A
Project Report
On

DESIGN ANALYSIS AND FABRICATION OF HUBLESS BICYCLE

Submitted to the
University of Mumbai, Mumbai.

University of Mumbai

Submitted in partial fulfillment of the requirement of the degree of
Bachelor of Engineering in Mechanical Engineering.

Submitted by,

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IDEAL INSTITUTE OF TECHNOLOGY

Wada 40,Posheri,Wada,Dist-Palghar

2021-22

Certificate

Date: _______________

This is to certify that, the project work embodied in this report entitled**, "DESIGN ANALYSIS AND FABRICATION OF HUBLESS BICYCLE"** submitted by **"Amolik Bhushan Petras", "Shaikh Afnan Shafi",** for the award of Bachelor of Engineering (B.E.) degree in the subject of Mechanical Engineering, is a work carried out by them under my guidance and supervision within the institute. The work described in this project report carried out by the concerned students and has not been submitted for the award of any other degree of the University of Mumbai.

Further it is certified that the students were regular during the academic year and have worked under the guidance of concerned faculty until the submission of this project work at the Ideal Institute of Technology..

Signature of the Guide	Signature of HOD	Signature of Principal
Prof. Pramod Sharma	Prof. Pramod Sharma	Dr. Bhuvan Chandra

Approval Sheet

Project Report Approval for B.E

This project report entitled, **“DESIGN ANALYSIS AND FABRICATION OF HUBLESS BICYCLE”** submitted by **“Amolik Bhushan Petras”, “Shaikh Afnan Shafi”,** is approved for the degree of Mechanical Engineering.

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I declare that this written submission represents my ideas in my own words and where other's ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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We would like to express our deep sense of respect and gratitude toward our guide**, Prof. Pramod Sharma**, who didn’t only guide the academic project work but also stood as a teacher andphilosopher in realizing the imagination in pragmatic way, we want to thank him for introducing us to the field of Optimization and giving the opportunity to work under him. Hisoptimism has provided an invaluable influence on my career and outlook for the future. We consider it our good fortune to have got an opportunity to work with such a wonderful person. He has been great source of inspiration to us and we thank him from bottom of our heart. Welike to express our gratitude to our workshop staff, our **Head of the Department, Prof. Pramod Sharma** and our **Principal Dr. Bhuvan Chandra** for their valuable advice and permission for carrying out project work inside the college premises. We are especially indebted to our parents for their love, sacrifices and Support. They are our teachers after we came to this world and have set great example for us about how to live, study and work.

ABSTRACT

The construction of Hubless wheel bicycle with gear train drive mechanism is designed to convert the human muscle power through pedaling work in to the mechanical work. The system is assembled with the combination of pedals, shafts, and Hubless wheel which is function as driving wheel. The pedal and shaft are receiving the human effort and convert in to rotational mechanical motion. This rotational motion is transmit up to the driving wheel via the spur gear drive train. The spur gear meshes with the internal gear and it rotates the wheel. These gear pairs not only transmit the power but also improve the gear ratio step by step. The gears and pinions of drive train are fixing with the bicycle body by using deep groove ball bearings. The spur gear in the gear train is coupled with the driving wheel through the Hubless mechanism which also performs the holding function of driving wheel. The front wheel it only perform the system balancing function without actually participate in driving and driven mechanism.

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CHAPTER 1

INTRODUCTION

1.1. Introduction

Today India is the second largest country in the world according to the population. India is the large market for all types of vehicles but up to till large numbers of peoples are deprived from good transportation system. There are large number of citizens are located in rural area where modern transportation facilities are not useful due to the poor condition of roads and their networks. Today the cost of the fuels is also increases very rapidly. There are several pollutants are emitted into atmosphere by these fossil fuel operated vehicles and day to day this problem becomes very critical. So, we have a need of the transportation vehicle which is able to provide service without the consumption of fossil fuels to prevent the emissions of pollutants. It should also able to conduct the goods where proper provision of road network is unavailable. Bicycle is essential to save the natural resources and it also help to keep the environment clean. There are different types of the bicycle available to provide service to customers. But there is the need to give an alternative to conventional bicycle to overcome different drawbacks. To overcome these drawbacks and to improve the quality of service we develop new mechanism which fulfills the need of customer.

Fig.1.1.1 Conventional cycle

Fig. 1.1.2 Hubless bicycle

Fig. 1.1.3 Hubless bicycle with gear train

1.2. Components

1.2.1. Internal Gear

Internal gear is a gear with its teeth cut in the internal surface of a cylinder and meshes with spur gears. In its manufacturing, because of its shape, the usual hobbing machine used in spur gear production cannot be used. Generally it is made with gear shaper (or gear shaping machine) equipped with a pinion cutter. More recently, the efficiency of internal gear cutting has been improved by a different process called skiving.

Fig. 1.2.1.1 internal gear

1.2.2. Spur Gear

Spur gears or straight-cut gears are the simplest type of gear. They consist of a cylinder or disk with teeth projecting radially. Viewing the gear at 90 degrees from the shaft length (side on) the tooth faces are straight and aligned parallel to the axis of rotation. Looking down the length of the shaft, a tooth's cross section is usually not triangular. Instead of being straight (as in a triangle) the sides of the cross section have a curved form (usually involute and less commonly cycloidal) to achieve a constant drive ratio. Spur gears gears mesh together correctly only if fitted to parallel shafts. No axial thrust is created by the tooth loads. Spur gears are excellent at moderate speeds but tend to be noisy at high speeds.

Fig. 1.2.2.1 Spur gear

1.2.3. Supporting Ring

Supporting ring is cut from a 3mm thick mild steel sheet to facilitate mounting point of supporting gear and tyre. The ring is cut via laser cutting machine. The ring carries the load of the rider and frame of the bicycle. It is also used to connect hubless wheel to the frame. Mild steel is a ferrous metal made from iron and carbon. It is a low-priced material with properties that are suitable for most general engineering applications. Low carbon mild steel has good magnetic properties due to its high iron content, it is therefore defined as being 'ferromagnetic'

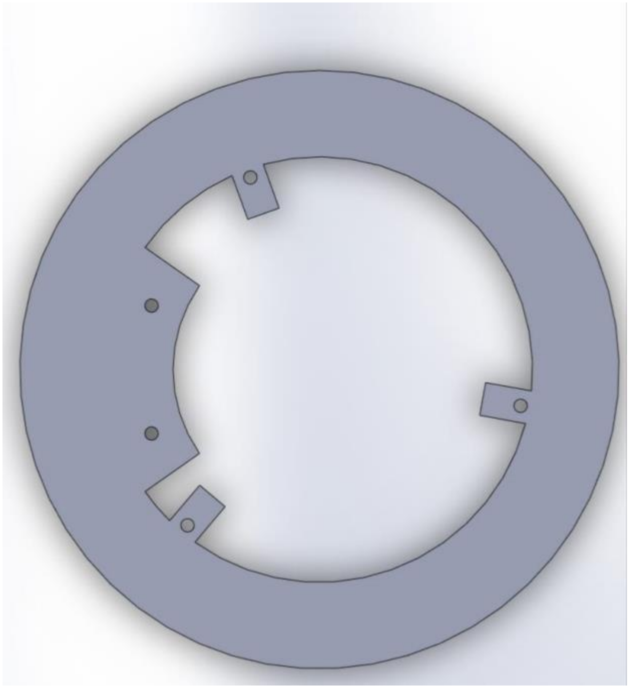


Fig. 1.2.3.1 Supporting ring

1.2.4. Bearing

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts.

Fig. 1.2.4.1 : Bearing

1.2.5. Hub

The hub is the central part of your bike's wheels (front and rear), which connects to the wheel's rim via the spokes and through which the axle is fitted, enabling the wheel to freely spin on two sets of bearings.

Fig. 1.2.5.1: Hub

1.2.6. Sprocket

A sprocket or chainwheel is a profiled wheel with teeth that mesh with a chain, track or other perforated or indented material name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth except for timing pulleys used with toothed belts.

Fig. 1.2.6.1: Sprocket

1.2.7. Chain Drive

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles. The main disadvantage of the belt drives and the rope drives is that the velocity ratio does not remain constant, but varies on account of slip. Since chain drives are positive drives there is no slip, hence the velocity ratio will remain constant.

