Rice Transplanting Machine

TA202A – Manufacturing Processes

Group Number: 44

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Guide Name: Mr. Mahesh Kumar

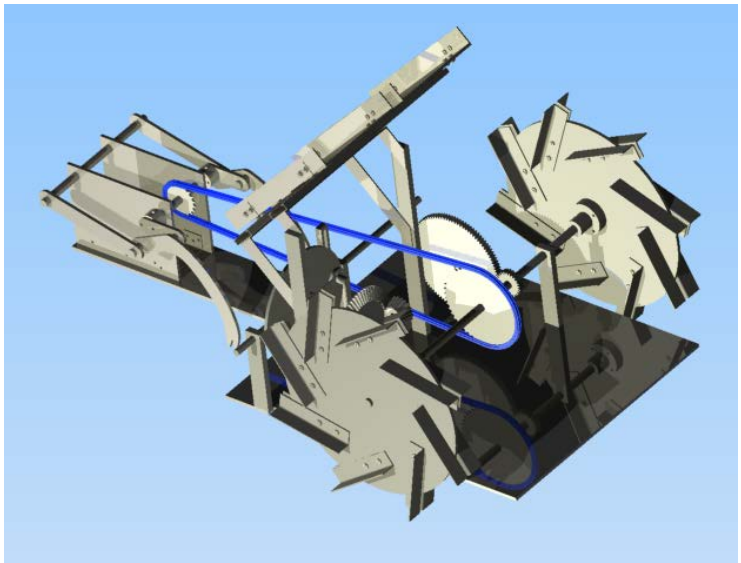


Table of Content

Part List

Part Number	QTY	Type of Material Required	Dimension	Material	Machining Processes Used	Page No.
Picking Arm 1	2	Flat	25mm * 5mm * 80mm	Mild Steel	Drilling	36
Picking Arm 2	2	Flat	25mm * 5mm * 180mm	Mild Steel	Drilling	37
Picking Arm 3	2	Sheet	5mm * 200mm * 140mm	Mild Steel	Drilling, Cutting	38
Picking Arm Shaft 1.0	4	Rod	12.7mm Dia * 25mm	Mild Steel	Drilling	39
Picking Mechanism Coupler	2	Rod	35mm Dia * 25mm	Mild Steel	Lathe	40
Picking Mechanism Shaft 2	1	Rod	12.7mm Dia * 150mm	Mild Steel	Drilling	41
Picking Mechanism Support Angle 1	6	Angle	25mm * 25mm * 3mm	Mild Steel	Drilling	42
Picking Mechanism Supporting Wall	2	Sheet	135mm * 180mm * 5mm	Mild Steel	Drilling, Cutting	43
Picking Mechanism Shaft 1	1	Rod	12.7mm Dia * 230mm	Mild Steel	Drilling	44
Tray Lower Part	2	Sheet	250mm * 150mm * 2mm	Steel, Mild	Drilling, Cutting	48
Tray Side Wall	4	Sheet	30mm * 250mm * 2mm	Steel, Mild	Drilling, Cutting	49
Tray Angle	8	Angle	25mm * 25mm * 3mm	Steel, Mild	Drilling	50
Tray Supporting Angular Plate 1	1	Flat	25mm * 5mm * 360mm	Steel, Mild	Drilling	51
Tray Supporting Angular Plate 2	1	Flat	25mm * 5mm * 550mm	Steel, Mild	Drilling	52
Wheel Plate	2	Sheet	5mm * 300mm * 300mm	Steel, Mild	Drilling, Cutting	55
Wheel Angle	32	Angle	25mm * 25mm * 3mm * 125mm	Steel, Mild	Drilling	56
Wheel Coupler	2	Rod	60mm Dia * 30mm	Steel, Mild	Lathe	57
Translation Mechanism Circular Plate	1	Sheet	170mm * 170mm * 5mm	Steel, Mild	Cutting, Drilling	60
Translation Mechanism Groove Rod	1	Flat	20mm * 10mm * 170mm	Steel, Mild	Milling	61
Translation Mechanism Coupler 1	1	Rod	45mm Dia * 35mm Length	Steel, Mild	Lathe, Drilling	62
Translation Mechanism Coupler 2	1	Rod	40mm Dia * 30 mm	Steel, Mild	Lathe, Drilling	63
Translation Mechanism Rod 10mm 1	1	Rod	10mm Dia * 50mm	Steel, Mild	Drilling	64
Translation mechanism Rod 10mm 2	2	Rod	10mm Dia * 200mm	Steel, Mild	Drilling	65
Pulling Mechanism Angle	2	Flat	150mm * 50mm * 5mm	Steel, Mild	Drilling	68
Pulling Rod	1	Flat	1000mm * 50mm * 10mm	Steel, Mild	Drilling	69

Pulling Mechanism Shaft	1	Rod	12.7mm Dia * 60 mm Length	Steel, Mild	Drilling	70
Pulling shaft 2	1	Rod	12.7mm Dia * 200mm Length	Steel, Mild	Drilling	71
Spur Gear 1	1	Rod	30mm Dia * 35mm Length	Steel, Mild	Turing, Milling, Drilling	74
Spur Gear 2	1	Rod	130mm Dia * 35mm Length	Steel, Mild	Turing, Milling, Drilling	75
Base Plate	1	Sheet	900mm * 500mm * 5mm	Steel, Mild	Cutting	81
Bevel Gear Support	2	Flat	140mm * 50mm * 10mm	Steel, Mild	Drilling	82
Shaft 210 mm	1	Rod	12.7mm Dia * 210mm Length	Steel, Mild	Drilling	83
Plant Blocking Plate	1	Sheet	470mm * 50mm * 2mm	Steel, Mild	Drilling	84
Wheel Rod	1	Rod	12.7mm Dia * 420mm Length	Steel, Mild	Drilling	85
Shaft 200mm	1	Rod	12.7mm Dia * 200mm Length	Steel, Mild	Drilling	86
Support Angle Standard	10	Angle	50mm * 50mm * 6mm * 50mm Length	Steel, Mild	Cutting, Drilling	87
Tray Power Transmission Support Bar	1	Flat	140mm * 25mm * 6mm	Steel, Mild	Drilling	88
Tray Support	2	Flat	25mm * 250mm * 10mm	Steel, Mild	Drilling	89
Tray Support Angle	3	Angle	50mm * 50mm * 6mm * 50mm Length	Steel, Mild	Drilling	90
Tray Supporting Bar	2	Flat	50mm * 10mm * 330mm	Steel, Mild	Drilling	91
Tray Supporting Bar 10mm	2	Flat	140mm * 50mm * 10mm	Steel, Mild	Drilling	92
Wheel Support	4	Flat	140mm * 50mm * 10mm	Steel, Mild	Drilling	93

Abstract

Agriculture is the most important sector of the Indian economy. It is the most important source of employment for the majority of the work force in the country. A major population in India is engaged in agriculture. Among that highest percentage was in paddy sector. Rice is the major stable food of the country. Releasing of work force to sectors other than Agriculture is important to develop the country. To release the work force in paddy sector mechanization plays a big role. To feed growing population is a huge challenge. Mechanization of paddy sector will lead to higher productivity with releasing of work force to other sectors. The objective of this project is to design a paddy transplanting mechanism to transplant paddy seedlings by small scale farmers in the country.

Introduction

Transplanting is one of the major process for establishment of paddy in India. In this method seed is sown in one place and seedlings after they have grown a little are transplanted to another. This is done in order to get higher yields and less weeding. Transplanting of rice is highly labour intensive and it may require 250-350 man-hours per hectares.

Seedling are prepared in nurseries where they grow for 15-20 days. After these seedling are been prepared, these are been transplanted manually by labour. The orientation of the labour at the time of transplanting is hazardous for their health. With manual transplantation the cost of production of rice also increases.

With the help of a Rice Transplanting Machine, the transplantation cost as well as time will decreases with increase in efficiency.

Design

The Rice Transplanting machine's most important mechanisms are for the planting unit, paddy seedling tray and Power transmission system and attachments.

Planting Unit

When designing the planting Mechanism following aspects were considered:

- Moving pathway
- Speed of traveling
- Plant catching mechanism
- Depth of planting

Moving pathway

A four bar linkage mechanism was used to get the required measurements.

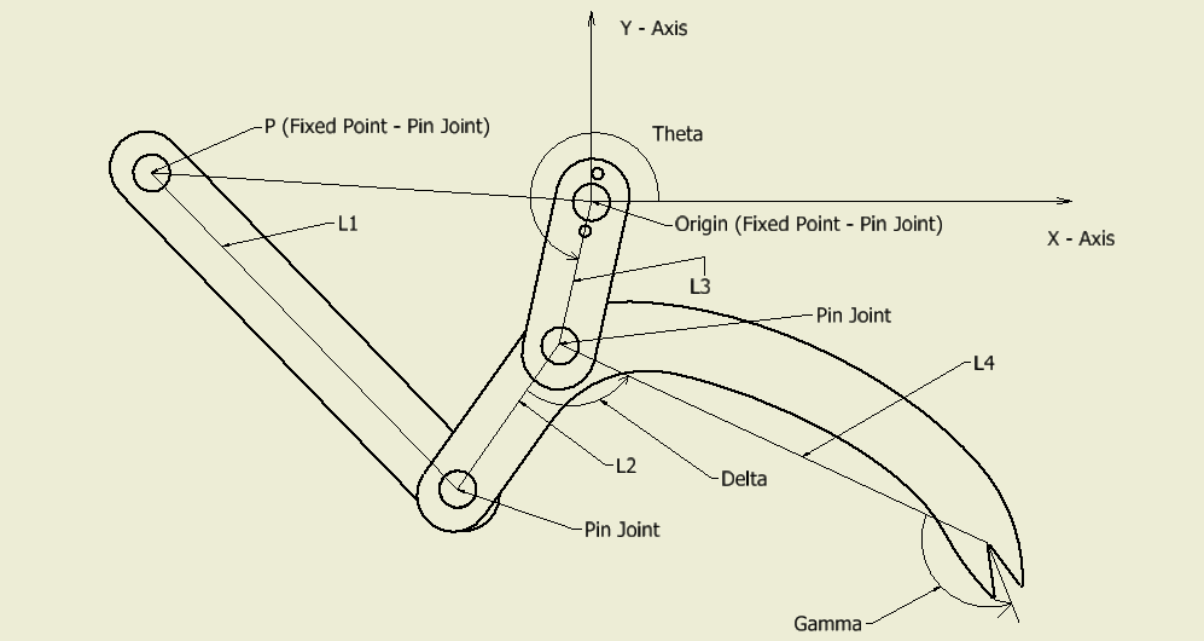


Figure 1: Planting Arm

The trajectory of the planting unit depends on:

1. Point P
2. Length L1, L2, L3 and L4
3. Delta

Theta is the variable which varies from 0 to 360 degree. The trajectory is plotted in MATLAB with all the variations of the above discussed variables. The optimised plot was chosen for which the values are:

P: (-150, 10) mm
L1 = 150 mm
L2 = 60 mm
L3 = 50 mm
L4 = 160 mm
Delta = 101 degree

The plot of the trajectory is shown in Appendix.

Also the variation in speed is simulated. Plot of the simulation is shown in Appendix.

Plant Catching Mechanism

There are several parameters were considered in designing the plant catching mechanism:

1. Place of catching
2. Number of plant per catching
3. Distance of travel
4. Releasing Point
5. Angle of Planting

Plant should not be damaged while catching and releasing by the planting arm. Suitable speed, position and angle of catching and angle of planting, height of tray, width and length of figures are the factors governing the proper planting mechanism.

Distance of travel was calculated according to walking speed of a normal man.

Man walking speed = 30 m/min

Diameter of the ground wheel = 240 mm

Perimeter of the ground wheel = $2\pi r$

$= 2*\pi*120$ mm

$= 753$ mm

Distance of plants = 180 mm

Number of plants per one ground wheel rotation = $4.18 \approx 4$

Tension of the plant should be enough to catch the plants and to prevent release until end point and not to damage the plant during the process. Angle of planting is decided by tray feeding point angle and moving direction.

Depth of Planting

Planting depth is important for growth of roots and to stand with the submerge condition. Planting depth for the machine is set to be 50mm below the ground level.

Designing of Tray

Tray is to carry the seed mat and to direct the plants to planting arm. Basic factors (width, length, angle, speed of movement) is considered in designing the tray mechanism. As two plant rows are planted at once, two trays are placed side by side for each planting hand. Movement of the tray per one planting of arm is decided by the volume taken away from the planting finger at a time. The length of the movement of tray is taken to be 5 mm.

To make constant feeding of the seed mat to the planting arm it should come down to the end of the try by gravity. Higher angle reduces energy requirement to feed the seed mat to transplanting arm while too much angle effect on falling down and compaction of nursery at the end of the tray making difficult to take out the plants from the nursery by transplanting arm. The final angle of the tray is 60°.

The design of the tray is shown in appendix.

Power Transmission system

All the power generation is achieved by wheel. Chain and sprocket mechanism is used to transmit power to the planting unit.

