KUMARAGURU COLLEGE OF TECHNOLOGY
COIMBATORE-641035

FABRICATION OF SLIDER CRANK MECHANISM

A PROJECT REPORT

FABRICATION OF SLIDER CRANK MECHANISM

Submitted by

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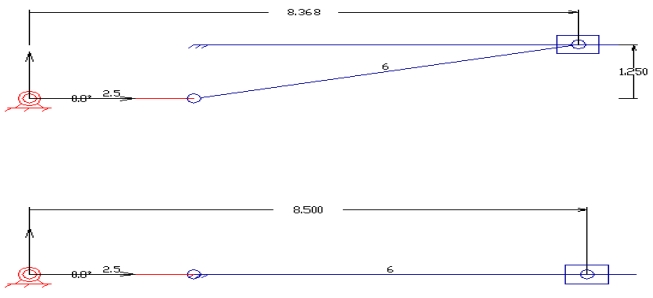
ABSTRACT:

A **slider-crank linkage** is a four-link mechanism with three revolute joints and one prismatic, or sliding, joint. The rotation of the crank drives the linear movement the slider, or the expansion of gases against a sliding piston in a cylinder can drive the rotation of the crank.There are two types of slider-cranks: in-line and offset. An in-line slider-crank has its slider positioned so the line of travel of the hinged joint of the slider passes through the base joint of the crank. This creates a symmetric slider movement back and forth as the crank rotates. If the line of travel of the hinged joint of the slider does not pass through the base pivot of the crank, the slider movement is not symmetric. It moves faster in one direction than the other. This is called a *quick-return mechanism*.There are also two methods to design each type: graphical and analytical.The slider-crank mechanism is a particular four-bar linkage configuration that exhibits both linear and rotational motion simultaneously. This mechanism is frequently utilized in undergraduate engineering courses to investigate machine kinematics and resulting dynamic forces. The position, velocity, acceleration and shaking forces generated by a slider-crank mechanism during operation can be determined analytically. Certain factors are often neglected from analytical calculations, causing results to differ from experimental data. The study of these slight variances produces useful insight. The following report details the successful design, fabrication and operation of Multi slider and single crank mechanism.



INTRODUCTION:

A slider-crank is a four-bar linkage that has a crank that rotates coupled to a slider that the moves along a straight line. This mechanism is composed of three important parts: The crank which is the rotating disc, the slider which slides inside the tube and the connecting rod which joins the parts together. As the slider moves to the right the connecting rod pushes the wheel round for the first 180 degrees of wheel rotation. When the slider begins to move back into the tube, the connecting rod pulls the wheel round to complete the rotation.

Different mechanism by fixing different link of slider crank chain are as follows :

First inversion

This inversion is obtained when link 1 (ground body) is fixed. Application- Reciprocating engine, Reciprocating compressor etc...

Second inversion

This inversion is obtained when link 2 (crank) is fixed. Application- Whitworth quick return mechanism, Rotary engine, etc...

Third inversion

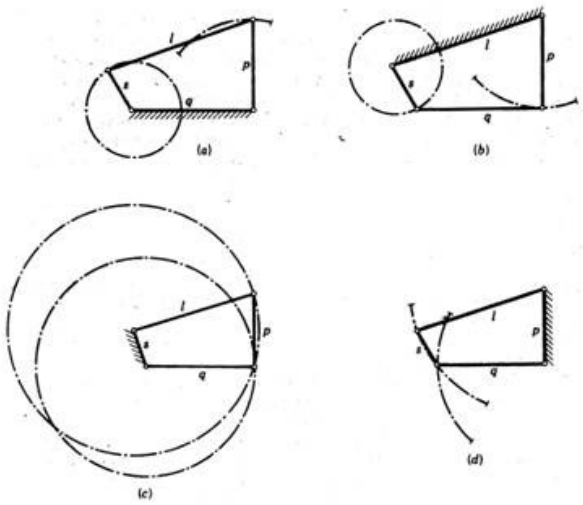
This inversion is obtained when link 3 (connecting rod) is fixed. Application- Slotted crank mechanism, Oscillatory engine etc..,

Fourth inversion

This inversion is obtained when link 4 (slider) is fixed. Application- hand pump, pendulum pump or Bull engine, etc.

