V-belt an effective solution, needing less width and tension than flat belts. V-belts trump flat belts with their small center distances and high reduction ratios. The preferred center distance is larger than the largest pulley diameter, but less than three times the sum of both pulleys. Optimal speed range is 1000–7000 Ft./min. V-belts need larger pulleys for their larger thickness than flat belts. For high-power requirements, two or more vee belts can be joined side-by-side in an arrangement called a multi-V, running on matching multi-groove sheaves. This is known as a multiple-V-belt drive (or sometimes a "classical V-belt drive").

V-belts may be homogeneously rubber or polymer throughout, or there may be fibers embedded in the rubber or polymer for strength and reinforcement. The fibers may be of textile materials such as cotton or polyester or, for greatest strength, of steel or aramid (such as Twaron or Kevlar).

When an endless belt does not fit the need, jointed and link V-belts may be employed. However they are weaker and only usable at speeds up to 4000 ft/min. A link v-belt is a number of rubberized fabric links held together by metal fasteners. They are length adjustable

by disassembling and removing links when needed.  
V pulley



Fig3.1(a). V pulley

#### 3.4.4. AC INDUCTION MOTOR

This AC motor is working in 230 V AC supply.



Fig3.2. Ac motor

An AC motor is an electric motor driven by an alternating current (AC). It commonly consists of two basic parts, an outside stationary stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft that is given a torque by the rotating field.

There are two main types of AC motors, depending on the type of rotor used. The first type is the induction motor, which runs slightly slower than the supply frequency. The magnetic field on the rotor of this motor is created by an induced current. The second type is the synchronous motor, which does not rely on induction and as a result, can rotate exactly at the supply frequency or a sub-multiple of the supply frequency. The magnetic field on the rotor is either generated by current delivered through slip rings or by a permanent magnet.

Other types of motors include eddy current motors, and also AC/DC mechanically commutated machines in which speed is dependent on voltage and winding connection.

Capacitor start motor

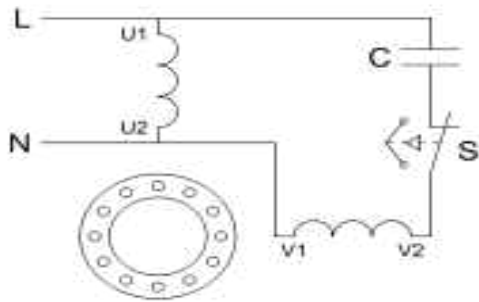


Fig3.3.Capacitor start motor

Schematic of a capacitor start motor.

A capacitor start motor is a split-phase induction motor with a starting capacitor inserted in series with the startup winding, creating an LC circuit which produces a greater phase shift (and so, a much greater starting torque) than a split-phase motor. The capacitor naturally adds expense to such motors. A **Capacitor start motors** are a single phase Induction Motor that employs a capacitor in the auxiliary winding circuit to produce a greater phase difference between the current in the main and the auxiliary windings. The name capacitor starts itself shows that the motor uses a capacitor for the purpose of the starting.

#### 3.4.5. PLUMMER BLOCK STRUCTURE

#### 3.5. HANDLING THE PLUMMER BLOCK AND BEARING

Rolling bearings are precision components. To maintain accuracies, they must be handled very carefully. In particular, they must be kept clean, not be subjected to long impact, and be protected against possible rusting. Plummer blocks also need similar handling practices.

#### INSPECTION BEFORE INSTALLATION

Before installation a bearing and a plummer block, the blowing point must be thoroughly checked and inspected.



Fig 3.4 Inspection component

Prepare installation tools, measured instruments, oil stone, and lubricant and factory cloth. Before the

installation work, remove dust and impurities from these tools

Make sure that the shaft is free from bends or other damages and that it has been dimensioned and formed as specified.