Fig. 1.2.7.1: Chain drive

CHAPTER 2

LITERATURE REVIEW

4. 1**Algat V.V., Bhalerao R.S., Autade K.N., Shimpi G.B., Prof. Ghodake A.P.,** explained in journal "HUBLESS WHEEL BICYCLE WITH GEAR TRAIN DRIVE MECHANISM" states that "The construction of Hubless wheel bicycle with gear train drive mechanism is designed to convert the human muscle power through pedaling work in to the mechanical work The system is assembled with the combination of pedals, shafts, one small size alloy wheel and one large size Hubless wheel which is function as driving wheel. The pedal and shaft are receiving the human effort and convert in to rotational mechanical motion. This rotational motion is transmit up to the driving wheel via the spur gear drive train. The gear drive train is the combination of four stages of gear pair. These gear pairs not only transmit the power but also improve the gear ratio step by step. The gears and pinions of drive train are fixing with the bicycle body by using deep groove ball bearings. The last spur gear in the gear train is coupled with the driving wheel through the Hubless mechanism which also performs the holding function of driving wheel. The front wheel is small in size as compared to drive wheel and it only perform the system balancing function without actually participate in driving and driven mechanism. This system has ability to reduce the fatigue on bicycle rider by improving the power transmission efficiency and by extending the maximum limit of bicycle speed."

4.2 **Nanh Souvanny**, in the research paper "BICYCLE DEVICE WITH DIRECT DRIVE TRANSMISSION AND HUBLESS WHEELS" explained that " A bicycle device with an internal drive train that eliminates any external mechanical drive train components. An internal drive gear is driven by user pedal input, which provides torque and rotation to a plurityof gear rods, connecting rods and disk gears. The drive train assembled at hubless raer wheel, which rotates a tire tread around a stationary hub. Overall, the present invention provides a sleek, modem upgrade to the traditional bicycle device, and incorporates several features that improve its design."

4.3 **Paul E. Lew**, in the paper “Hubless Wheel” states that “A Hubless wheel for a vehicle which provides advantageous weight and aerodynamic properties. The wheel includes a rotationally stationary inner hoop, coupled to the vehicle, and a rotatable outer hoop, concentric with the inner hoop. The inner hoop and outer hoop are both fabricated with a woven fiber composite shell. A ground engaging tread is disposed on the radial periphery of the outer hoop. Bearings, preferably three rotating bearings spaced circumferentially around the inner hoop at approximately 120° intervals, are mounted on the inner hoop to be rotationally stationary therewith and each include a support surface on their respective radial peripheries. The support surface is particularly contoured to operatively engage a bearing engaging surface located on the inner periphery of the outer hoop. The outer hoop is axially and radially supported relative to the inner hoop through this engagement to allow rotation there between.”

4.4 **Bennett Ross**, in the paper “SPOKELESS BICYCLE SYSTEM” states that “A spokeless bicycle system for providing a bicycle that does not have spokes within the wheels- The inventive device includes a frame having a seat structure and handle bars, a rear bracket having rear bearings within that rotatably engages a rear wheel, a front bracket having front bearings within that rotatably engages a front wheel, and a drive train that engages the rear Wheel for driving the rear wheel. The rear rim of the rear wheel includes a rear groove that receives the plurality of rear bearings. The rear rim of the rear Wheel includes a rear gear that is engaged by a drive sprocket from the drive train. The front rim of the front wheel includes a front groove that receives the plurality of front bearings.” 4.6 Andrew J. Horst, in the paper “HUBLESS WHEEL AND RELATED STROLLER” states that “A seat is disposed on the frame. The Hubless Wheels are disposed on the frame. The Hubless Wheel includes a rim, an internal sliding structure and at least one bridging component. A tire is disposed on the Hubless Wheel. The rim has an external sliding structure on an inner surface of the rim. The internal sliding structure is disposed inside the external sliding structure. The bridging component is disposed between the external sliding structure and the internal sliding structure. The bridging component revolves on its own axis.

4.5 **Andrew J. Horst**, in the paper “HUBLESS WHEEL AND RELATED STROLLER” states that “A seat is disposed on the frame. The Hubless Wheels are disposed on the frame. The Hubless Wheel includes a rim, an internal sliding structure and at least one bridging component. A tire is disposed on the Hubless Wheel. The rim has an external sliding structure on an inner surface of the rim. The internal sliding structure is disposed inside the external sliding structure.

The bridging component is disposed between the external sliding structure and the internal sliding structure. The bridging component revolves on its own axis.

4.6 **Mohan Radhesh Mallaya et al**, discussed thatin this design, hubless wheel comprises of gear drive to transmit power from the motor to the wheel. this work focuses on using nylon MC 901 gears which is much lighter than their metal counter parts. The sun gear meshes with the internal gear ring made up of nylon MC 901 material. The power from the inner gear ring is transmitted to the rim by the bearings. The bearing are held on a bolt whose ends are connected to the stationary plates.

CHAPTER 3

METHODOLOGY

3.1. Introduction

1. In popular we recognize that the cycle run on chain power mechanism and it is ideal and famous manner of transportation in rural as well as city area also. Due to the fact preliminary price may be very low, no gasoline is needed to run the bicycle. There is no threat to pollute the environment because of no use of fuel. But the bicycle used for many years now change only in looks of the frame of bicycle. In the traditional bicycle the rider needs to put more effort to ride because of the spokes attached to the rim of the cycle. When the rider pedals the flywheel rotates because of the chain and the spokes attached to the rim were forcefully rotated which causes the rider to put more effort to ride the bicycle. So considering it as the most objective of our venture, the hub less cycle is designed. In the hub less bicycle the rear rim have a internal gear mounted on it and the hub will behaving the spur gear mounted on it. Because of the use of gears for transmission the rider will be needing less effort to ride the bicycle and as the spokes are removed it also give a new and stunning look to the bicycle.

Figure 3.1: Portable Sand Blasting Machine

3.2. How do we make Hubless Bicycle?

Fig.3.2.1 Hubless bicycle

3.2.1. Material used for making the Hubless bicycle.

1. Internal Gear
2. Spur gear
3. Supporting Ring
4. Bearing
5. Spur Gear (supporting)
6. Hub
7. Sprocket
8. Chain Drive
9. Nut & Bolt

3.2.2. Procedure for making Hubless bicycle.

First, we disassembled the whole cycle. Then we removed tire and spokes from the rim of both wheels. Using gear shaper machine internal gear of outer diameter 393mm module 3 and spur gear were manufactured using gear hobbing machine having 36 teeth and module 3 and and 3 additional smaller spur gear for supporting having 14teeth and module 3. Supporting ring was cut by a laser cutting machining having thickness of 3mm and id 345mm & od 485mm. The internal gear is mounted internally on the rim of cycle through welding.

Fig.3.2.2.1 internal gear mounted on inner diameter of the rim

4 piece of metal of 5mm was welded on the supporting ring to mount supporting gear and driving spur gear. The welded piece was then drilled. Through nut & bolt the supporting gear were fitted on the supporting ring.

Fig.3.2.2.2 supporting spur gear

Spur gear is mounted on the hub by welding and the rear sprocket is mounted on one side of the hub where thread is present on the hub.

Fig.3.2.2.3 Spur gear mounted on the hub

This assembly was then attached to the supporting rings via nut & bolt. Using Gear Hobbing machine front sprocket of 54 teeth having module 0.5 was manufactured. Then the front sprocket and pedal assembly was mounted on the frame. Since conventional tubed tired would result in complicated design due to air filling knob we opted for tubeless rubber tire. A sheet metal of 3mm was cut using gas cutting machine and weld to the frame to provide mounting pointes for rear wheel assembly. A similar piece was welded on the rear part of the frame. Through nut and bolts rear wheel assembly was mounted on the frame. Chain was mounted on the sprocket. To avoid wobbling of wheel 8 bearing of 607zz were mounted on the supporting ring. Hence rear wheel assembly is complete. For front wheel a ring of OD 393.7mm, ID 375.7mm and thickness of 8mm was cut via gas cutting machine. For a smoother finish surface we used lathe machine. The ring was welded on the rim of the cycle. A similar rubber tube less tire was mounted. 3 sheet metal piece of 5 mm thickness was welded on the supporting ring. To avoid wobbling of wheel 8 bearing of 607zz were mounted on the supporting ring. 3 bearings of 6200-z are meshed with the ring for supporting purpose.

Fig.3.2.2.4 Support bearing mounted on M.S ring through nut and bolt and side bearing mounted on ring though nut and bolt.

A sheet metal of 3mm was cut using gas cutting machine and weld to the frame to provide mounting pointes for front wheel assembly. A similar piece was welded on the rear part of the frame. Through nut and bolts front wheel assembly was mounted on the frame.

Fig.3.2.2.5 Front wheel mounted on the bicycle frame.

Hence front wheel assembly is completed. Front and rear brakes are mounted on the cycle. Finally we painted the frame of the body.