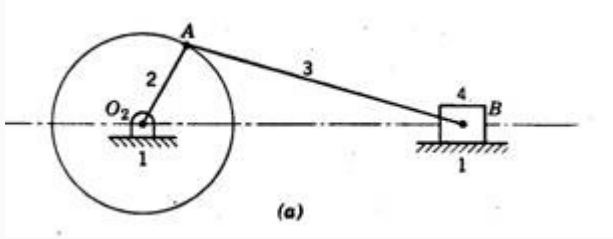
The slider-crank mechanism is a particular four-bar linkage configuration that converts linear motion to rotational, or vice versa. Internal combustion engines are a common example of this mechanism, where combustion in a cylinder creates pressure which drives a piston. The piston's linear motion is converted into rotational motion at the crank through a mutual link, referred to as the connecting rod. As the geometry of the crank forces the conversion of linear motion to rotational, shaking forces are generated and applied to the crank's

housing. These shaking forces result in vibrations which impede the operation of the engine.

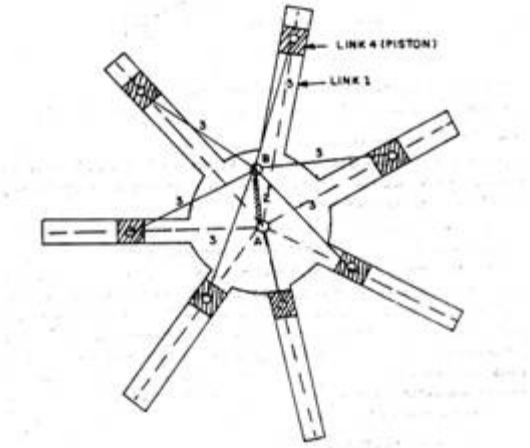


Rotary Engine Principle:

By fixing link 2 of a slider mechanism gives second inversion. Rotary engine mechanism or gnome engine is the application of second inversion. It is a rotary cylinder V – type internal combustion engine used as an aero engine. The rotary engine has generally seven cylinders in one plane. The crank (link 2) is fixed and all the connecting rods from the pistons are connected to this link. In this mechanism when the pistons reciprocate in the cylinders, the whole assembly of cylinders, pistons and connecting rods rotate about the axis O, where the entire mechanical power developed, is obtained in the form of rotation of the crank shaft.



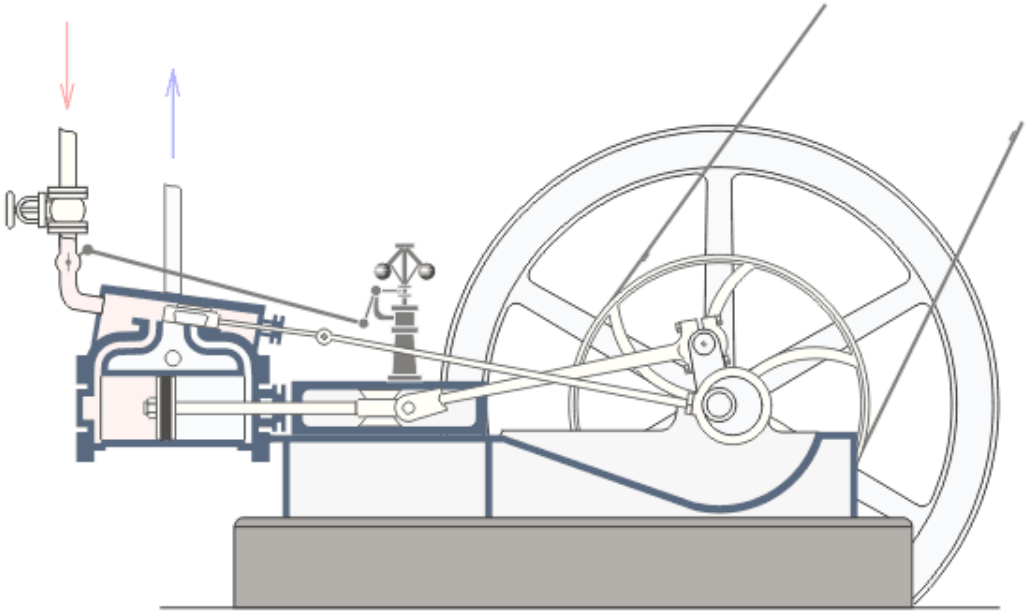
Application: Rotary engine mechanism or gnome engine