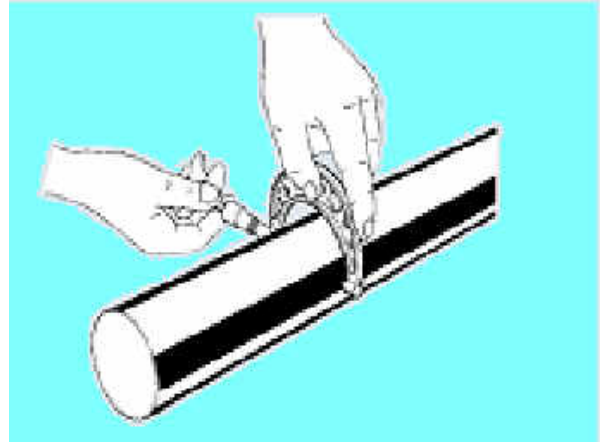


Fig 3.5 Screw gauge

Remove dent marks even through very small from the mating faces with an oil stone or fine emery paper. Check that the contact face to the seal has specified surface roughness. Wipe dust away from the shaft with clean factory cloth.

Remove possible dust and metal chips from the inside of plummer block.

Check the flatness of the mounting face of the plummer block. When placed on a frame, the plummer block must be stably seated.

#### 3.5.2 PREPARATION FOR INSTALLATION THE BEARING

Unpack the bearing just before the installation work.

If the bearing is to be grease-lubricated, the rust-proof coating on it may remain unremoved. If it is to be oil-lubricated, remove the coating with benzene or kerosene.

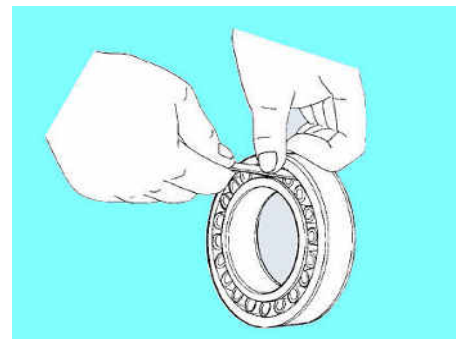


Fig 3.6 Bearing

For a bearing with an adapter, check its radial clearance before the installation work. To do so, place it on a flat work bench, and fit a thickness gage between

the uppermost roller and the raceway surface on the outer ring to measure the clearance. Do not force the thickness gage in or turn the bearing. Otherwise, the resultant clearance measurement will be greater than the actual clearance.

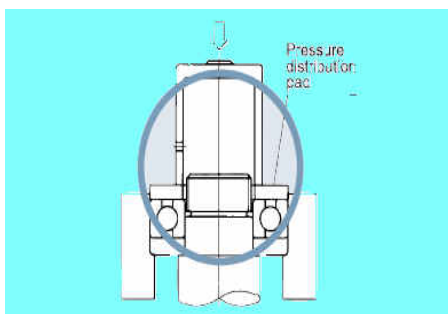
### 3.5.3 INSTALLATION OF THE BEARING AND ASSOCIATED COMPONENTS

Once careful checking is complete, install the bearing and associated components. For the positional relationship.

### INSTALLATION OF THE BEARING AND ASSOCIATED COMPONENTS

When a bearing is installed onto a shaft or into a housing. Do not directly hit its end face with a hammer. Otherwise, its design performance can be lost. Always evenly exert force around the entire bearing ring face. Also, do not apply force to one bearing ring. EXAMPLE: Outer ring

To convey the force via the rolling elements to the other bearing ring inner ring to install the latter. Otherwise, a dent mark or other damage can occur on either or both ring. When installing a cylindrical bore bearing, whose interference is relatively small, its whole inner rings can be uniformly press-fitted at an ordinary temperature as illustrated. Usually, the inner ring is press-fitted by tapping the sleeve with a hammer. However, when many bearings must be installed at a time, a mechanical or hydraulic press will be helpful.



When installing a non-separable bearing to the shaft and housing at a time, apply a press-fitting force to both the inner and outer rings by using a pressure distribution pad.

### 3.5.4. ASSEMBLING THE PLUMMER BLOCKS

When installing two or more Plummer blocks on a shaft, use one block to locate the outer ring of a bearing in the axial direction, and arrange the other block (s) so that the outer ring (s) of bearing (s) in the latter block (s) can move freely in the axial direction.

Once the bearing has been installed to the shaft and the associated components have been inserted over the shaft, assemble the Plummer blocks according to the following procedure.

### 3.5.5. MAINTENANCE AND INSPECTION

To be able to use a bearing to its design life and avoid by accident, check the following points at regular intervals.