CHAPTER 4

DESIGN, CALCULATION & COST ESTIMATION

4.1. Introduction

In popular we recognize that the cycle run on chain power mechanism, and it is ideal and famous manner of transportation in rural as well as city area also. Due to the fact preliminary price may be very low, no gasoline is needed to run the bicycle. There is no threat to pollute the environment because of no use of fuel. But the bicycle used for many years now change only in looks of the frame of bicycle. In the traditional bicycle the rider needs to put more effort to ride because of the spokes attached to the rim of the cycle. When the rider pedals the flywheel rotates because of the chain and the spokes attached to the rim were forcefully rotated which causes the rider to put more effort to ride the bicycle. So considering it as the most objective of our venture, the hubless cycle is designed. In the hubless bicycle the rear rim have a internal gear mounted on it and the hub will behaving the spur gear mounted on it. Because of the use of gears for transmission the rider will be needing less effort to ride the bicycle and as the spokes are removed it also give a new and stunning look to the bicycle.

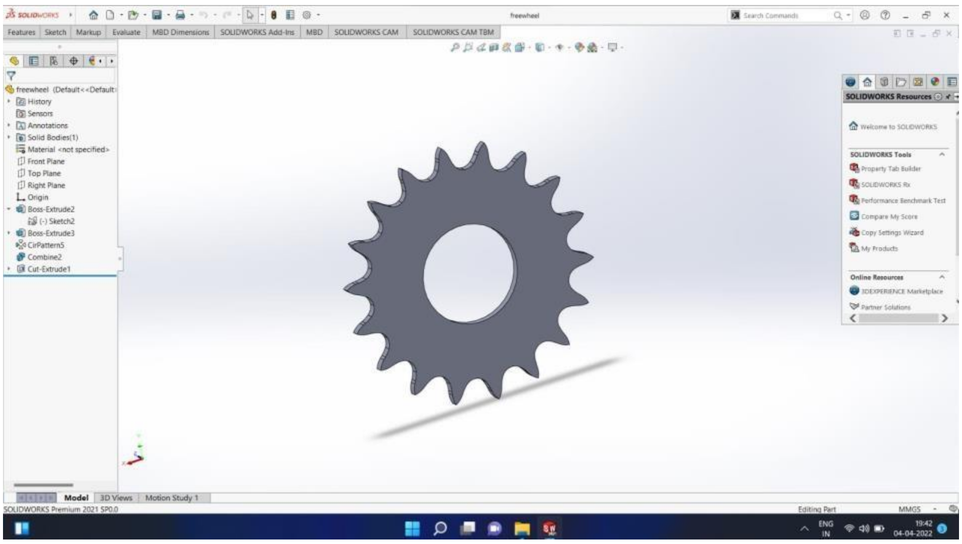


Fig4.1.1: Rear sprocket

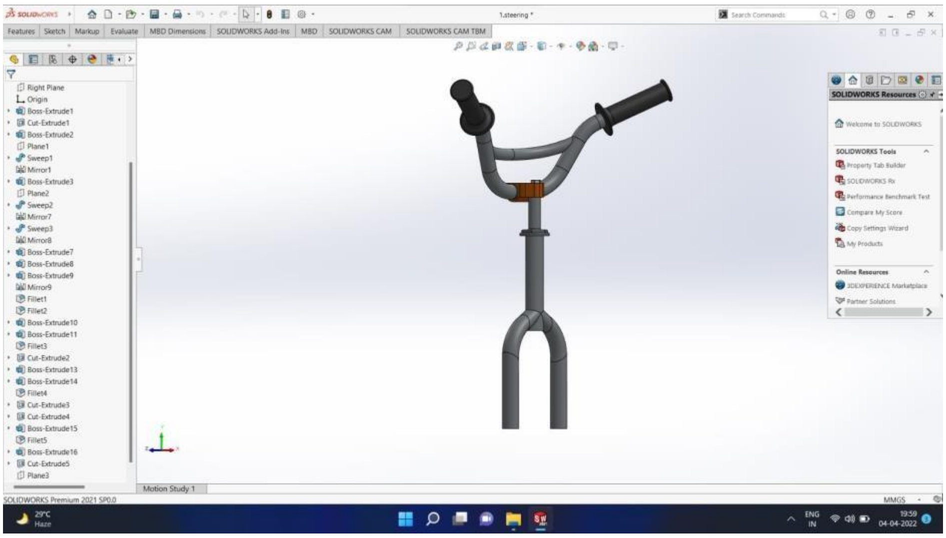


Fig4.1.2: Handel and front forks

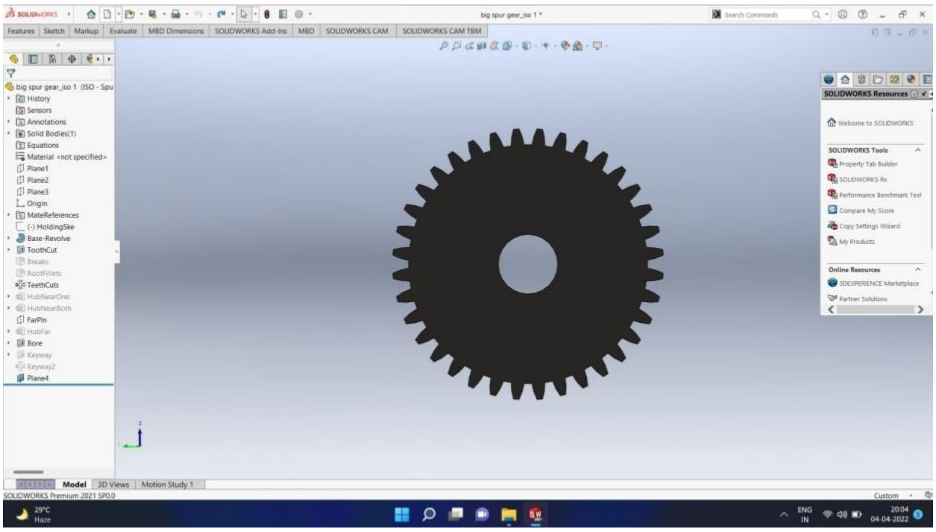


Fig4.1.3: Spur gear

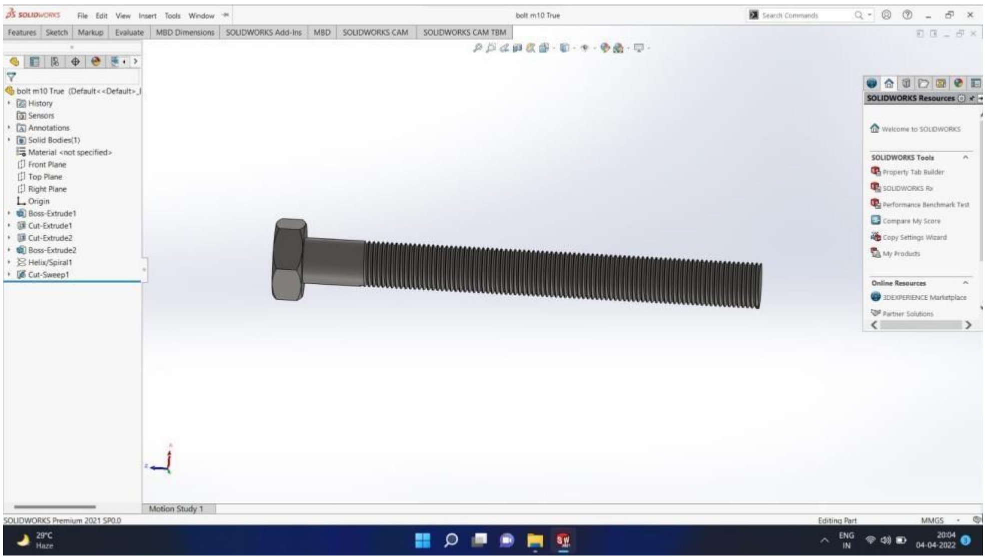


Fig4.1.4: Ms Bolt

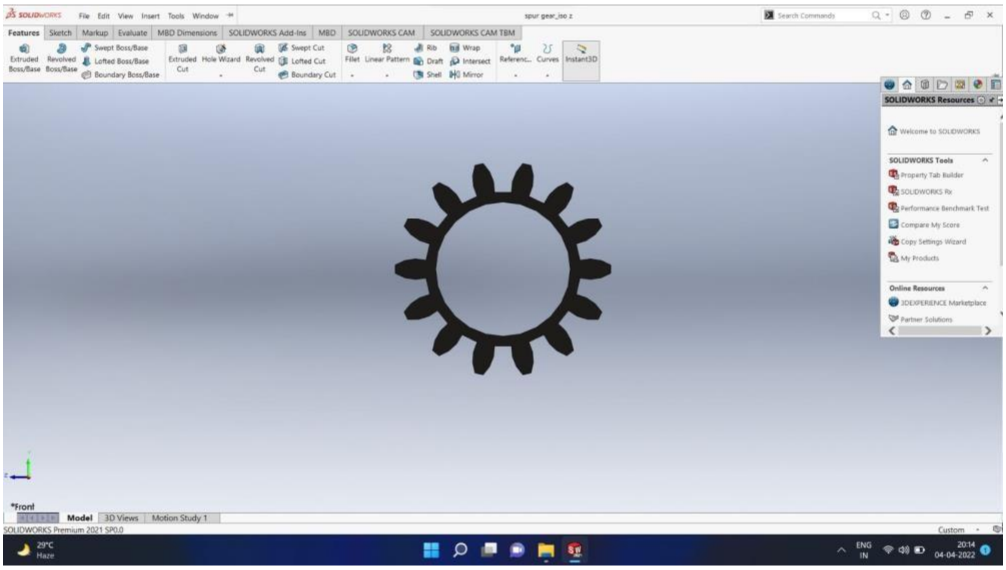


Fig4.1.5: Supporting Spur Gear

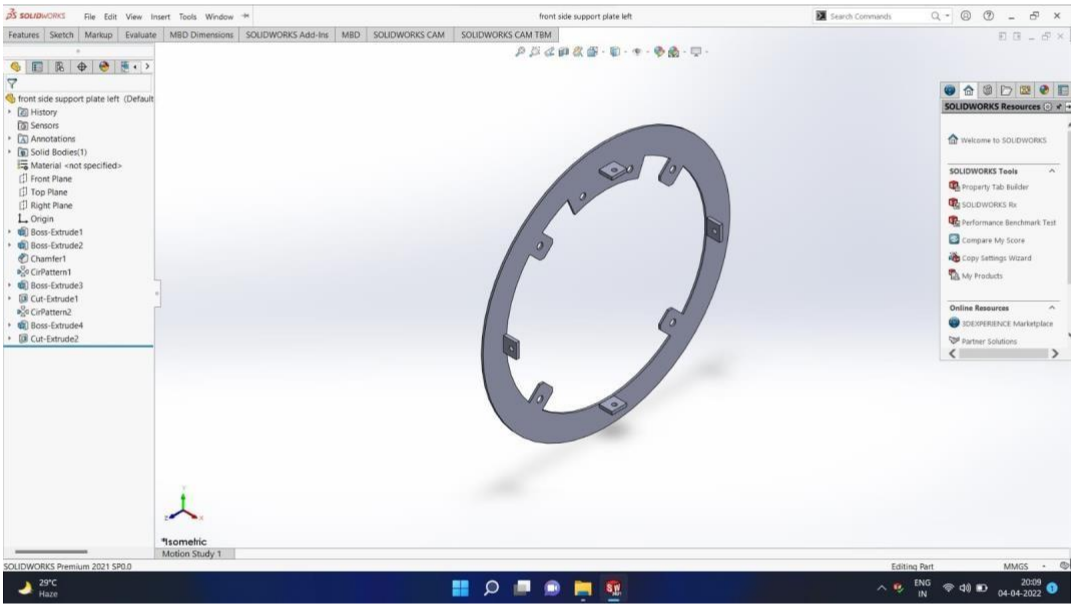


Fig4.1.6: Supporting ring

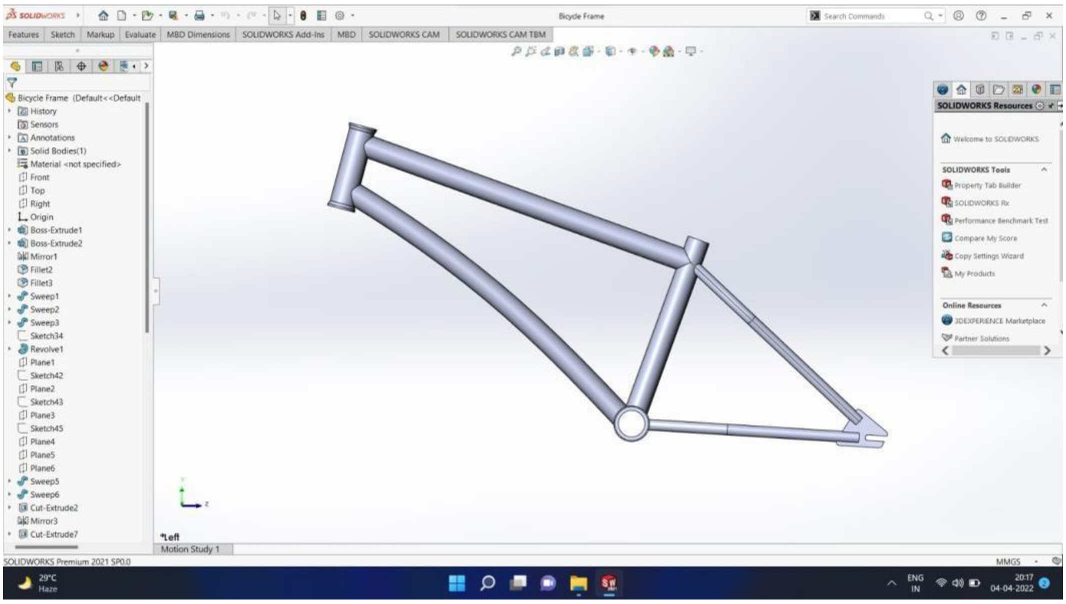


Fig4.1.7: Frame

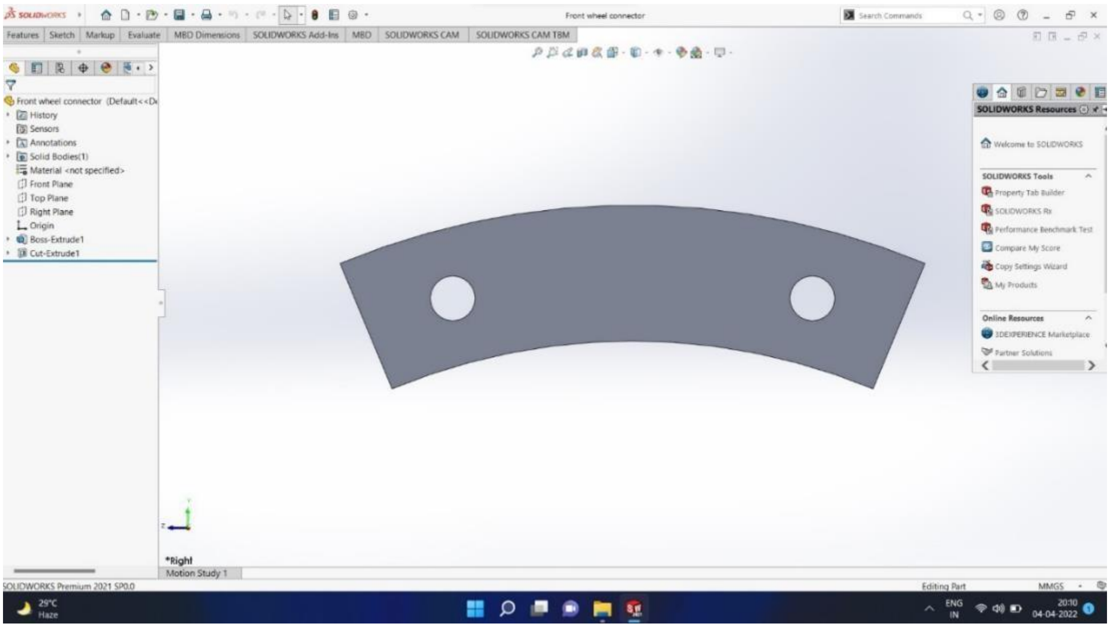


Fig4.1.8: Mounting Plate

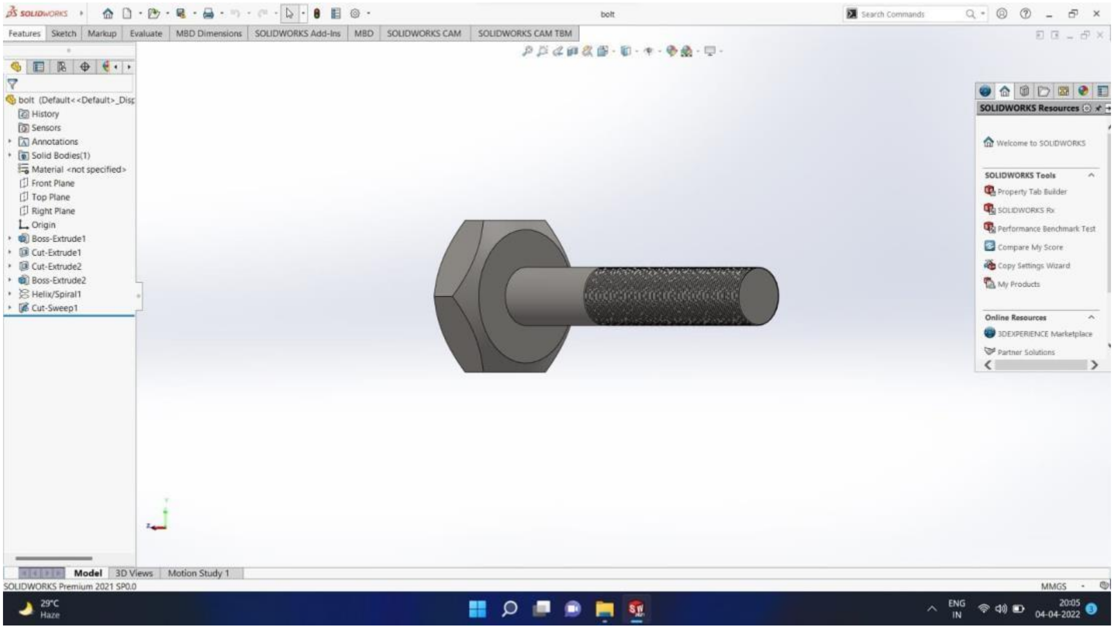
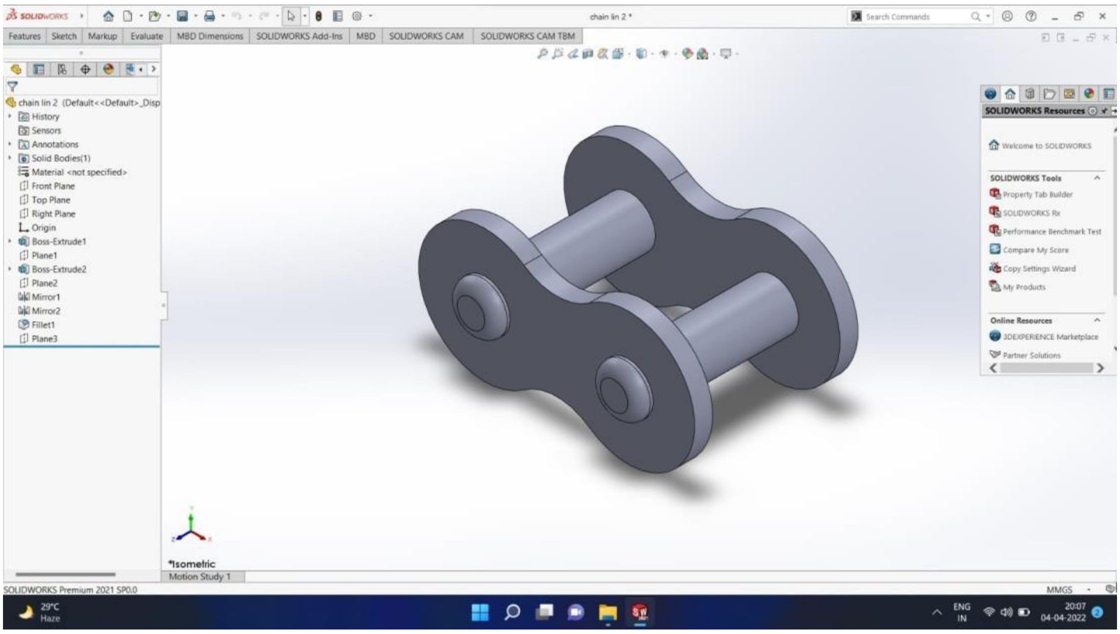