Parts of Radial Piston Pump:

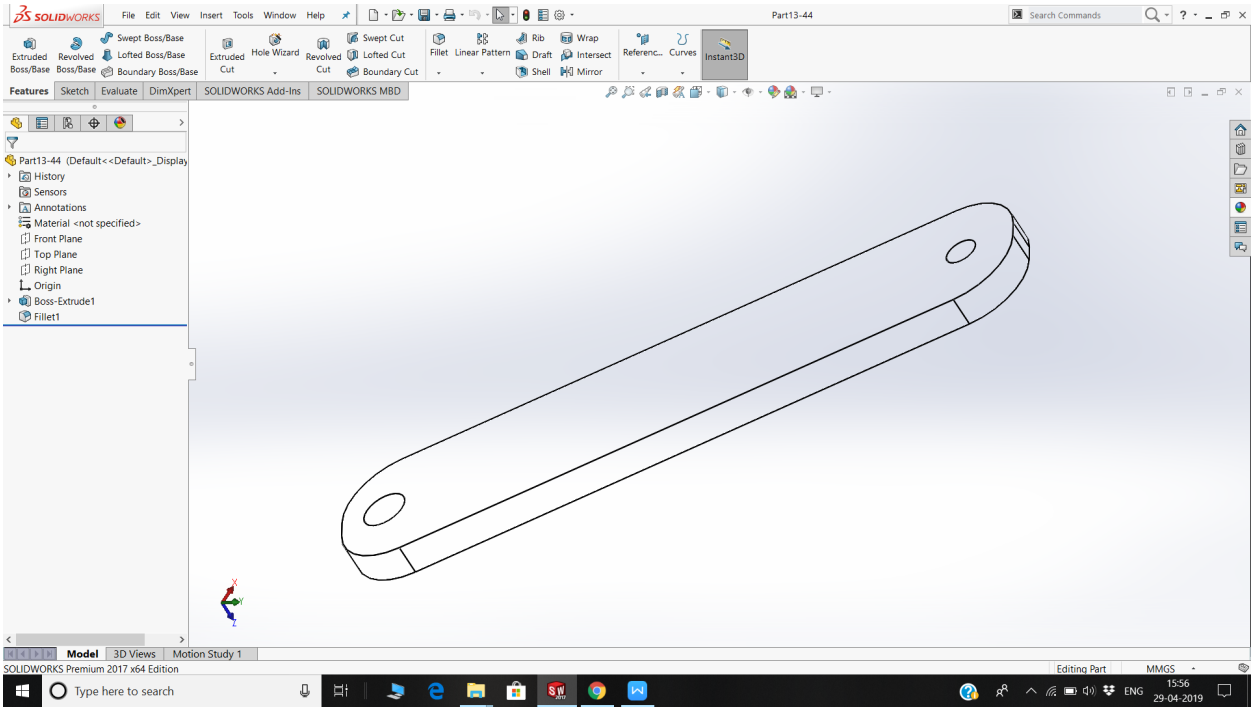
Crank:

A **crank** is an arm attached at a right angle to a rotating shaft by which reciprocating motion is imparted to or received from the shaft. It is used to convert circular motioninto reciprocating motion, or vice versa. One end of the crank is connected to thr motor and other end is connected to all the connecting rods that connects crank and slider.