No of teeth of sprocket at wheel = 34

No of teeth of sprocket at planting mechanism = 9

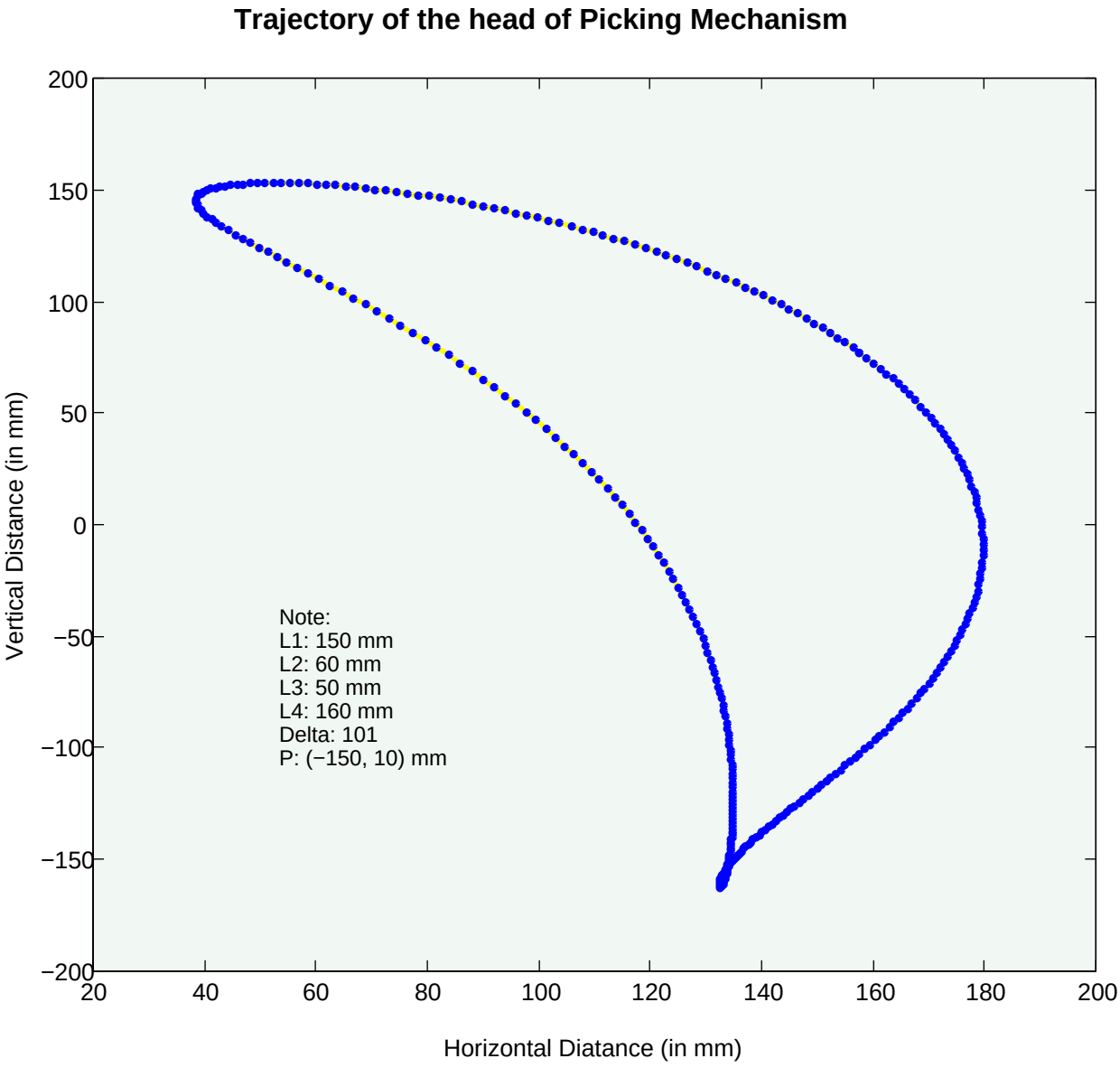
No of plants planted per wheel rotation = 34/9 = 3.8

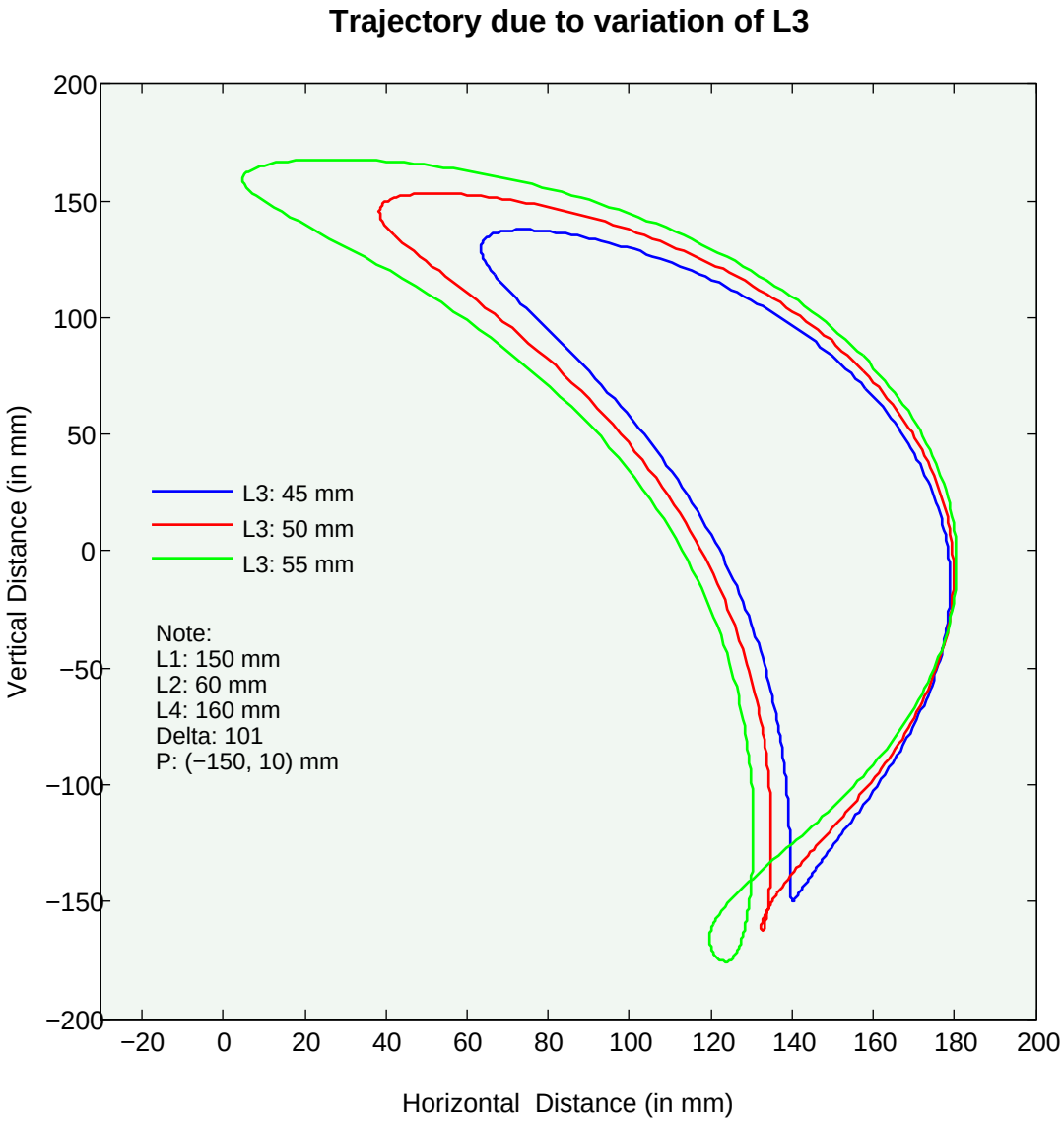
Tray has to move very slowly relative to the wheel. The gear ratio is 9:1.

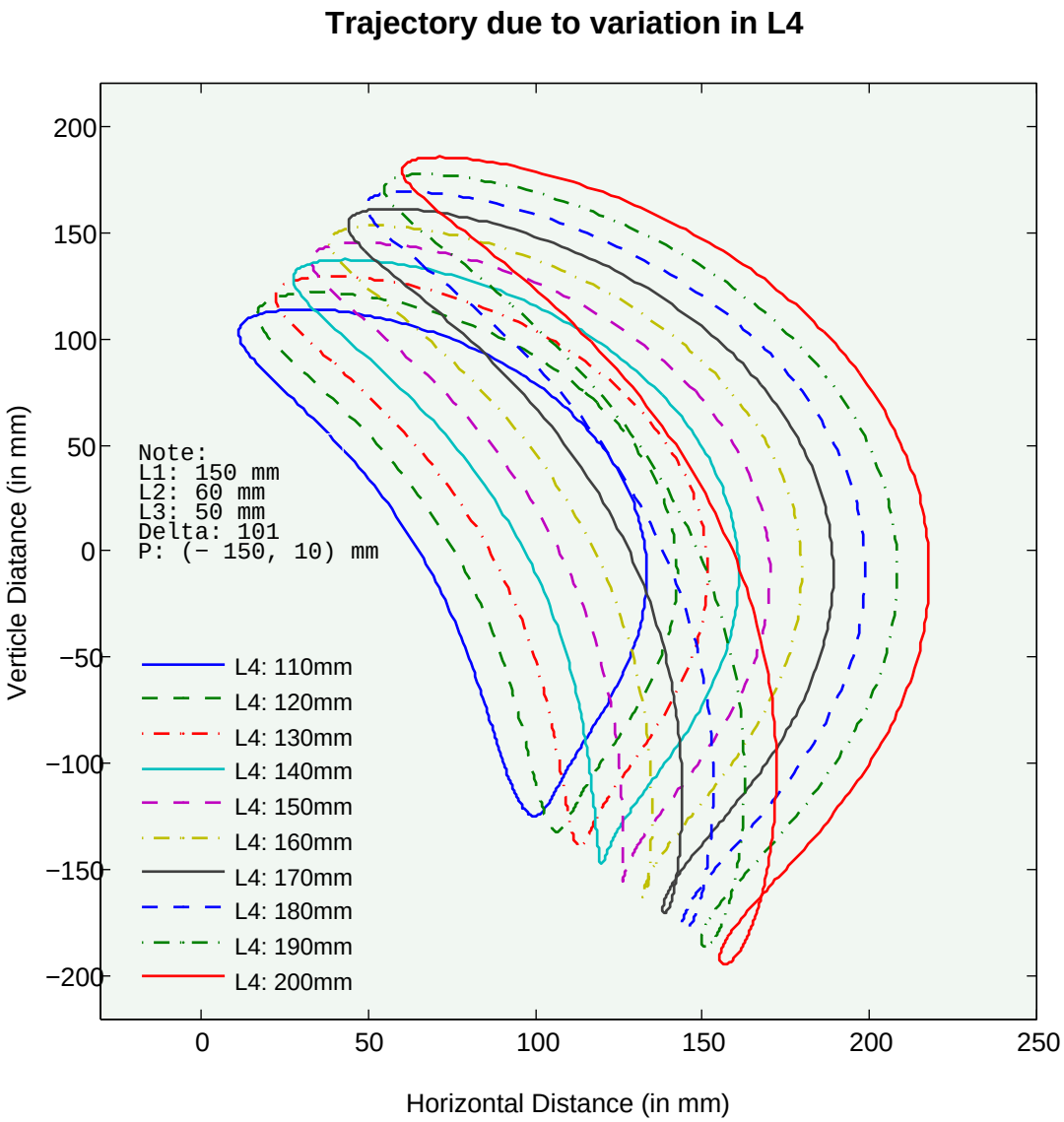
APPENDIX – 1

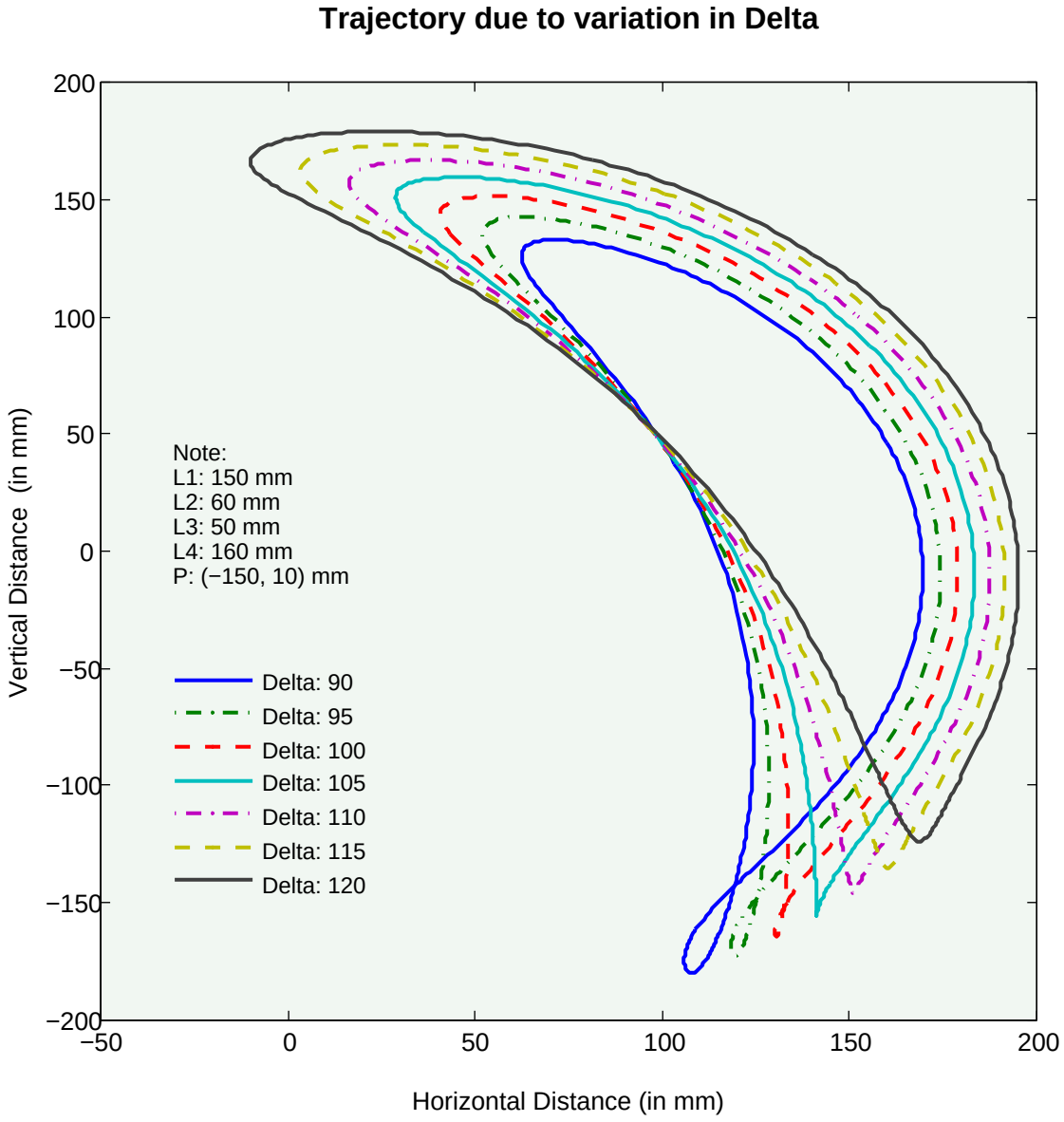
Plot of the trajectory of the planting fingers and the speed of the optimised mechanism