Fig4.1.9: Bolt



- Fig4.1.10: Chain

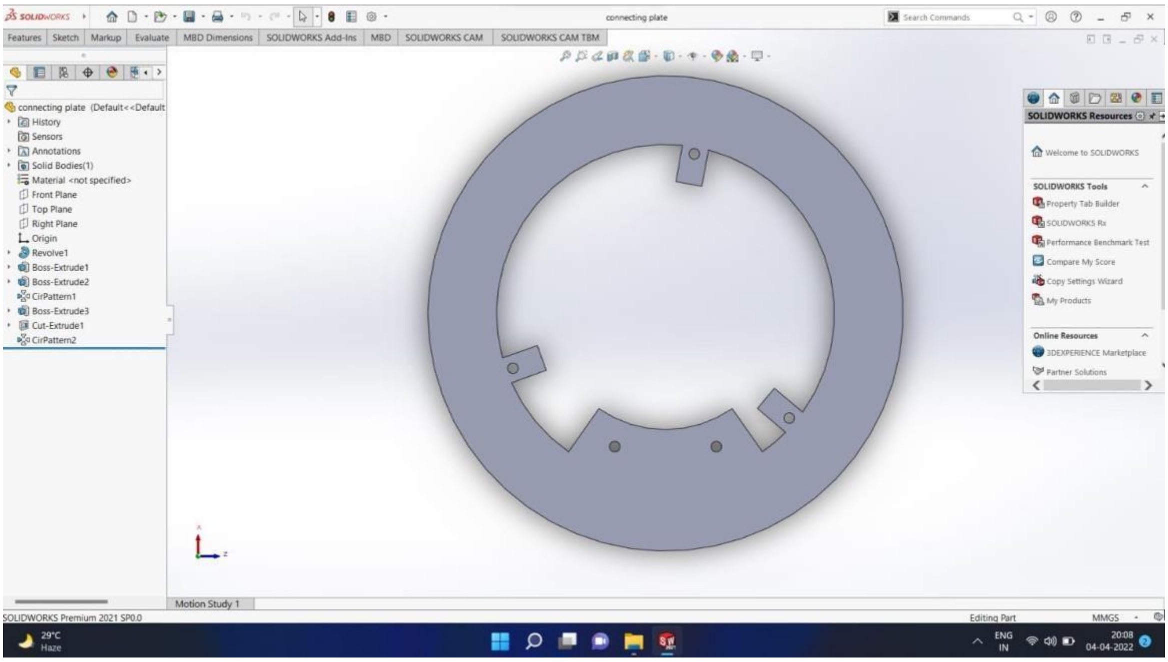


Fig.4.1.11: Front supporting ring

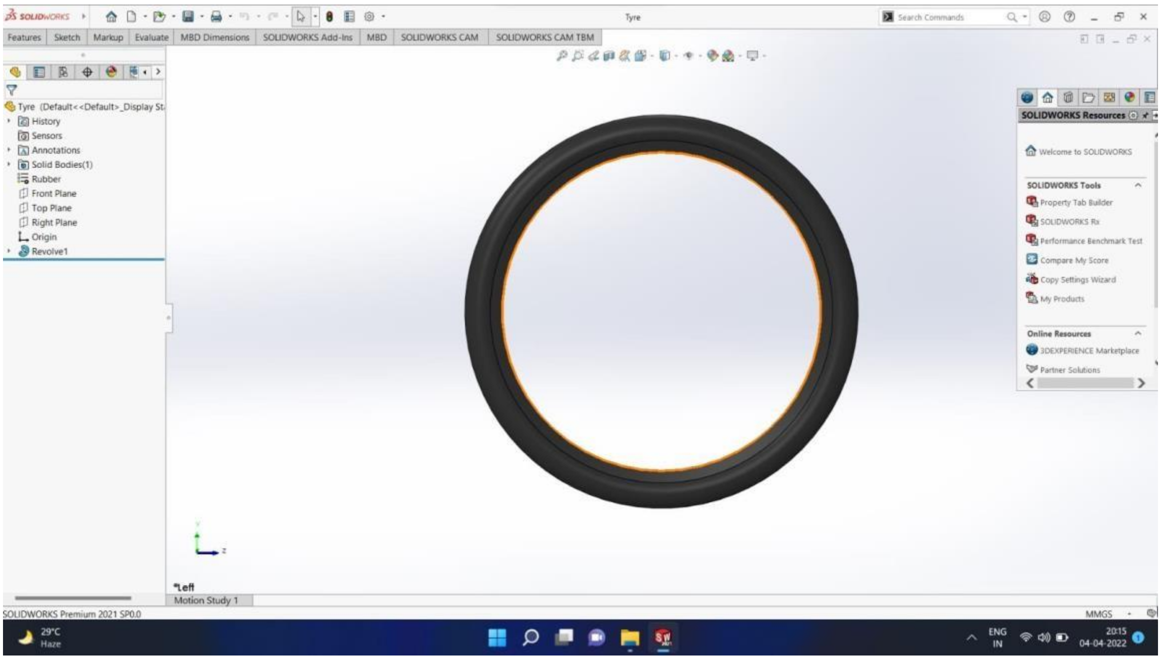


Fig.4.1.12: Tyre

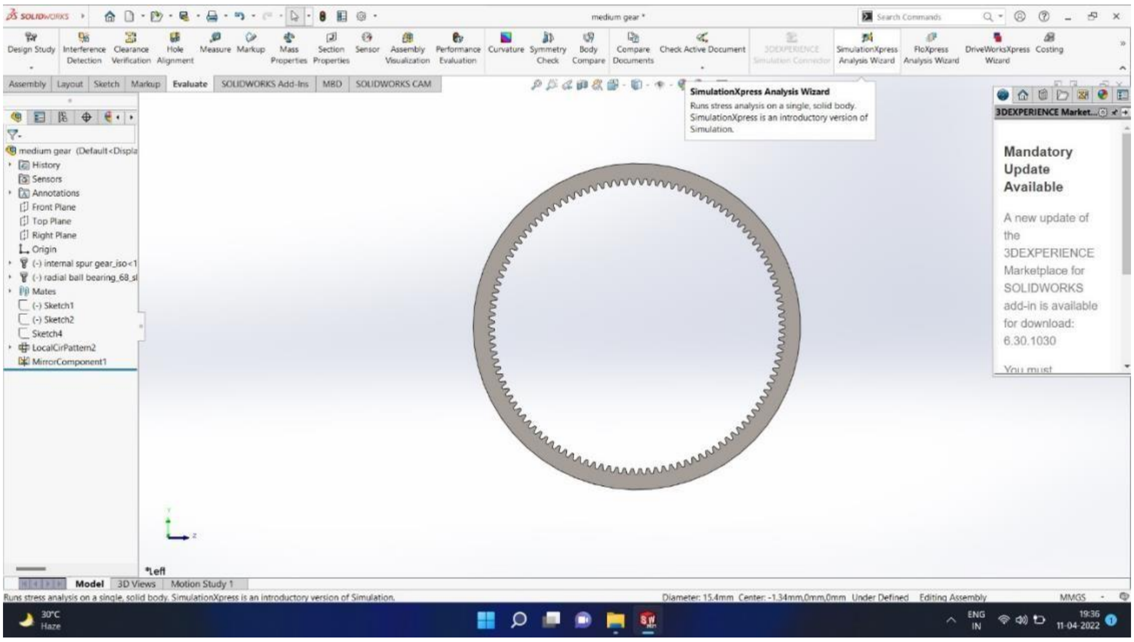


Fig.4.1.13: Internal gear

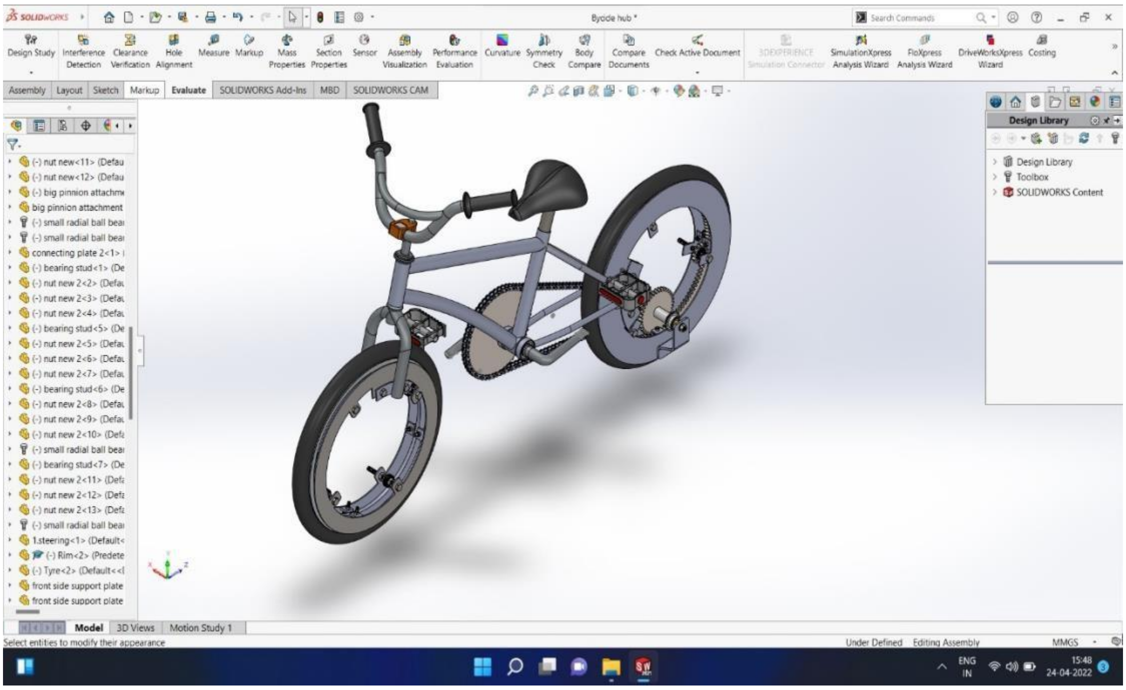


Fig.4.1.14: Hubless bicycle

4.2. Arc Welding

Arc welding is a welding process used to join metal to metal by using electricity to generate enough heat to melt metal and the melted metals, when cooled, resulting in a joint of the metals. It is a type of welding that uses a welding power supply to create an arc between a metal stick ("electrode") and the base material to melt the metals at the point of contact. Arc welders can use either direct current (DC) or alternating current (AC) and consumable or non-consumable electrodes.

The welding area is usually protected by some type of gas welding, vapor, or slag. Arc welding processes can be manual, semi-automatic, or fully automatic. Arc welding was developed in the late 19th century and gained commercial importance in shipbuilding during World War II. Today it remains an important process for the manufacture of steel structures and vehicles.