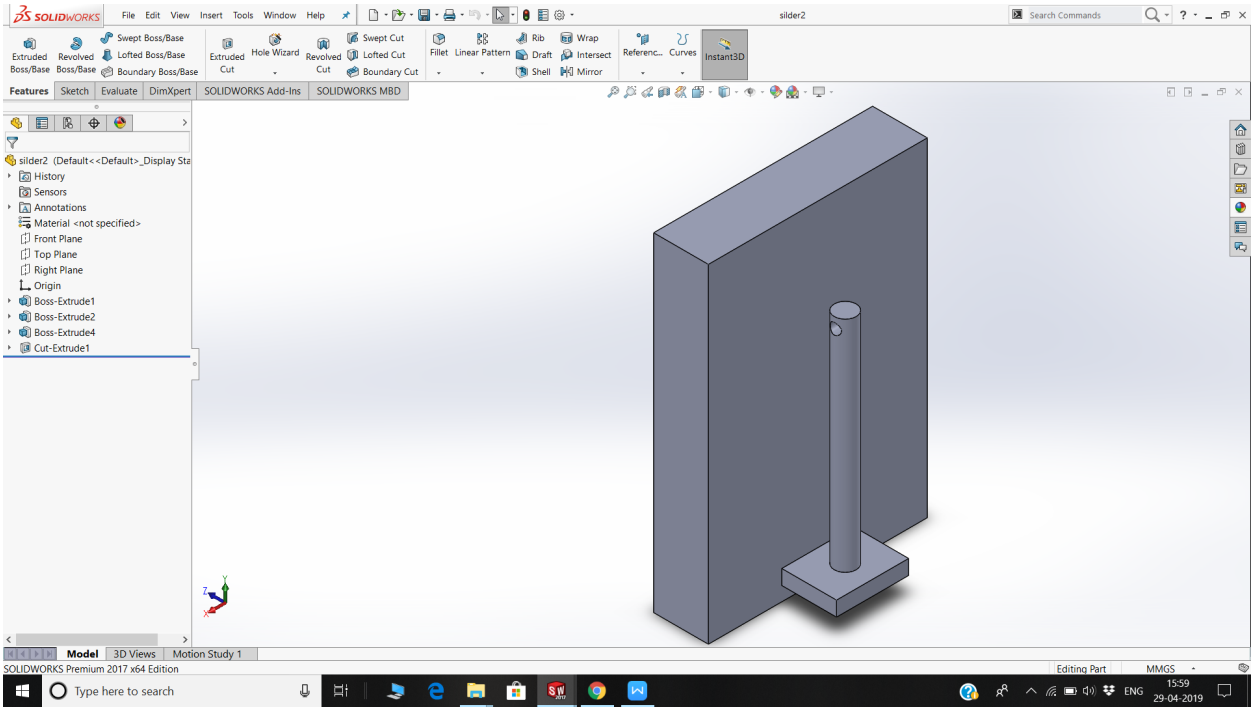
Connecting rod:

A connecting rod is a shaft which connects a slider to a crank or crankshaft in a rotory engine. Together with the crank, it forms a simple mechanism that converts rotary motion into reciprocating motion. A connecting rod may also convert reciprocating motion into rotating motion.