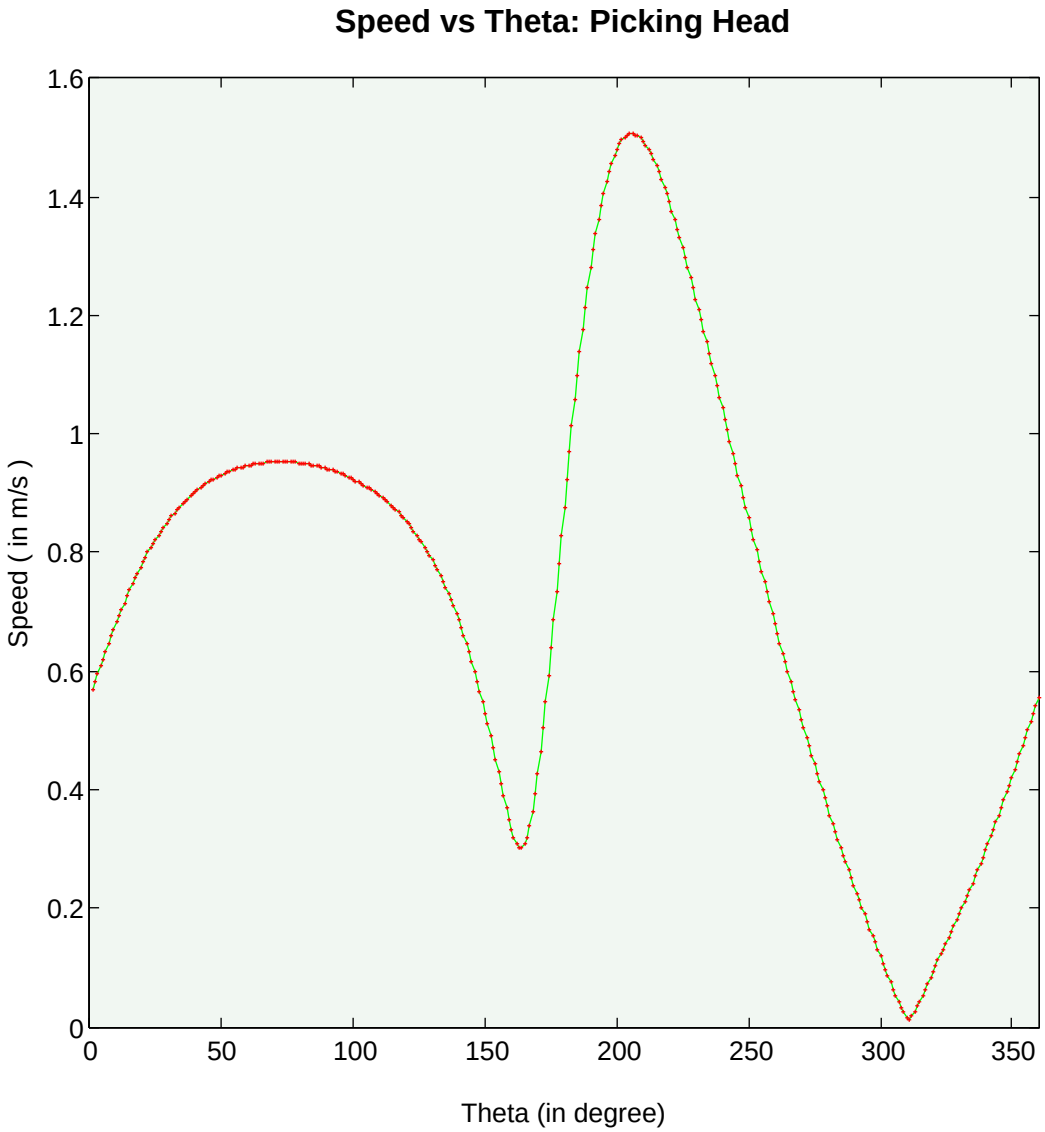
1. Optimised length and angle of the Mechanism
2. Plot due to variation of length L3
3. Plot due to variation of length L4
4. Plot due to variation of angle delta
5. Plot of the speed of the planting finger


Trajectory of the head of Picking Mechanism
Vertical Distance (in mm)
Horizontal Diatance (in mm)
Note:
L1: 150 mm
L2: 60 mm
L3: 50 mm
L4: 160 mm
Delta: 101
P: (−150, 10) mm
200
150
100
50
0
−50
−100
−150
−200
20
40
60
80
100
120
140
160
180
200


Trajectory due to variation of L3
Vertical Distance (in mm)
Horizontal Distance (in mm)
L3: 45 mm
L3: 50 mm
L3: 55 mm
Note:
L1: 150 mm
L2: 60 mm
L4: 160 mm
Delta: 101
P: (−150, 10) mm
200
150
100
50
0
−50
−100
−150
−200
−20
0
20
40
60
80
100
120
140
160
180
200

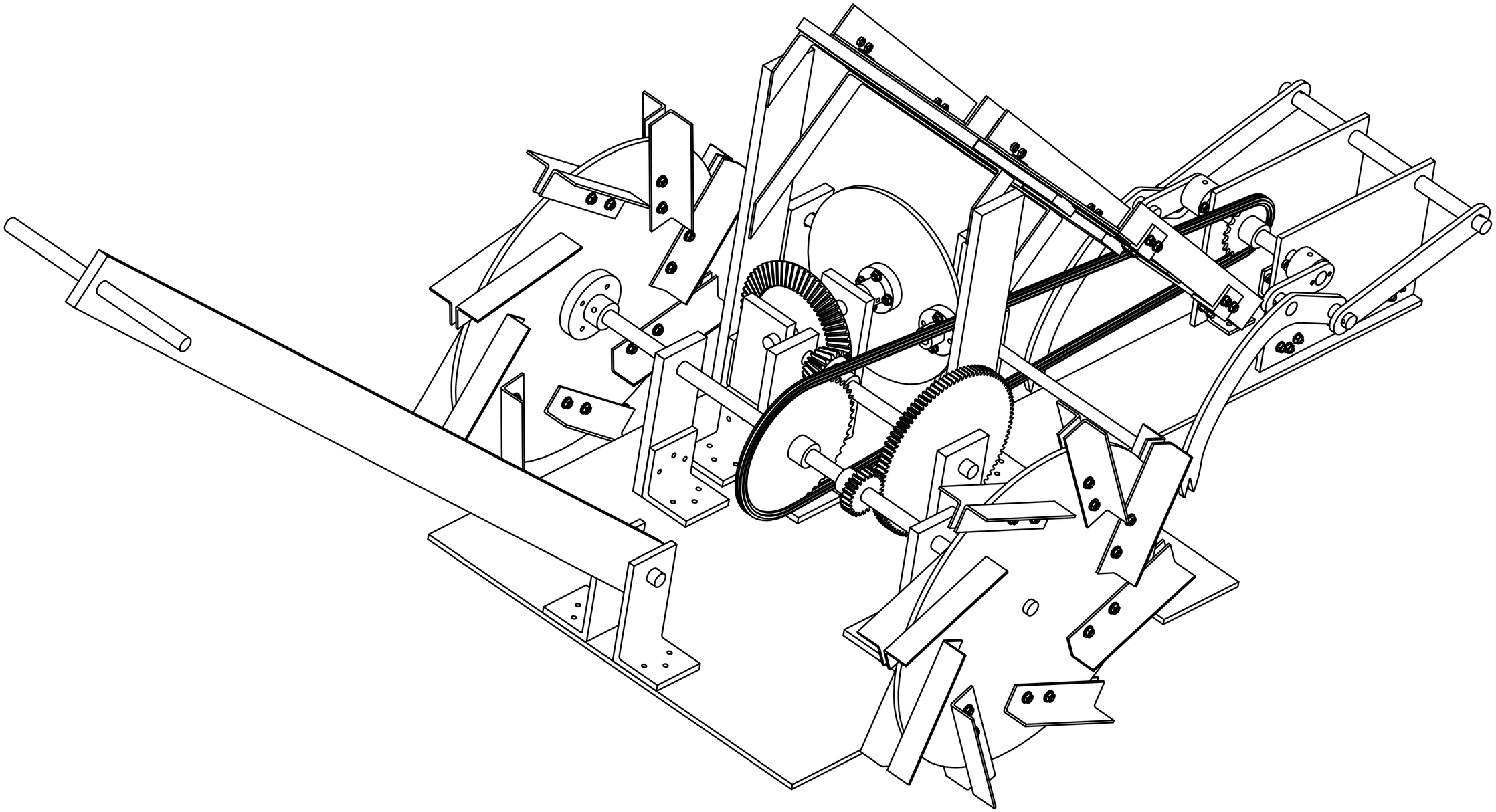

Trajectory due to variation in L4
Verticle Diatance (in mm)
Horizontal Distance (in mm)
Note:
L1: 150 mm
L2: 60 mm
L3: 50 mm
Delta: 101
P: (- 150, 10) mm
L4: 110mm
L4: 120mm
L4: 130mm
L4: 140mm
L4: 150mm
L4: 160mm
L4: 170mm
L4: 180mm
L4: 190mm
L4: 200mm
200
150
100
50
0
−50
−100
−150
−200
0
50
100
150
200
250


Trajectory due to variation in Delta
Vertical Distance (in mm)
Horizontal Distance (in mm)
200
150
100
50
0
−50
−100
−150
−200
−50
0
50
100
150
200
Note:
L1: 150 mm
L2: 60 mm
L3: 50 mm
L4: 160 mm
P: (−150, 10) mm
Delta: 90
Delta: 95
Delta: 100
Delta: 105
Delta: 110
Delta: 115
Delta: 120


Speed vs Theta: Picking Head
Speed (in m/s)
Theta (in degree)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
0
50
100
150
200
250
300
350

APPENDIX – 2

Isomeric drawing of full assembly and all sub-assemblies



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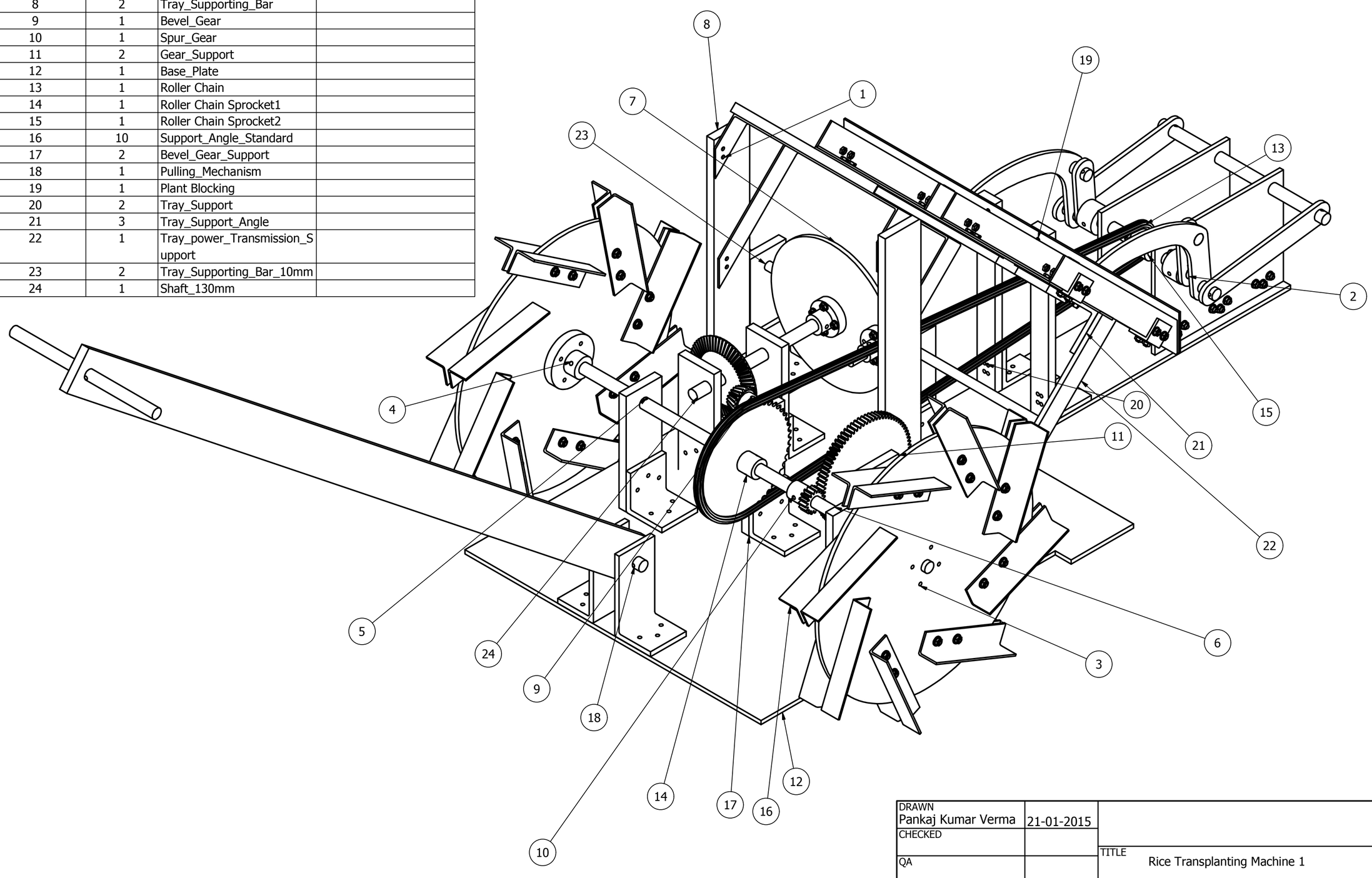
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Tray_Full_Assembly	
2	1	Picking_Mechanism_supporting_Walls	
3	2	Wheel	
4	2	Wheel_Hub	
5	1	Rod_Wheel_420mm	
6	2	Wheel_Support	
7	1	Transational_Mechanism	
8	2	Tray_Supporting_Bar	
9	1	Bevel_Gear	
10	1	Spur_Gear	
11	2	Gear_Support	
12	1	Base_Plate	
13	1	Roller Chain	
14	1	Roller Chain Sprocket1	
15	1	Roller Chain Sprocket2	
16	10	Support_Angle_Standard	
17	2	Bevel_Gear_Support	
18	1	Pulling_Mechanism	
19	1	Plant Blocking	
20	2	Tray_Support	
21	3	Tray_Support_Angle	
22	1	Tray_power_Transmission_Support	
23	2	Tray_Supporting_Bar_10mm	
24	1	Shaft_130mm	