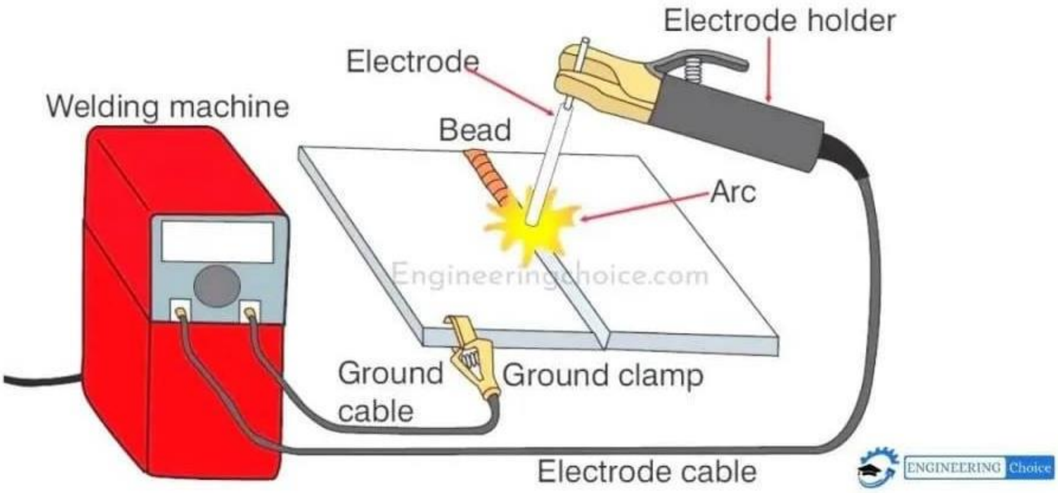


Fig.4.2.1: Arc welding

Types of arc welding

The different types of arc welding are roughly divided into the non-consumable electrode and consumable electrode types, as well as the arc generation and welding principles.

Consumable Vs Non-Consumable Arc Welding

The electrodes (or "sticks" or "rods") used in arc welding can be either consumable or non-consumable.

A consumable electrode not only conducts the current but also supplies filler metal to the joint. This means the electrode is made of a type of metal that melts along with the metals being welded together. This type of welding is often used in the manufacture of steel products.

A non-consumable electrode, on the other hand, is made of material that is not melted during the weld, such as tungsten, which has an extremely high melting point.

4.3 Gas Cutting

Oxyfuel gas cutting (also referred to as oxyfuel cutting or gas cutting) is a rather popular variation of thermal cutting process applied at industrial level. There are several different variations of gas that can be used to perform this process, with a noticeable variation of the end results.