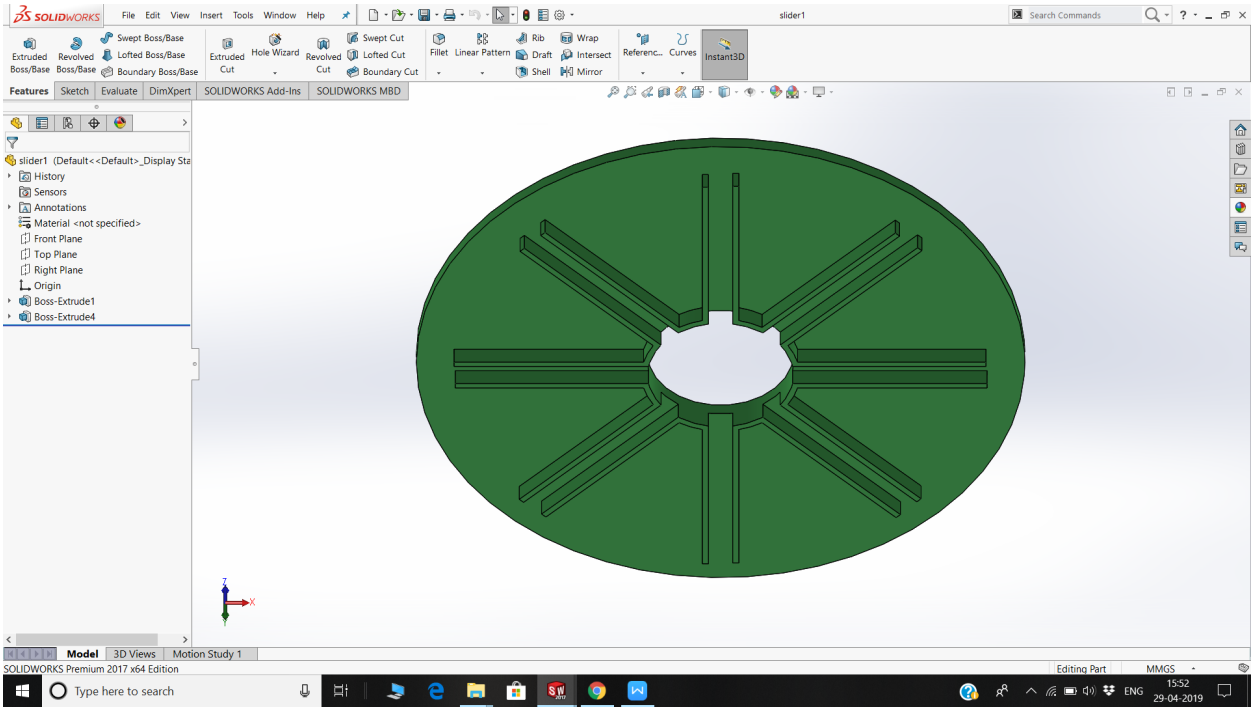
Slider:

Slider moves in a vertical direction with respect to the rotation of the crank.It is kept in a particular chamber , so that it moves smoothly.



Base support:

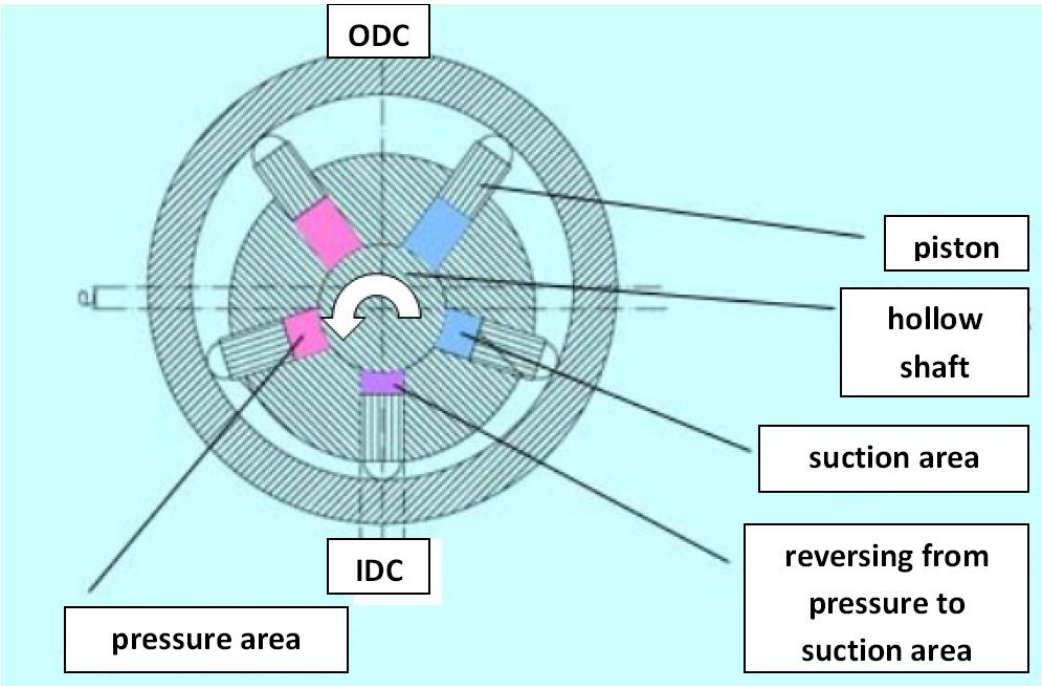
It is fixed on the floor and it supports the lever while transmitting the motion during punching of the metal sheets.