Running sound on bearing.

Temperature on bearing or Plummer block.

Vibration on shaft.

Leaking grease or worn oil seal.

Loose tightening and mounting bolts.

Trouble-free operation of the lubrication system, and loosening or leakage with piping.

The bearing arrangement must be inspected while it is a standstill, check it for the following points:

1. Check appearance of bearing for any irregularity.
2. Fouling of grease, or contaminants in grease.
3. Loose adapter sleeve.
4. Worn or damage seal.

## 4. WORKING PRINCIPLE

### 4.1. Working principle of fabrication of gearless drive

The Gearless transmission or El-bow mechanism is a device for transmitting Motions at any fixed angle between the driving and driven shaft. The synthesis of this mechanism would reveal that it comprises of a number of links would be between 3 to 8 the more the links the smoother the operation. These links slide inside hollow cylinders thus forming 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 brackets wooden table. Power is supplied by an electric motor.

The working of the mechanism is understood by the diagram. An unused form of transmission of power on shaft located at an angle. Motion is transmitted from driving to the driven shaft through the rods which are bent to conform to the angles between the shafts. These rods 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 quiet 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 during a revolution. If we assume that driving shaft "A" is revolving as indicated by arrow the driven shaft B will rotate counter

clockwise. As shaft A turns through half revolution C shown in the inner and most effective driving position slides out of both shafts A & B.

The first half revolution and rod "C" then will be at the top then during The remaining half this rod "C" slide in wards until it again reaches to inner most position shown in Fig. in the meanwhile the other roads have of course passed through the same cycle of movements all rods are successively sliding inwards and outwards. Although this transmission is an old one many mechanics are skeptical about its operation, however it is not only practicable but has proved satisfactory for various applications when the drive is for shafts which are permanently located at given angle. Although this illustration shows a right angle transmission this drive can be applied also to shafts located at intermediate angle between 0\* and 90\*.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 atwhich the shaft are 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 pumping action of the rods.

These holes are useful for oiling to avoid blind holes shafts may have enlarged port or shoulder. 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 crosspin to permit rotation of the shaft about the rod simply active as a retaining device for shipping and handling purposed.



Fig. 4.2. Fabricated model

#### 4.2. Gearless drive specification

1. L angle -----40 x 3
2. Shaft diameter----20mm x 550 length
3. Sliding shaft -----10mm diameter/100mm length
4. Flange with 4 holes-----115 mm diameter 100mm length
5. Plummer block bearings-----UCP 204(20mm bore diameter)

#### 5.APPLICATIONS

Driving for all kinds four faced tower clocks. The elbow mechanism was first use in the year 1685 for the famous London tower clock named bigben.

The mechanism is invariable used for multiple spindle drilling operation called the gang drilling.

Used for angular drilling between 0 to 90 degree position.

Lubrication pump for C.N.C. lathe machines.

The mechanism is very useful for a reaching a drive at a clumsy location.

Air blower for electronic and computer machine.

The mechanism has found a very usefully use in electronic and computer technology for multiple.

The elbow mechanism is used for movement of periscope in submarines, the year 1685 for the famous London tower clock.

#### ADVANTAGES

Gearless mechanism is used to reduce the maintenance cost.

Quick response is achieved.

Simple in construction.

Easy to maintain and repair.

Cost of the unit is less when compared to other Machines.

No fire hazard problem due to over loading.

Comparatively the operation cost is less.

The speed of forward and reverse stroke is varied.

Continuous operation is possible without stopping

## 6. CONCLUSION

ADAMS, ME 491, Independent Study

We are assembling the gearless drive to enable the machine to perform one additional operation. At present this attachment is purely operated and controller by means of mechanical.

The present made can eliminate the rescue work of the geared drive and at the same time reduce the maintenance cost of the same machine.

We present out idea for mechanism in manual assisted or operated type attachment. We have decided an equipment namely "Gearless Attachment" has been completed successfully to our entire satisfaction While processing his project, we happen to visit number of libraries and industries to collect information. We got an opportunity to meet a few experienced person in this field. This experience have also enriched our knowledge both theoretically and practically creating confidence, which would be useful in my future span of life.

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