One of thickness that gas cutting can work with ranges from 0.5mm to 250mm. The equipment costs for gas cutting are also relatively cheap by industry standards, and the entire process can be performed mechanically, and not just manuallthe biggest reasons for why it is so popular is the range of materials that it can cut – the material

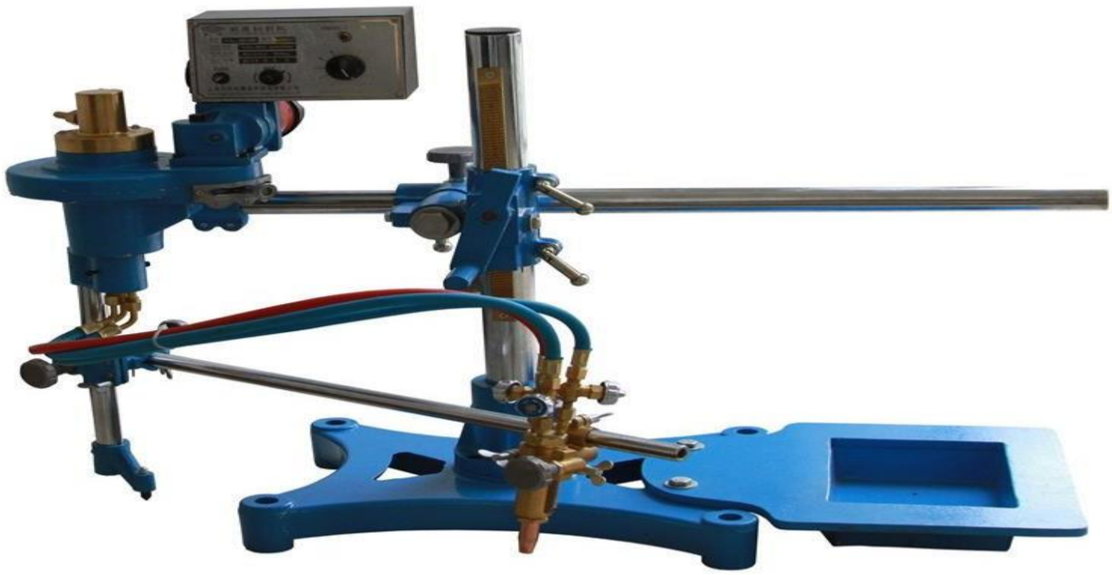


Fig.4.3.1: Gas Cutting

4.4 Laser cutting

Laser cutting is a technology that uses a laser to vaporize materials, resulting in a cut edge.

While typically used for industrial manufacturing applications, it is now used by schools, small businesses, architecture, and hobbyists. Laser cutting works by directing the output of a high-power laser most commonly through optics. The laser optics and CNC (computer numerical control) are used to direct the material, or the laser beam generated. A commercial laser for cutting materials uses a motion control system to follow a CNC or G-code of the pattern to be cut onto the material. The focused laser beam is directed at the material, which then either melts, burns, vaporizes away, or is blown away by a jet of gas, leaving an edge with a high-quality surface finish.

Fig. 4.4.1 : laser cutting machine

4.5 Gear hobbing

Gear Hobbing is the process of generating gear teeth by means of a rotating cutter referred to as a ‘hob’. A hob resembles a worm gear; it has a number of flutes (also referred to as a gash) around its periphery, parallel to the axis, to form cutting edges. The hob is rotated and fed against the rotating gear blank to generate the teeth. Hobbing can be used to produce spur, helical, and worm gears, as well as splines in almost any material (ferrous and nonferrous metals and plastics), but not bevel or internal gears. The versatility and simplicity of hobbing makes it an economical method of cutting gears although conventional hobbing cannot achieve high accuracies (close tolerances) and needs subsequent finishing operations if high accuracy is required. Fig. 4.5.1 depicts the working principle of the gear hobbing process.

Gear Hobbing Parameters :

Three important parameters are to be controlled in the process of gear hobbing indexing movement, feed rate, and the angle between the axis of gear blank and gear hobbing tool (gear hob).

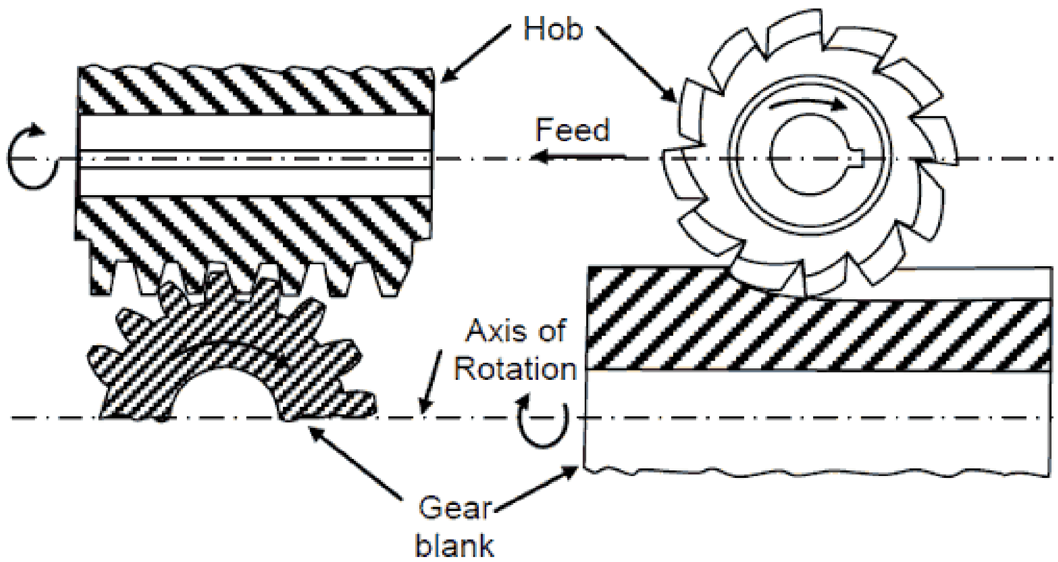


Fig. 4.5.1 : gear hobbing processes

4.6 Gear shaping

Gear shaping is a flexible process to manufacture internal and even external gears. Especially, to manufacture internal gears or external parts with interfering contours, when gear hobbing is not possible. For these applications, gear shaping is the most chosen process.

Gear shaping belongs to the generating process due to its continuous rotational movement during the operation. The workpiece and the tool form a pair of gears where the rotation speed of these partners is coupled by the number of teeth ratio. The gear profile is generated by the rolling action on the same pressure line. During the operation, a stroking motion of the tool is needed to ensure the cutting operation. This oscillating cutting movement (cutting stroke and return stroke) is realised by the simultaneous radial feed of the tool on the desired profile. During the return stroke, the tool is raised from the gear by a special raising system to prevent any scraping on the tooth flanks and to avoid significant tool damage. To reach the defined tooth height of the workpiece, the centre distance between the partners is adjusted continuously until the required geometry is reached.

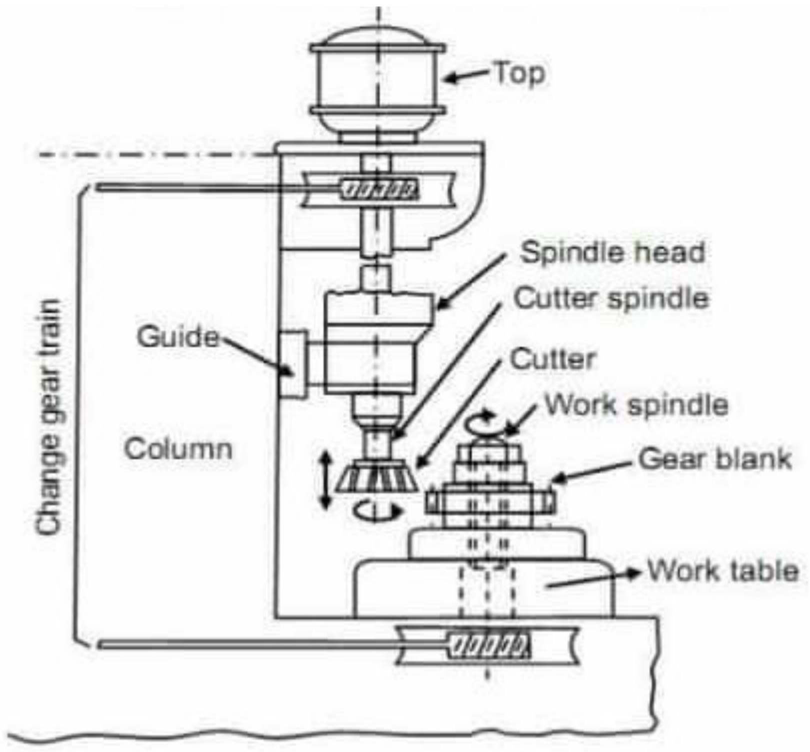


Fig. 4.6.1 gear shapping machine

4.7 Grinding

Grinding is an abrasive machining process that uses a grinding wheel or grinder as the cutting tool. Grinding is a subset of cutting, as grinding is a true metal-cutting process. Grinding is very common in mineral processing plants and the cement industry.