Working of Radial Piston Pump:

The general mode of operation will be explained at the movement of one pumping piston by means of picture 1:
The outer ring for bracing of the pumping pistons is in eccentric position to the hollow shaft in the center. This eccentricity determines the stroke of the pumping piston.

The piston starts in the inner dead center (IDC) with suction process. After a rotation angle of 180° it is finished and the workspace of the piston is filled with the moved medium. The piston is now in the outer dead center (ODC). From this point on the piston displaces the previously sucked medium in the pressure channel of the pump.



Applications:

Due to the hydro-statically balanced parts it is possible to use the pump with various hydraulic fluids like mineral oil, biodegradable oil, HFA (oil in water), HFC (water-glycerin), HFD (synthetic ester) or cutting emulsion. That implies the following main applications for a radial piston pump:

- Machine tools (e.g., displace of cutting emulsion, supply for hydraulic equipment like cylinders)
- High pressure units (HPU) (e.g., for overload protection of presses)

  test rigs

- Automotive sector (e.g., automatic transmission, hydraulic suspension control in upper-class cars)
- Plastic- and powder injection molding
- Wind energy

MATERIAL SELECTION:

Material selection is a step in the process of designing any physical object. In the product of design, the main goal of material selection is to minimize the cost while meeting product performance goals. Systematic selection of the best material for a given application begins with properties and cost of candidate materials.

MATERIAL SELETION FOR SINGLE CRANK AND MULTI SLIDER MEACHANISM:

The material selected for this mechanism is Mild steel. Generally used in industries are made of mild steel. The mild steel properties that suits the place, work and duration. It is made up of mild steel because the mild steel can become harder and stronger through heat treatment. So, that it can give a good support to the job. Now a days mild steel is used everywhere because it is very less in cost compare to other materials. Mild steel can be classified on the basis amount of carbon which it contains. Normally the carbon range from 0.12%- 2%. As the carbon content increase the melting point of mild steel will gets reduced. There are four type of heat treatment processes which are used to increase the heredity of carbon steel. They are annealing, normalizing, Quenching.

SPECIFICATION OF THE SLIDER CRANK MECHANISM:

CRANK:

Diameter of the crank (D) = 10 mm

Thickness of the crank (t) = 02 mm

Distance from centre of the crank to connecting rod= 13 m

Material used = Mild steel

CONNECTING ROD:

Length of the connecting rod (L) =150 mm

Width of the connecting rod (W) =23.5 mm

Thickness of the connecting rod (t) =0.5 mm

Number of holes on the Connecting rod =2 nos

Centre distance between two holes = 130 mm

Material used = Mild steel

Slider:

Length of the Slider =40mm

Width of the Slider =70mm

Thickness of the Slider = 40 mm

Number of holes on Slider = 1 nos.