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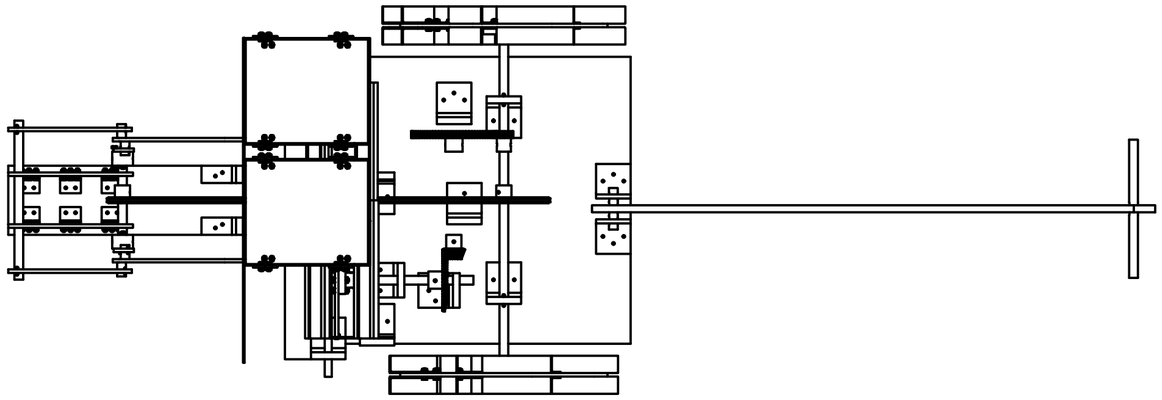

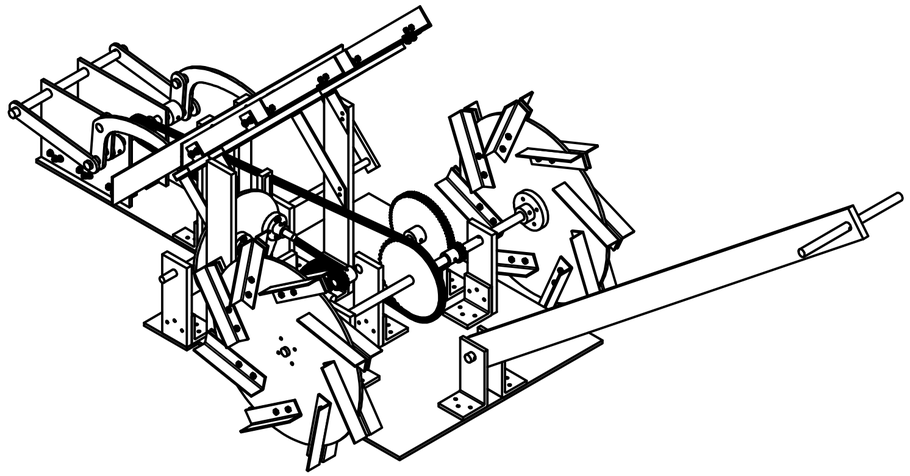

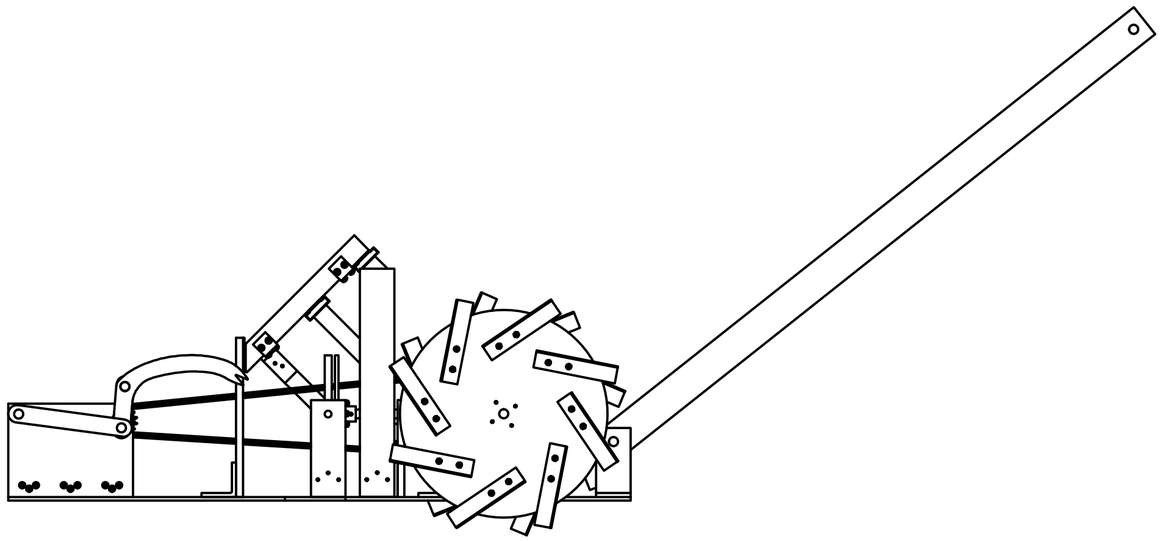

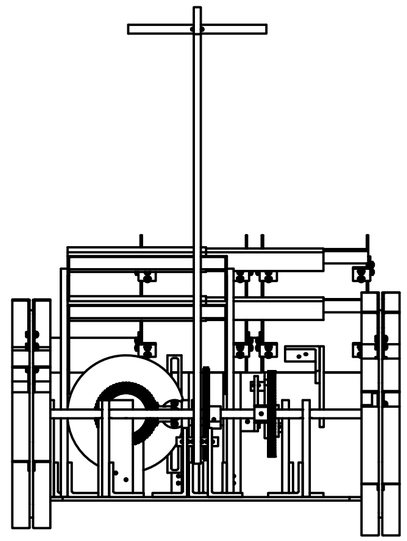

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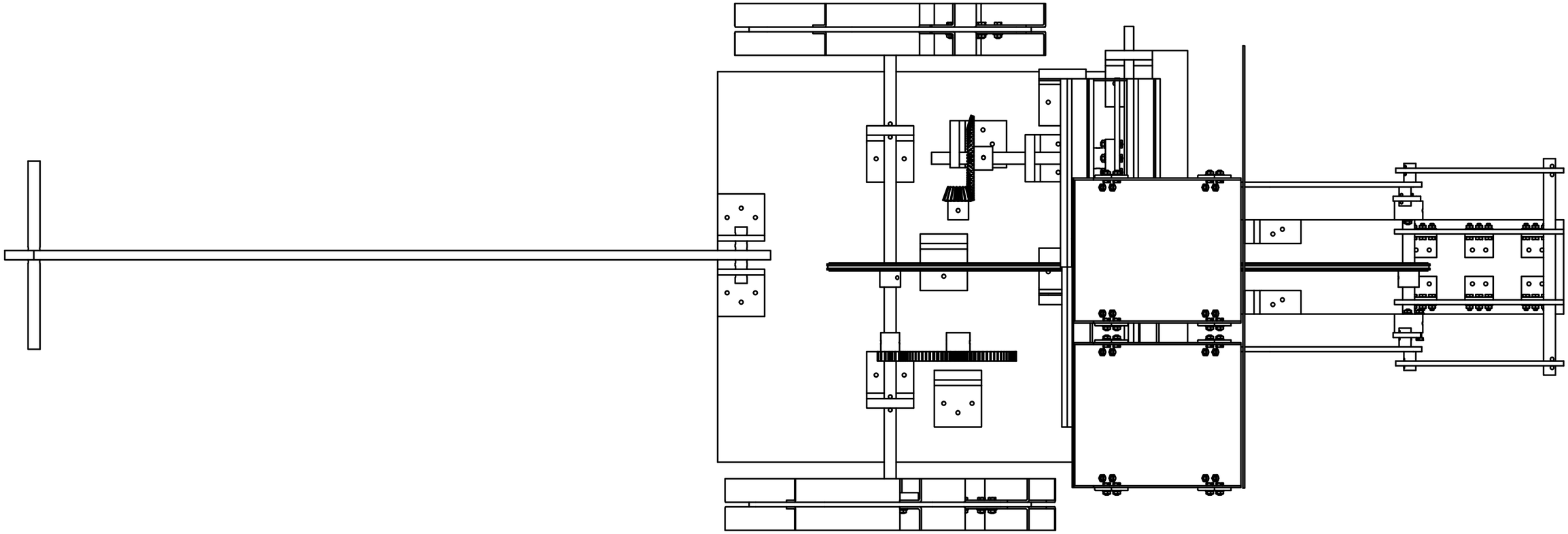

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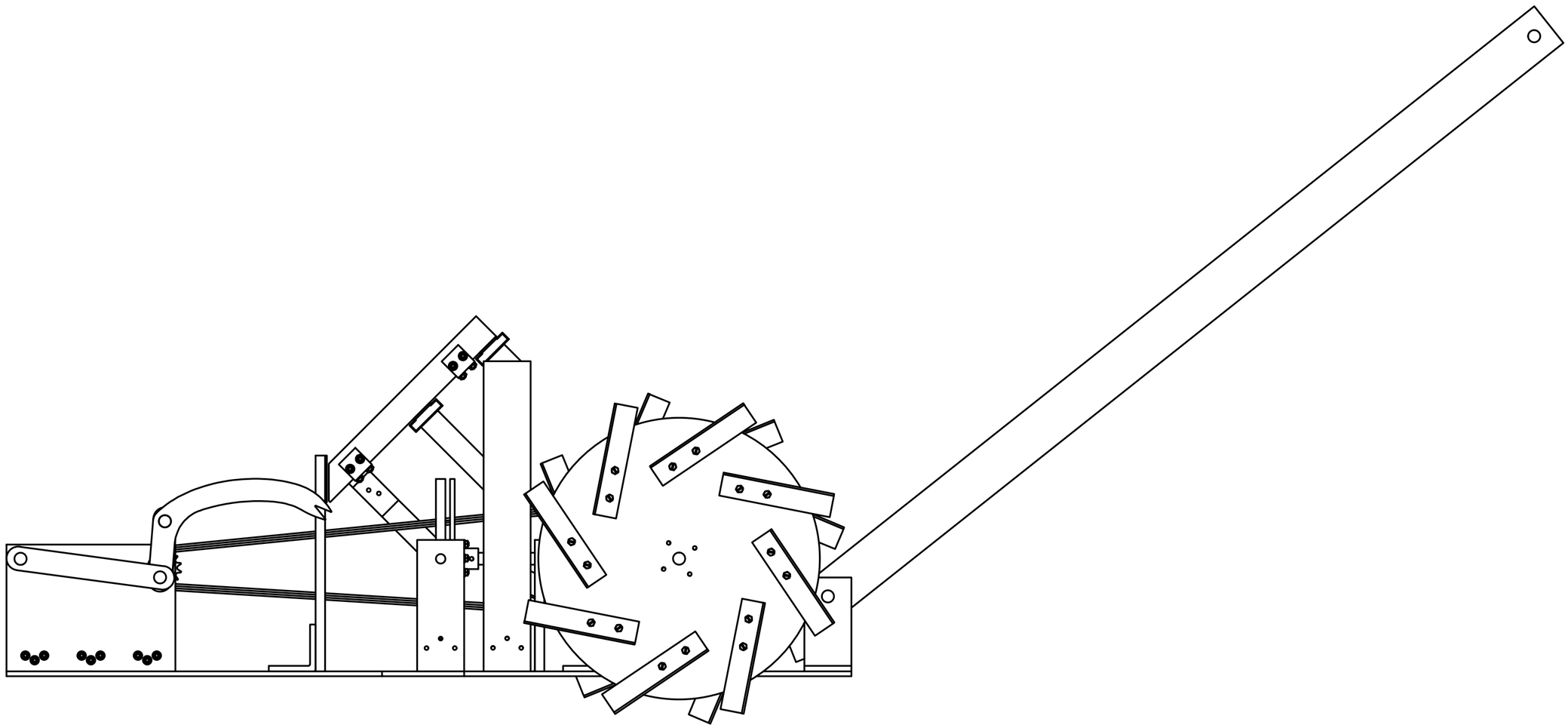

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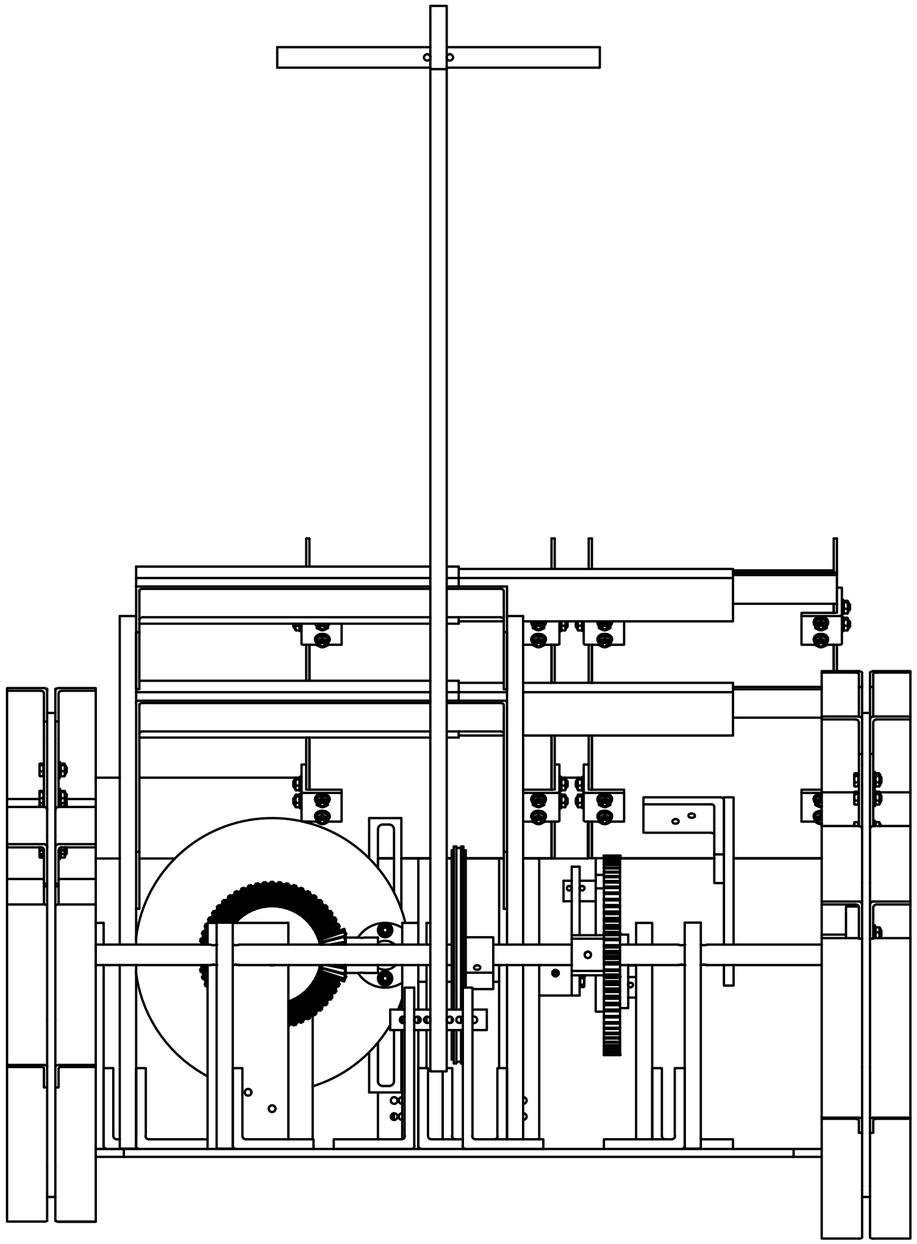