Grinding is used to finish workpieces that must show high surface quality and high accuracy of shape and dimension. It has some roughing applications in which grinding removes high volumes of metal very rapidly.

Grinding is a method of reducing the size of hard materials or sharpening tools, generally accomplished in several stages. To produce desired fineness of end products, grinding is done after crushing. For example, through crushing the mineral ore to below a certain size and finishing by grinding it into powder, the ultimate fineness depends on the fineness of dissemination of the desired mineral.

Fig. 4.7.1 Portable grinder

4.8 Drilling

Drilling is the most important and common drilling machine operation. In the drilling, we usually, produce a cylindrical hole inside the workpiece and remove the material inside it. Here, the material is removed by the rotating edge of the cutting tool. And that rotating edge is called a drill.

Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool, often multi-point. The bit is pressed against the work-piece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the work-piece, cutting off chips (swarf) from the hole as it is drilled.

Fig. 4.8.1 Drilling machine

4.9. Cost Estimation

4.9.1. Introductions

Cost estimation may be defined as the process of forecasting the expenses that must be incurred to manufacture a product. These expenses take into a consideration all expenditure involve in a design and manufacturing with all related services facilities such as pattern making, tool, making as well as a portion of the general administrative and selling costs.

4.9.2. Purpose of Cost Estimating

Cost estimating is the predictive process used to quantify, cost, and price the resources required by the scope of the project, to better manage budgets and deliver projects that do not exceed the identified scope, and that are on time throughout the development process. The need to solidify the estimation process can be seen in four areas:

1. State financial plan
2. Creation of public satisfaction and a positive response
3. Project control
4. Problems currently being encountered

The state financial plan is affected as cost estimates are used to obtain and allocate funding for the overruns of the estimated project costs. This leads to the second reason for the need for cost estimates: influencing public opinion. Public satisfaction is increased if transportation projects show and prove to the general public that they are timely and within budget. Public declaration of the estimated cost of projects needs to be thoughtfully provided only after care is taken to produce a well-documented, quality estimate.

Project control relies on cost estimates to help keep projects within the appropriate fiscal boundaries. Although not necessarily a "check and balance" format, the existence of the original estimate will keep the project from growing and expanding beyond its spending limit. As projects encounter problems, and their estimates come "under fire," great scrutiny is given to the project and its associated estimates. The ability to confront and solve problems and obstacles relies in large part on the quality of the estimate and the documentation, which, if done properly, will provide critical support to project success.

4.9.3. Types of Budget Estimation

- Material Cost Estimation
- Machining Cost Estimation

4.9.4. Material Cost Estimation

Material cost is the cost of materials used to manufacture a product or provide a service. Excluded from the material cost is all indirect materials, such as cleaning supplies used in the production process. Add the standard amount of scrap associated with manufacturing one unit.

These materials are divided into two categories:

a. Material for fabrication:

In this the material is obtain in raw condition and is manufacture or processed to finished size for proper functioning of the component.

b. Standard purchased parts:

This includes the parts which were readily available in the market like sprocket, bearing, gear motor, wheel, chain, blower etc. A list is forecast by the estimation stating the quality, size and standard parts, the weight of raw material and cost per kg for the fabricated parts.

4.9.5. Machining Cost Estimation

Machining cost includes total cost for performing different machining operations such as

4.10. Raw Material & Standard Material Cost

Table 4.9.1: Raw Material & Standard Material Cost

Sr. No.	Part Name	Material	Quantity	Cost
1	Frame	Alloy Steel	1	500
2	Supporting ring	Mild steel	4	3200
3	Internal gear	Mild steel	1	3000
4	Spur gear	Mild steel	1	1000
5	Supporting spur gear	Mild steel	3	600
6	Bearing(607zz)	Carbon steel 1020	16	400
7	Bearing(6200-Z)	Carbon steel 1020	6	120
8	Front sprocket	Mild steel	1	600
9	Rear sprocket	Mild steel	1	150
10	Chain drive	1	1	150
11	Tyre	rubber	2	400
12	Brakes		2	500
13	Rim	Stainless steel	2	450
14	Spray paint		800ml	360
15	Bolt (9mm)	MS	10	50
16	Bolt (7mm)	MS	16	50

17	Nut (9mm)	MS	36	60
18	Nut (7mm)	MS	16	50
	TOTAL COST			11640

4.11. Machining Cost

Welding, Drilling and other machining cost: 8000

Total project cost = Raw material & Standard material cost + Machining cost

= 11640 + 8000

= 19640/-

4.12. Analysis

1] 3 Supporting gear = 14 teeth

Medium gear = 36 teeth

Large gear = 116 teeth

3 Supporting = 3 bearing [6200z]

Side bearing = 4x2 [607zz]

Small sprocket = 18 teeth

Connecting plate = 4 plate

45.72 = 18 inch OD/48.5 cm

= 34.50 cm

Width = 3mm

2] **Large gear**:

Pitch = 3x3.142 = 9.42 mm

No of teeth = 116

Module = 3

ID = 3(116 + 2) =354 mm

OD = 3(116 - 2) = 342 mm

3] Sprocket large

OD = 22.5 cm

Pitch = 15 cm

Module = 0.5 Center to center =56 cm

4] **Chain**:

No. of pocket = 124
Distance between Hub and ID of rim = 9 cm

CHAPTER 5

RESULTS, CONCLUSION & FUTURE SCOPE

5.1. Observation

During the practical performance of the project, we observed that the compressor which we used for compressed air was delivering the pressure of 8.2 bar of compressed air from the compressor and the flow rate form the sandblasting machine was nearly 2 Sq. foot per inch. Which was fast than the available portable sand blasting machine in the market. The abrasive which is used our portable sand blasting machine was only the sand. The sand which was use in the machine was heated at a high temperature for 2 hours and then it was filtered 2 times to get the pure sand for machining purpose. While we had done a test a piece on M.S. plate. The dimensions of the M.S plate are 70x50x5 cm. It takes nearly 1 to 1hour 15 min to clean the whole M.S. plate the mixture from the machine is flow in the jet flow pattern. The nozzle is made of the cast iron and the diameter of the nozzle is 3.1 mm which help the mixture to flow in more pressure and give an accurate result while performing the work on the job.

5.2. Result

Table 5.2: Result

CONVENTIONAL CYCLE	HUBLESS BICYCLE
It Is Having a Old School Conventional Design Which Is Being Used For Centuries	The project enhances the aesthetics of the conventional cycle by giving it a good look
In conventional cycle the handle bar is connected to the hub	In the hubless bicycle the handle bar is connected to the rim
The front sprocket of 44 teeth	We are using bigger sprocket of 54 teeth

In conventional cycle the hub is in the centre of the wheel	In hubless bicycle the hub is placed eccentrically
Conventional cycle RPM is 123	Hubles cycle RPM is 150
It is required more effort to ride on a steep road	It is required comparatively less effort to ride on a steep road due to gear ratios

5.3. Summary

The construction of Hubless wheel bicycle with gear train drive mechanism is designed to convert the human muscle power through pedaling work in to the mechanical work. The system is assembled with the combination of pedals, shafts, and Hubless wheel which is function as driving wheel. The pedal and shaft are receiving the human effort and convert in to rotational mechanical motion. This rotational motion is transmit up to the drivingwheel via the spur gear drive train. The spur gear meshes with the internal gear and it rotates the wheel. These gear pairs not only transmit the power but also improve the gear ratio step by step. The gears and pinions of drive train are fixing with the bicycle body by using deep groove ball bearings. The spur gear in the gear train is coupled with the driving wheel through the Hubless mechanism which also performs the holding function of driving wheel. The front wheel it only perform the system balancing function without actually participate in driving and driven mechanism..

5.4. Conclusion

Thus the project enhances the aesthetics of the conventional cycle by giving it a good look. The use of gears also reduced the effort of the rider to pedal. The steering efficiency is also increases because the cycle fork is mounted on the ring directly. The load carrying capacity also increases because of the strength of Mild Steel ring which is welded to the bicycle frame. The weight of the cycle can be reduces by using nylon gears or composite nylon gears.

5.5. Future Scope

By using nylon gears instead of Mild steel gear the overall weight of the cycle will be reduced. By using nylon gear the the gears noise will be reduced. The asthetic of the bycycle can be improved. Gear ratio can also be increased

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