Centre distance between the two links connection = 170 mm

Material used = Mild steel

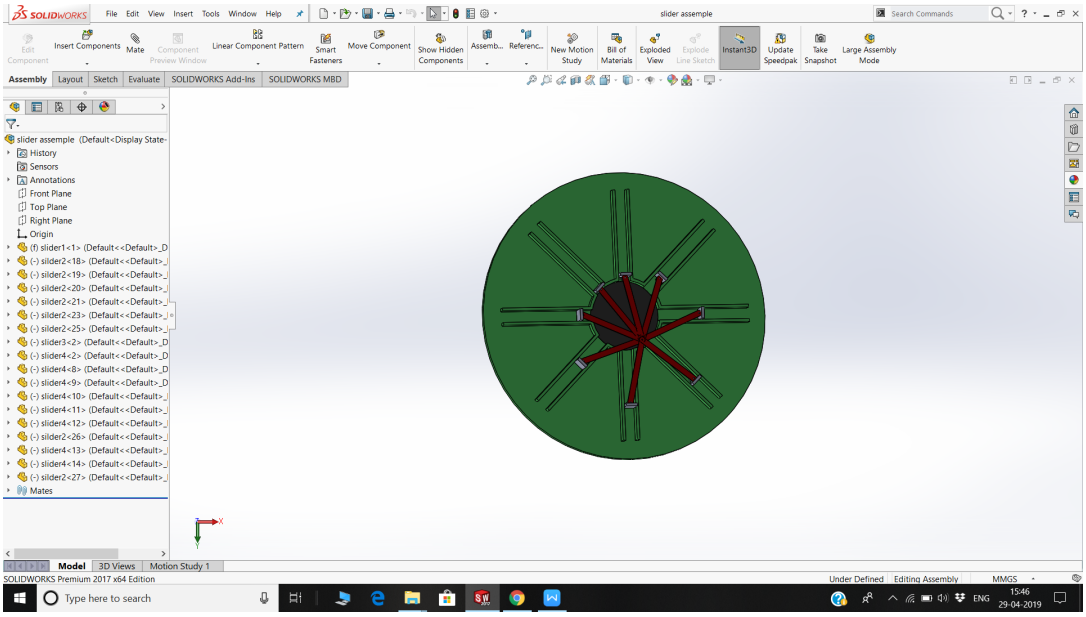
METHOD OF CONNECTING LINKS:

M5 L=30mm NUTS and M5 Bolts are used.

PRIME MOVER:

12V DC motor used to rotate crank.