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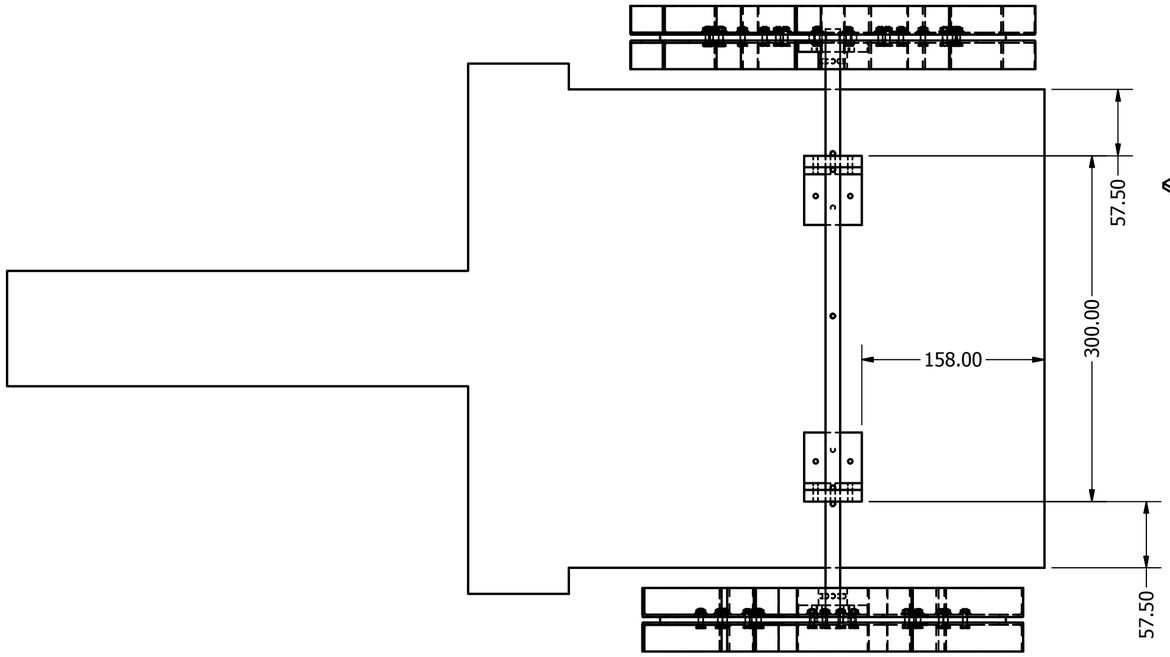

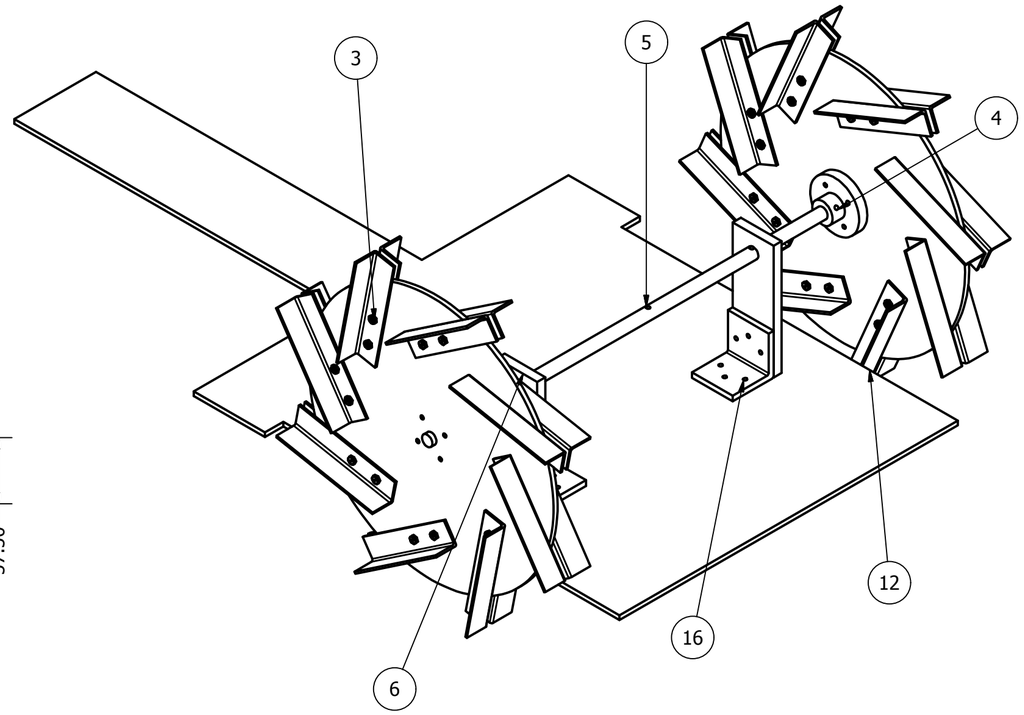

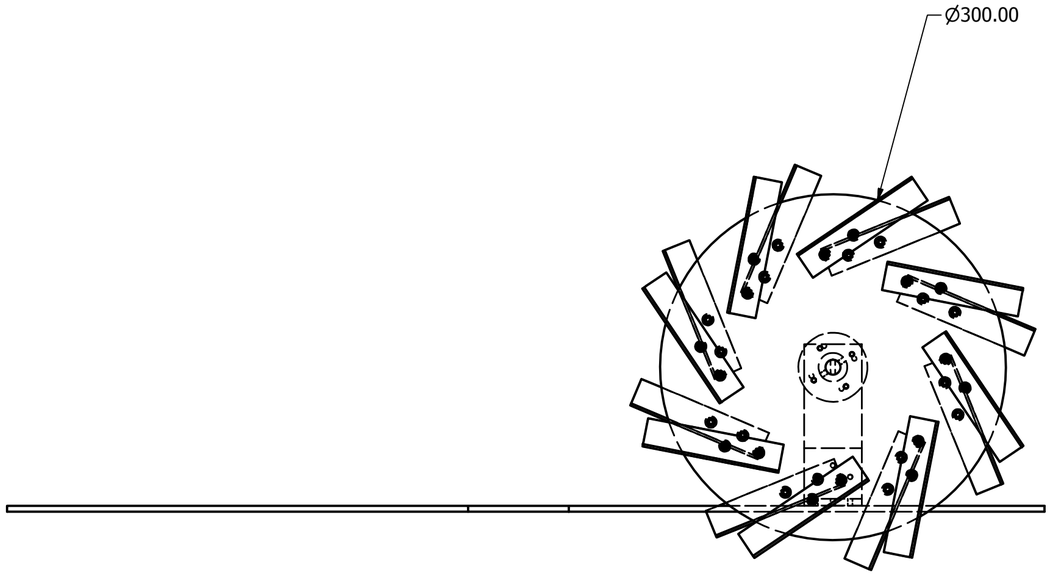

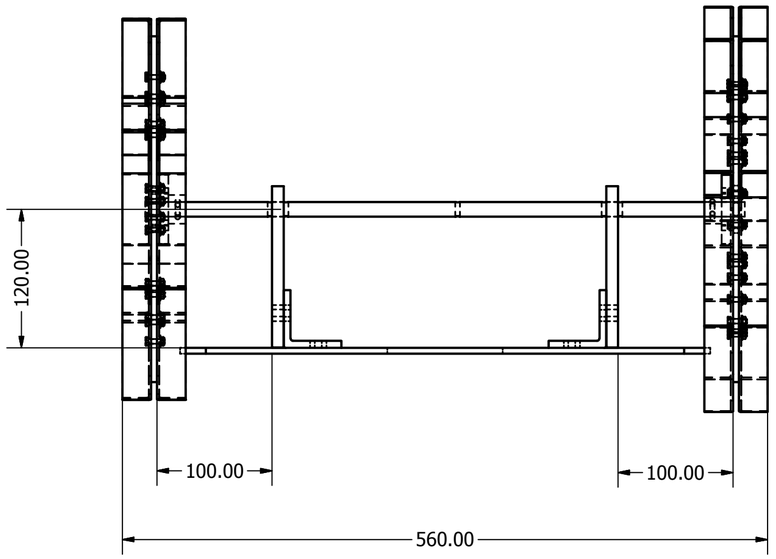

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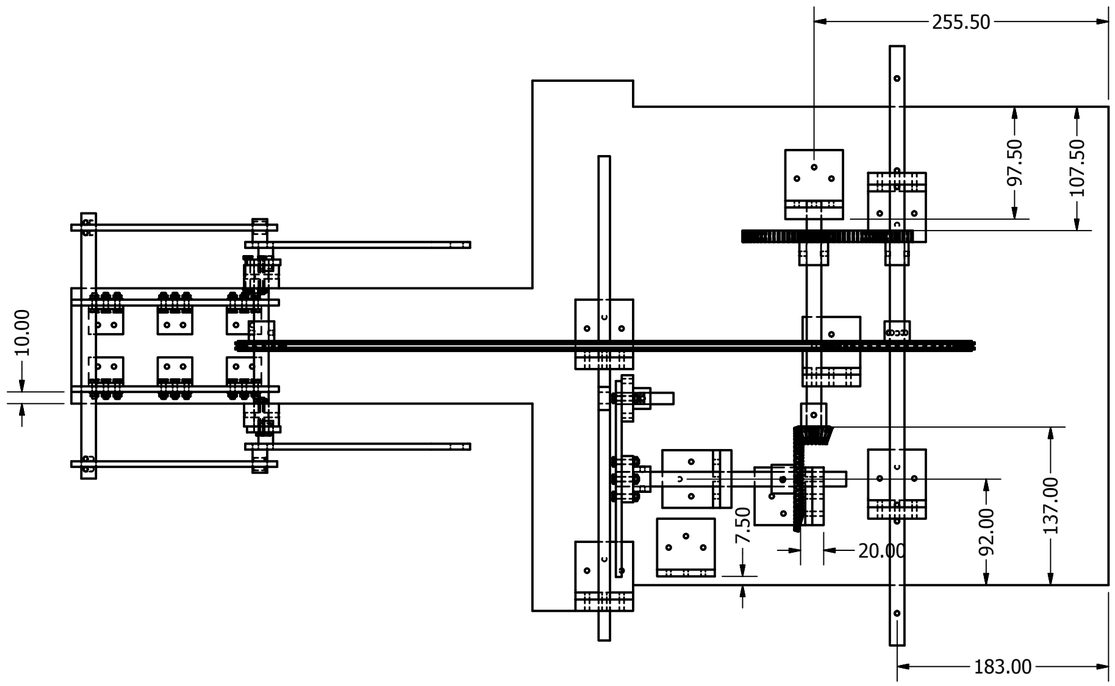