SOLID WORKS: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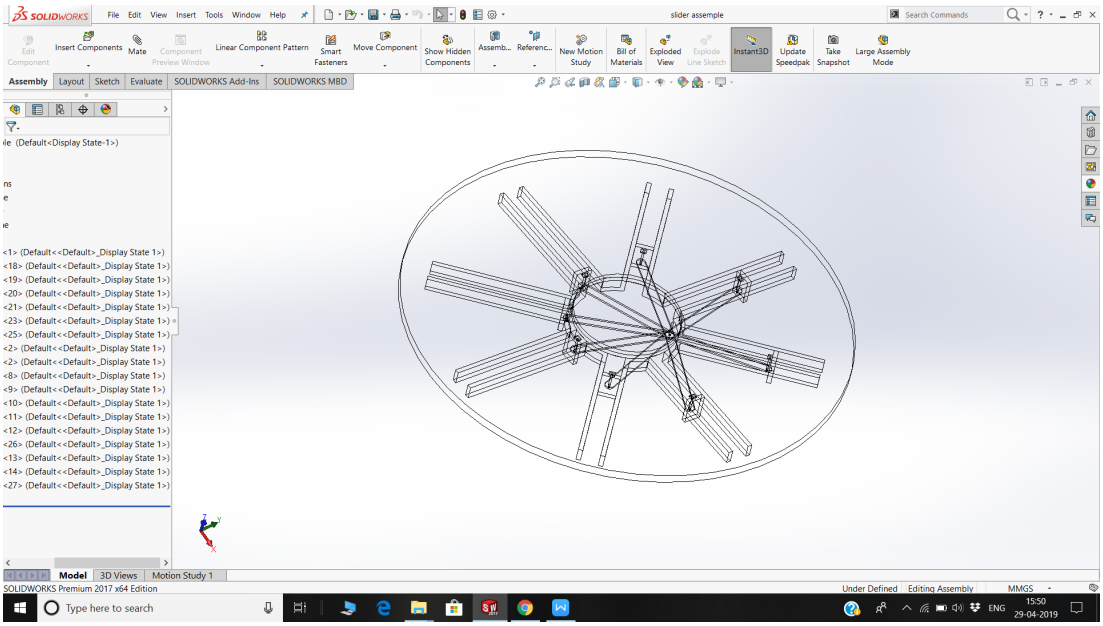
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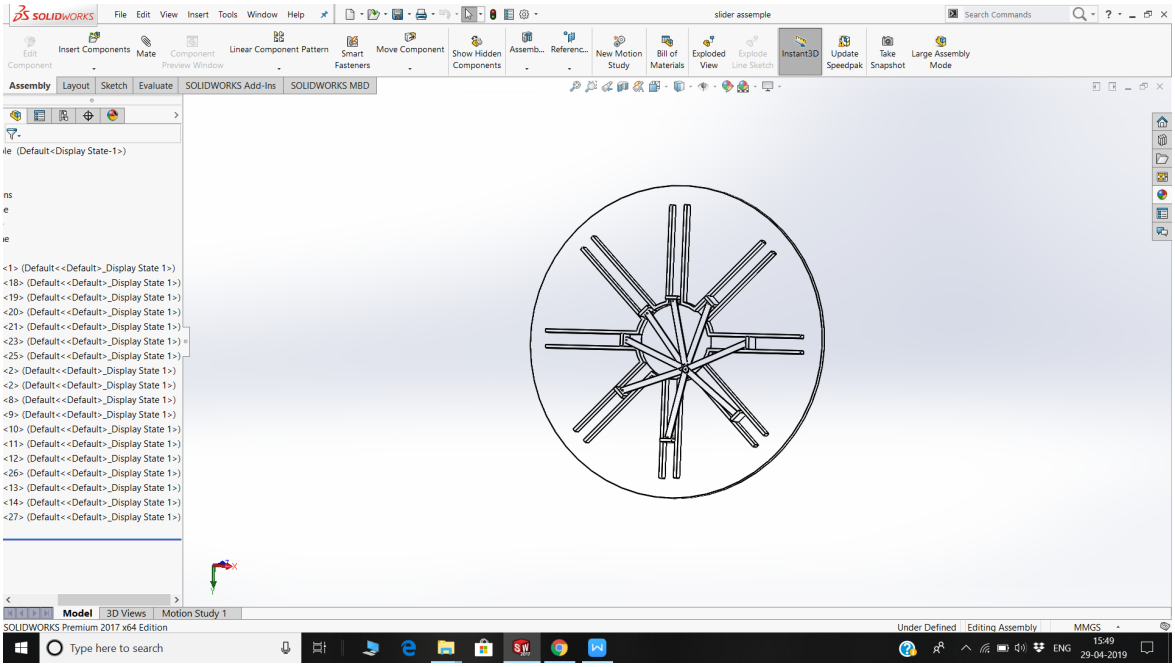

RESULT AND DISCUSSION:

In this project we did the beam engine mechanism which drives by DC electric motor for the rotation of the crank. We used mild steel to fabricate this mechanism. We used M5 Nuts and Bolts for connecting links and joints. Its 3D model was designed in SolidWorks Software

It was not controlled by microcontroller because we used 12v DC motor which runs in 12v DC supply but microcontroller(Arduino UNO) output is only 5v so we couldn't use the microcontroller instead we connected the motor directly to the crank.

Secondly, at the angle of 200 (approx.) the movement was not smooth and motor struggled to pull at that point because it is the point where upward trust is needed to overcome the gravity. Since we fabricated it without calculating the power (torque) we, faced some irregularity in the motion and the system was unbalanced.

Since we used screw in the crank, its rotation was not free after certain rotation because since it was rotating in clockwise direction its screw became tight and the rotatory motion was blocked.

CONCLUSION:

We faced these kind of faults while fabricating it and we learnt how to overcome the issues. We here by conclude that the beam engine mechanism is generally used to convert reciprocating motion into rotary motion, but here we are using this mechanism to convert rotary motion into reciprocating motion. By using electric DC motor to rotate the crank and actuating the reciprocating piston. we worked together as a team and we learnt something new. We got some exposure and as well as knowledge regarding the subject

The final look of the chasis will be like