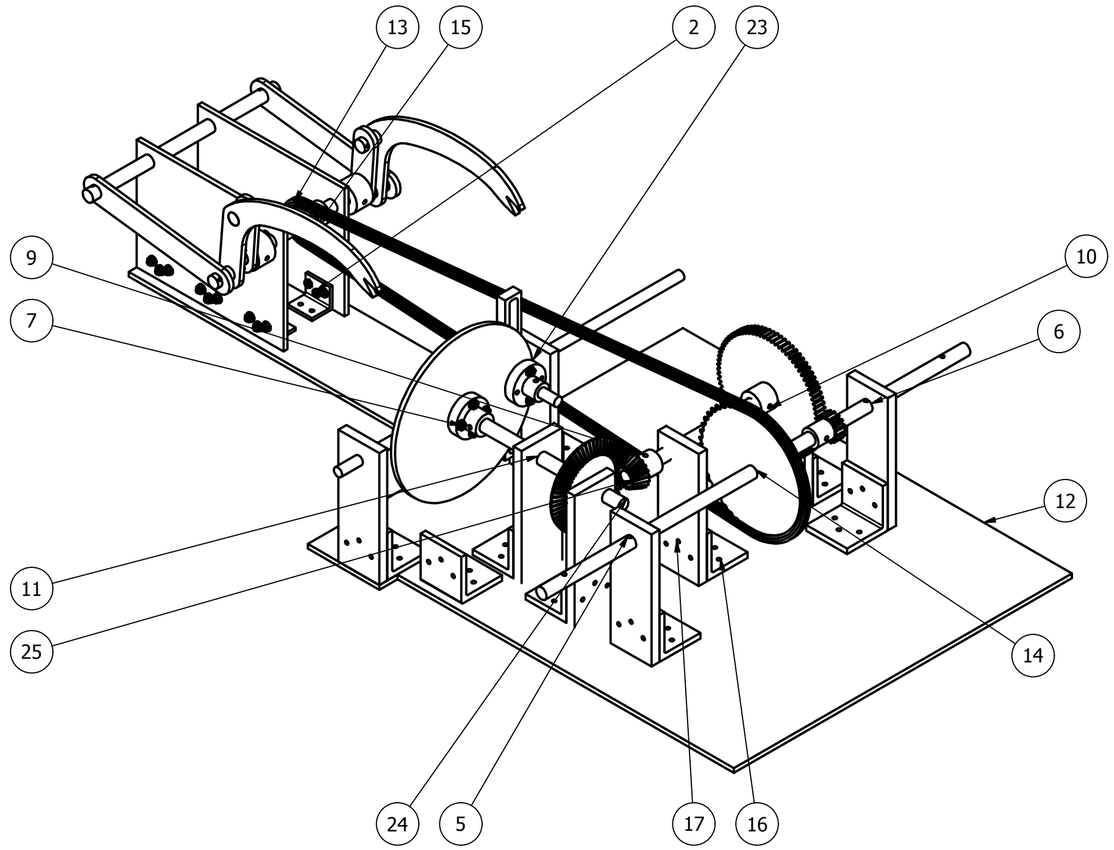

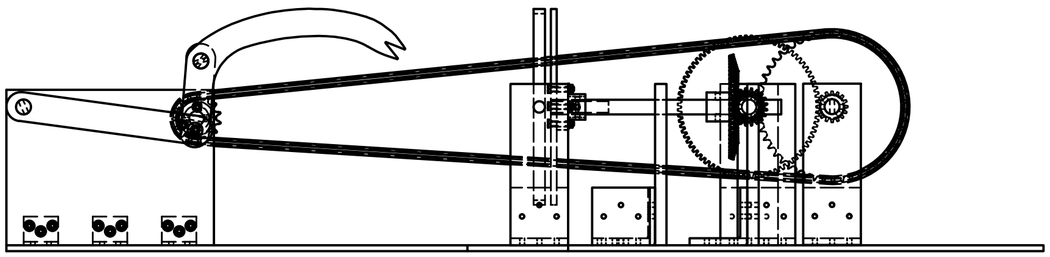

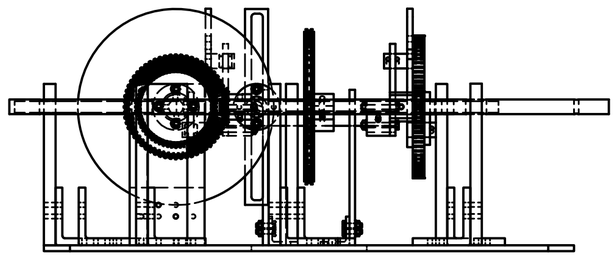

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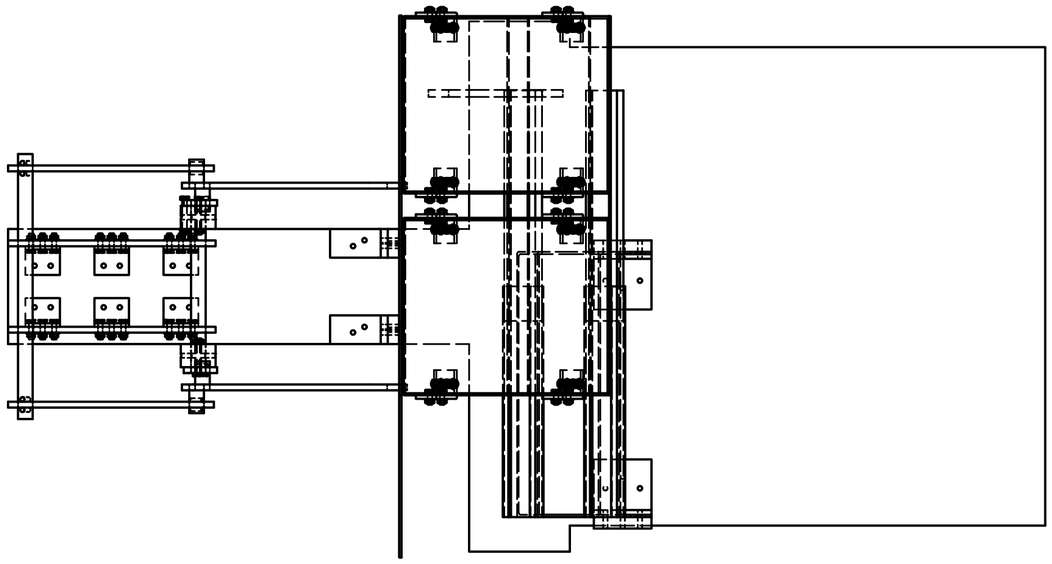

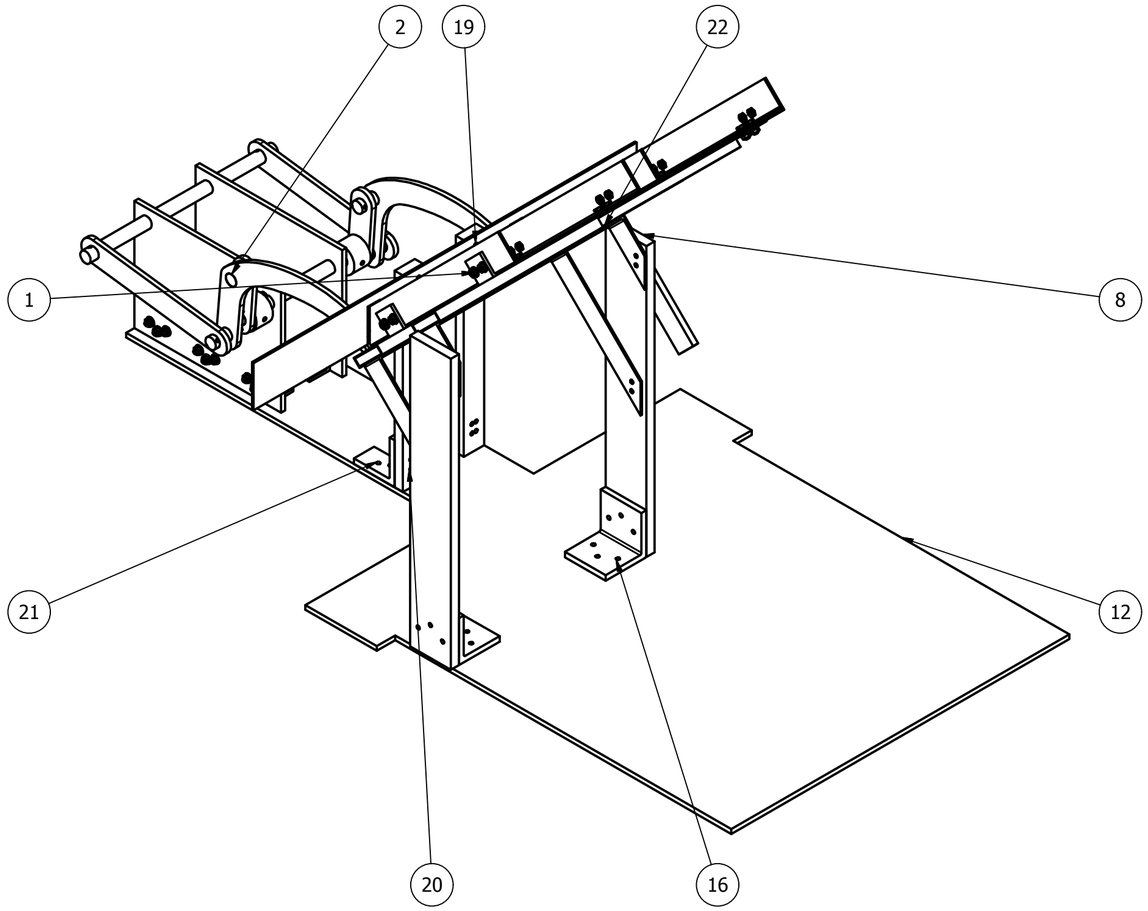

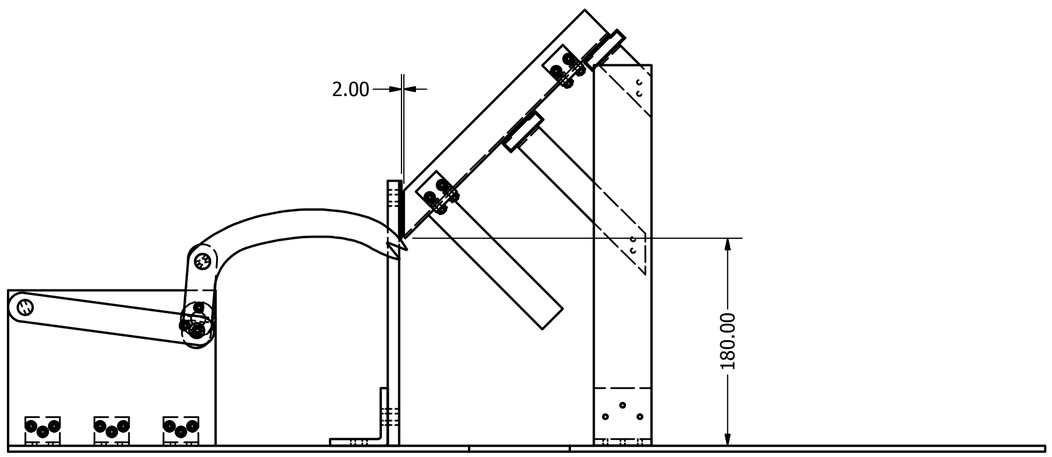

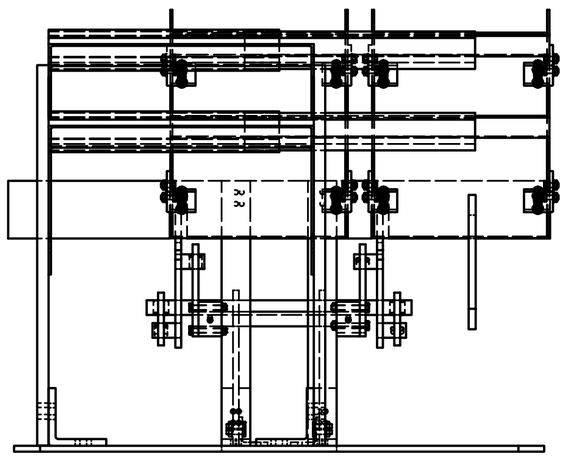

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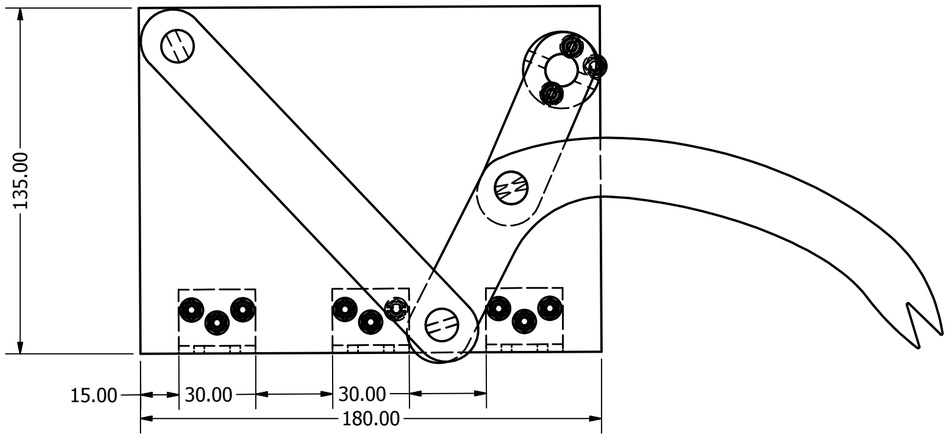
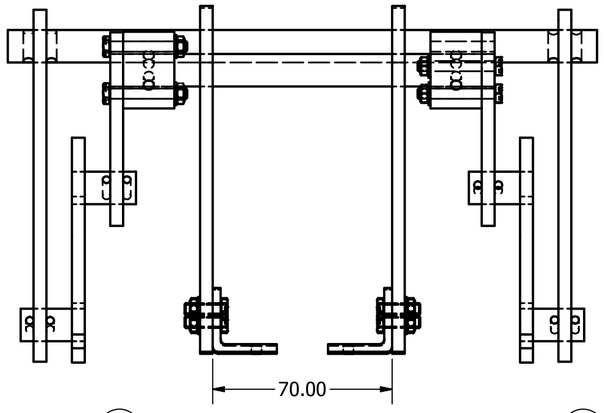
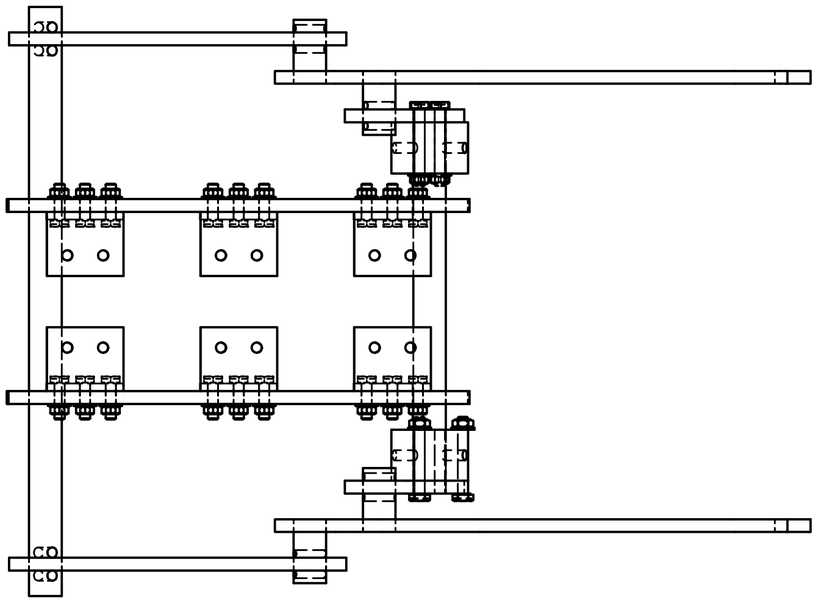
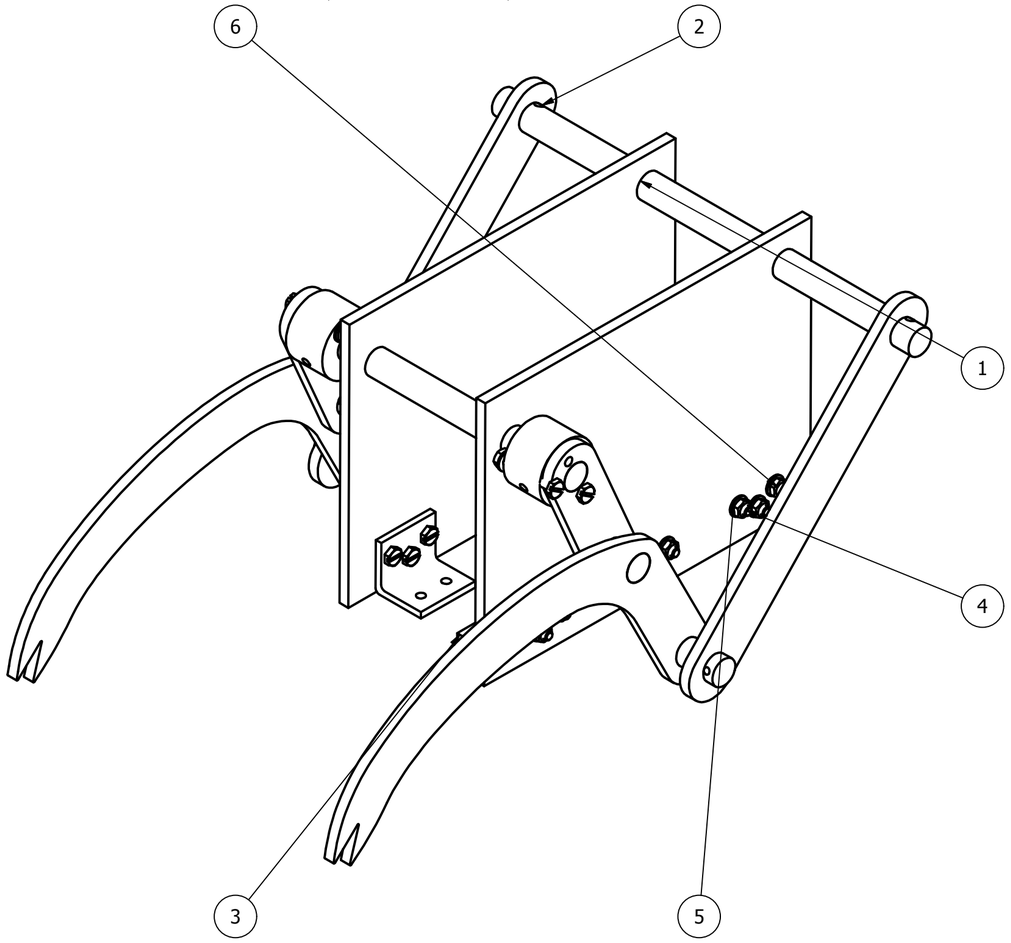
APPROVED		SIZE C / DWG NO / REV	
		SCALE	SHEET 1 OF 1



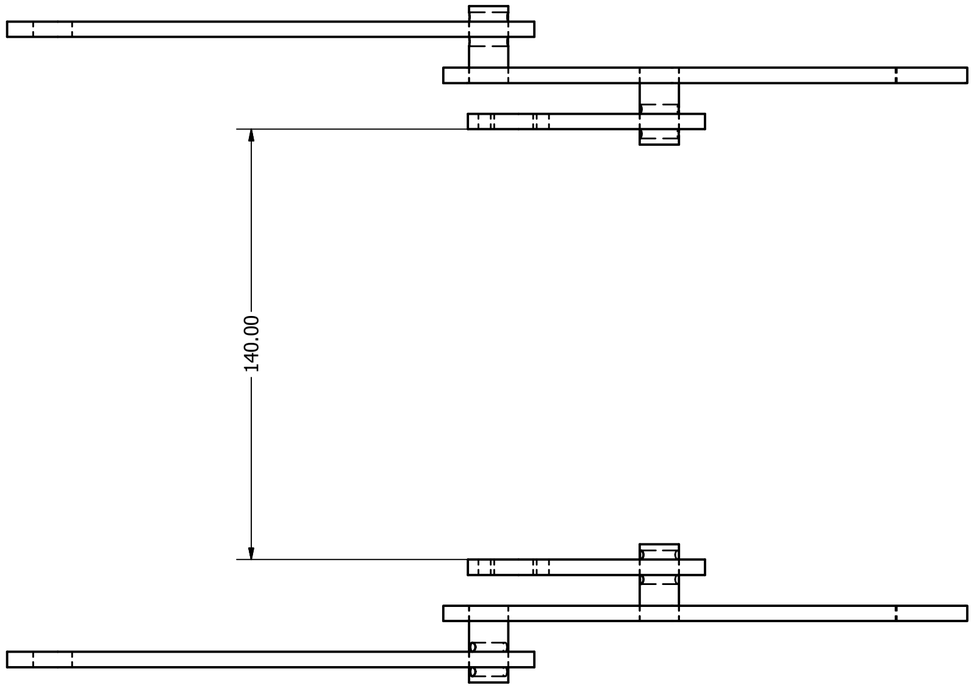


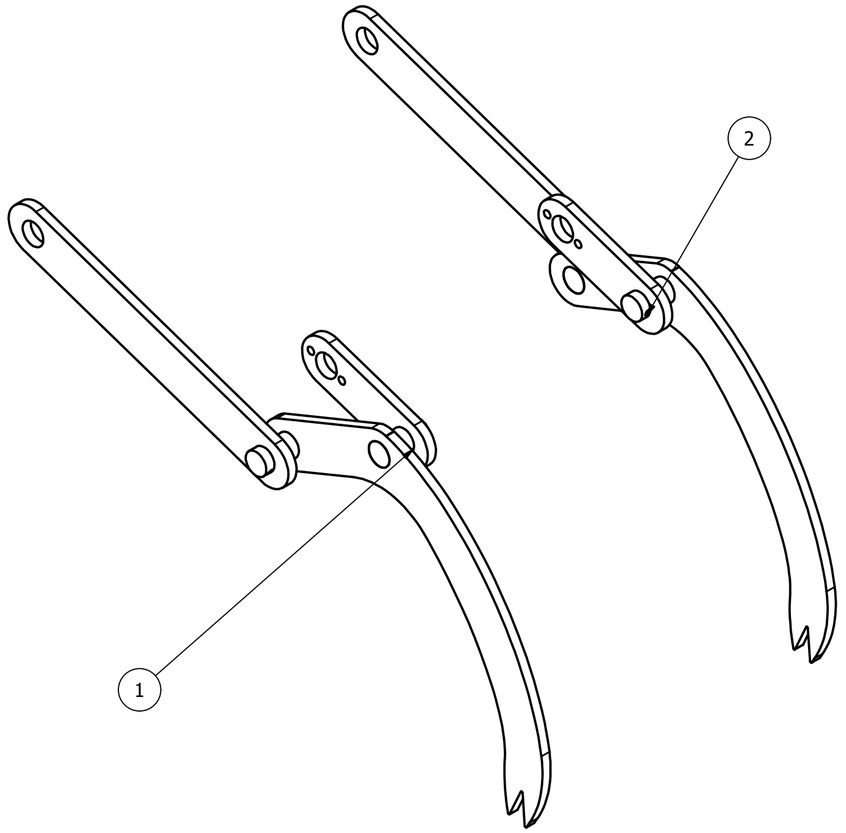


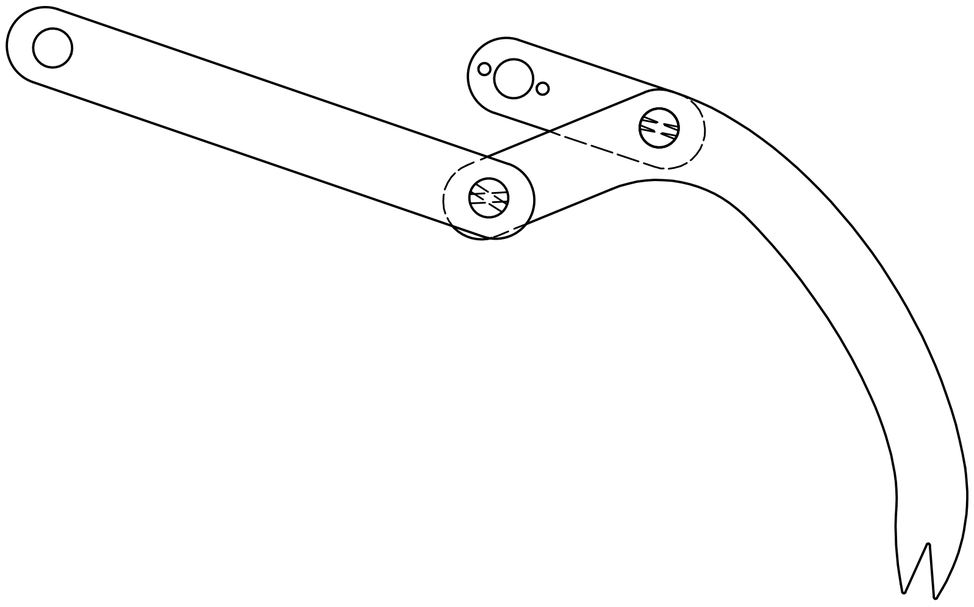


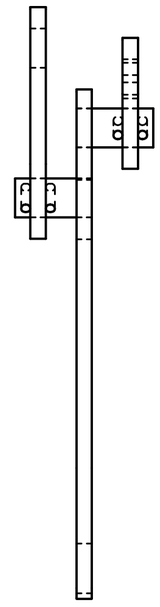
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	Picking_Mechanism_Supporting_Wall	
2	1	Picking_Mechanism_1.0	
3	6	Picking_mechanism_Support_Angle_1	
4	18	Bolt GB 29.1 M4 x 14	Hexagon bolts with slot on head - Product A and B
5	18	ISO 7089 - 4 - 140 HV	Plain washers - Normal series - Product grade A
6	18	ISO 4032 - M4	Hexagon nuts, style 1 - Product grades A and B

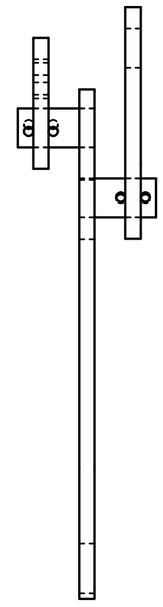
DRAWN Pankaj Kumar Verma	19-01-2015	TITLE Picking and Planting Mechanism with Support wall
CHECKED		3rd ANGLE PROJECTION
QA		All dimensions are in mm
MFG		SIZE C | DWG NO Picking_Mechanism_with_supporting_W | REV
APPROVED		SCALE | SHEET 1 OF 1





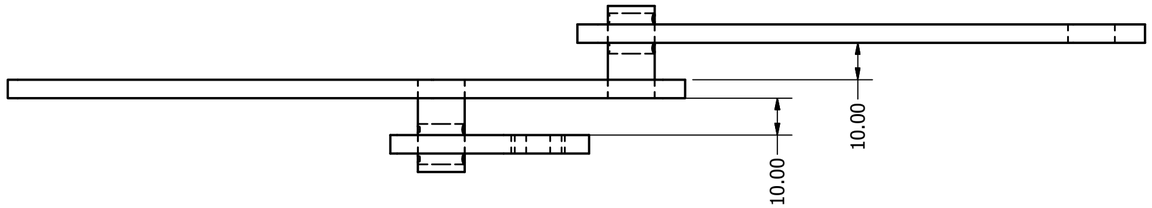


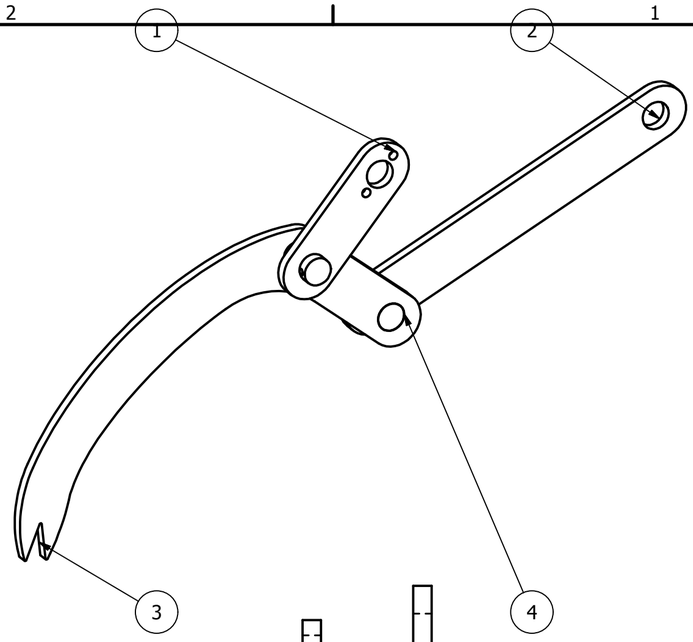


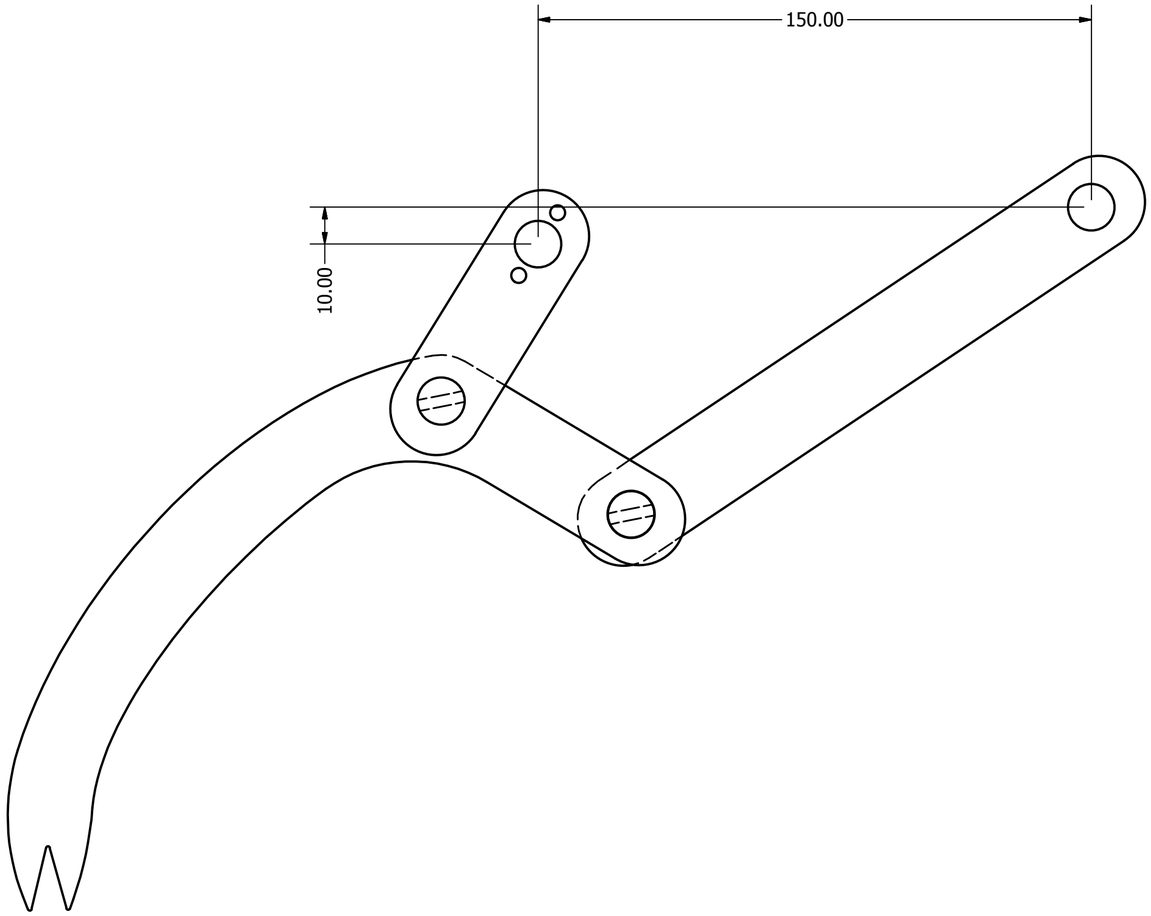


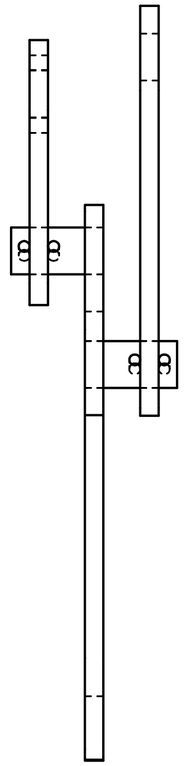
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Picking_Mechanism_Left	
2	1	Picking_Mechanism_Right	

DRAWN Pankaj Kumar Verma	20-01-2015		
CHECKED			
QA		TITLE Picking Mechanism	
MFG		3rd ANGLE PROJECTION	
APPROVED		SIZE C	DWG NO / REV
		SCALE	SHEET 1 OF 1





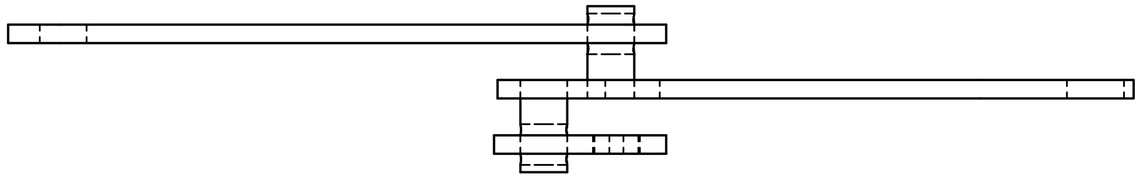


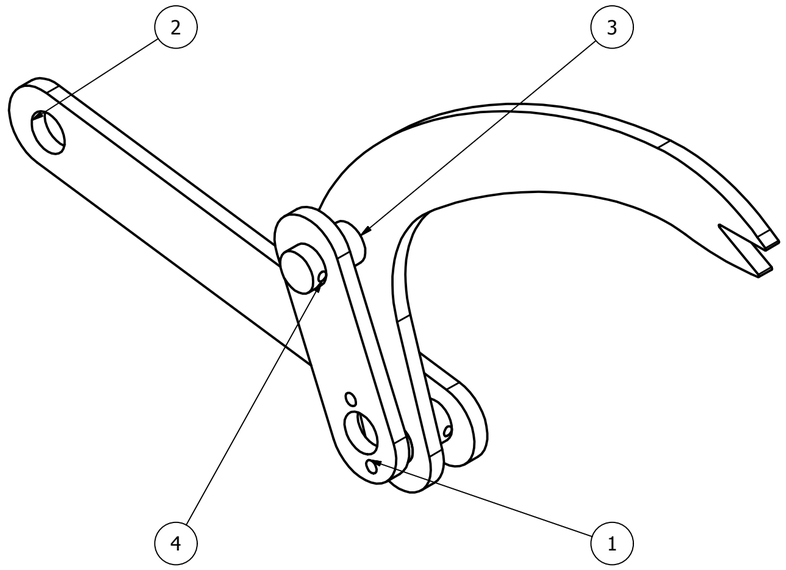


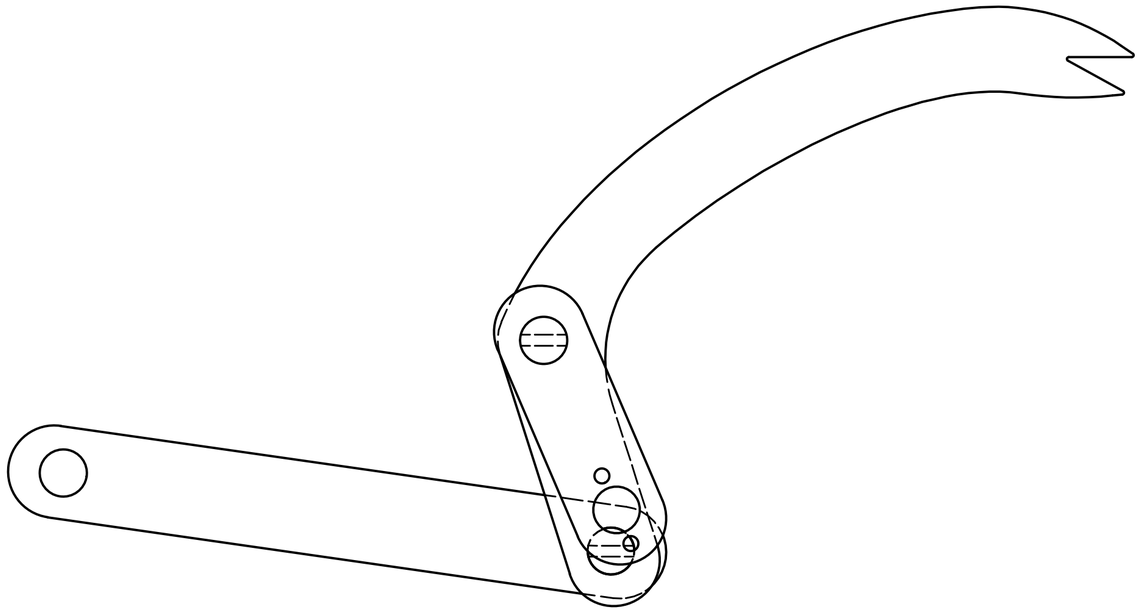
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Picking_Arm_1	
2	1	Picking_Arm_2	
3	1	Picking_Arm_3	
4	2	Picking_Arm_Shaft_1	

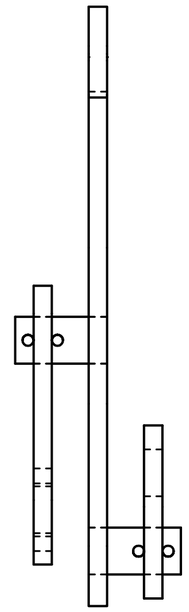
DRAWN Pankaj Kumar Verma	20-01-2015		
CHECKED		TITLE Picking Mechanism Left	
QA			
MFG			
APPROVED			
		SIZE C	DWG NO / REV
		SCALE	SHEET 1 OF 1

3rd ANGLE PROJECTION





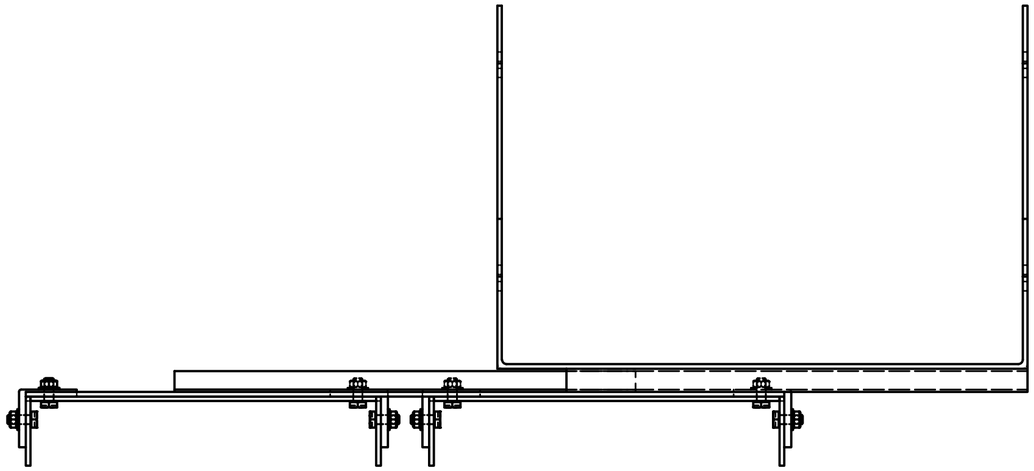


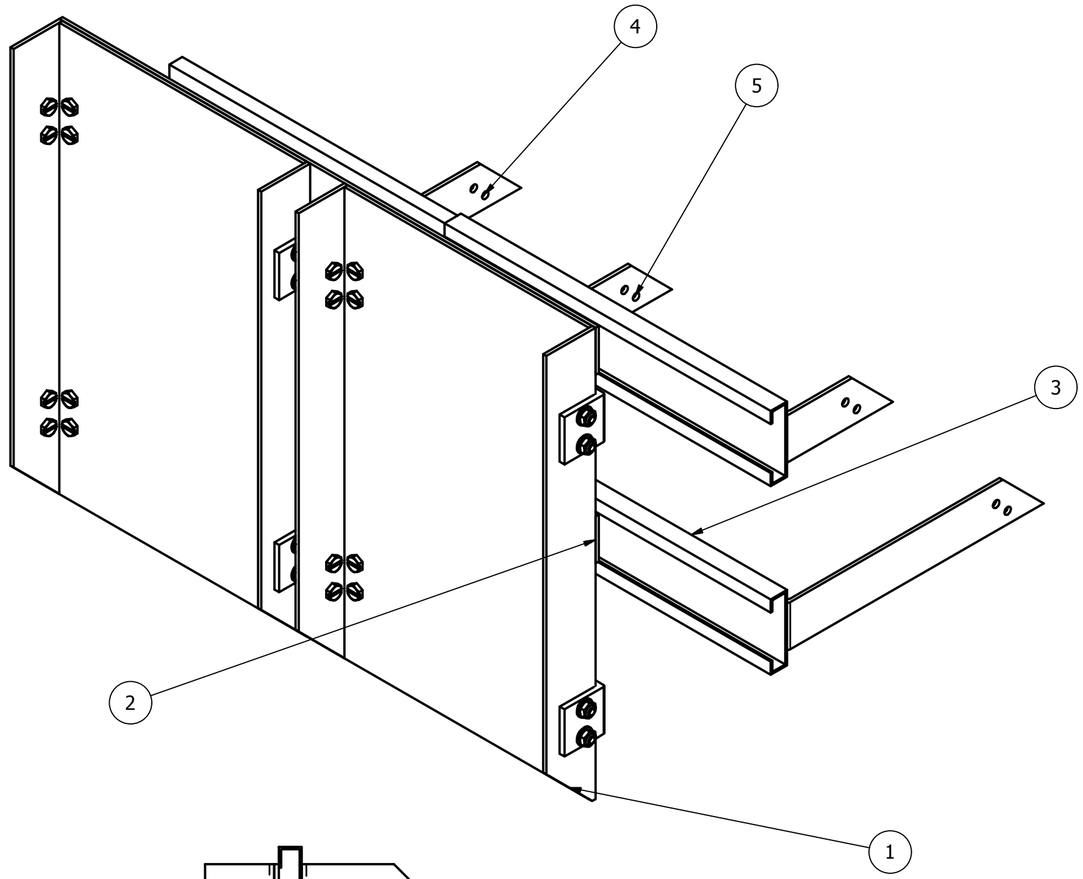


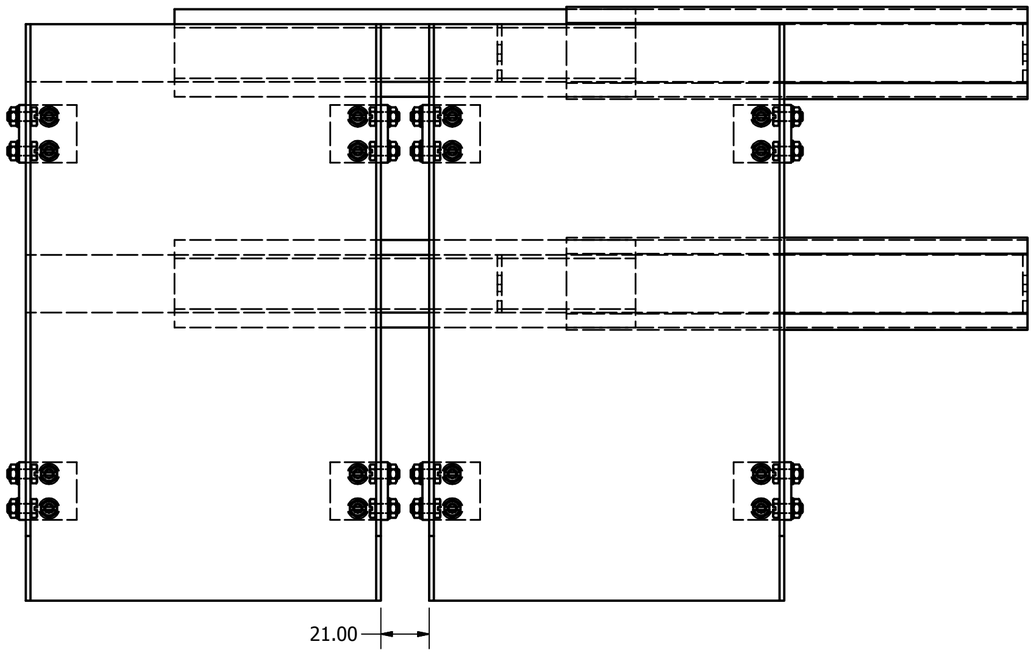
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Picking_Arm_1	
2	1	Picking_Arm_2	
3	1	Picking_Arm_3	
4	2	Picking_Arm_Shaft_1	

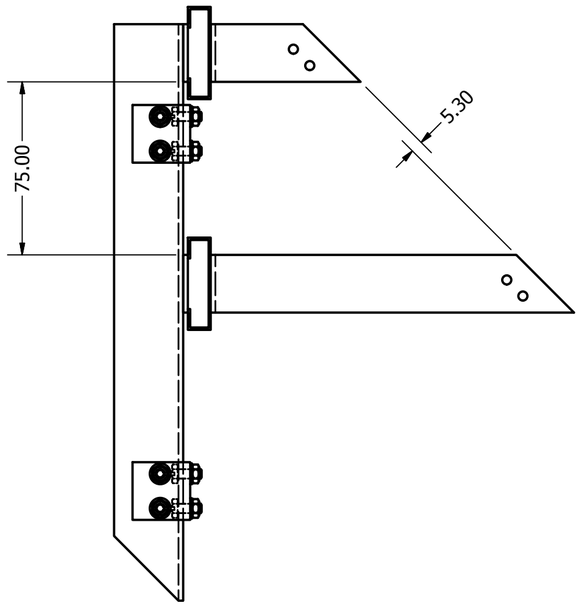
DRAWN Pankaj Kumar Verma	20-01-2015	TITLE: Picking Mechanism Right
CHECKED		
QA		
MFG		
APPROVED		
		SIZE: C; DWG NO; REV
		SCALE; SHEET 1 OF 1

3rd ANGLE PROJECTION



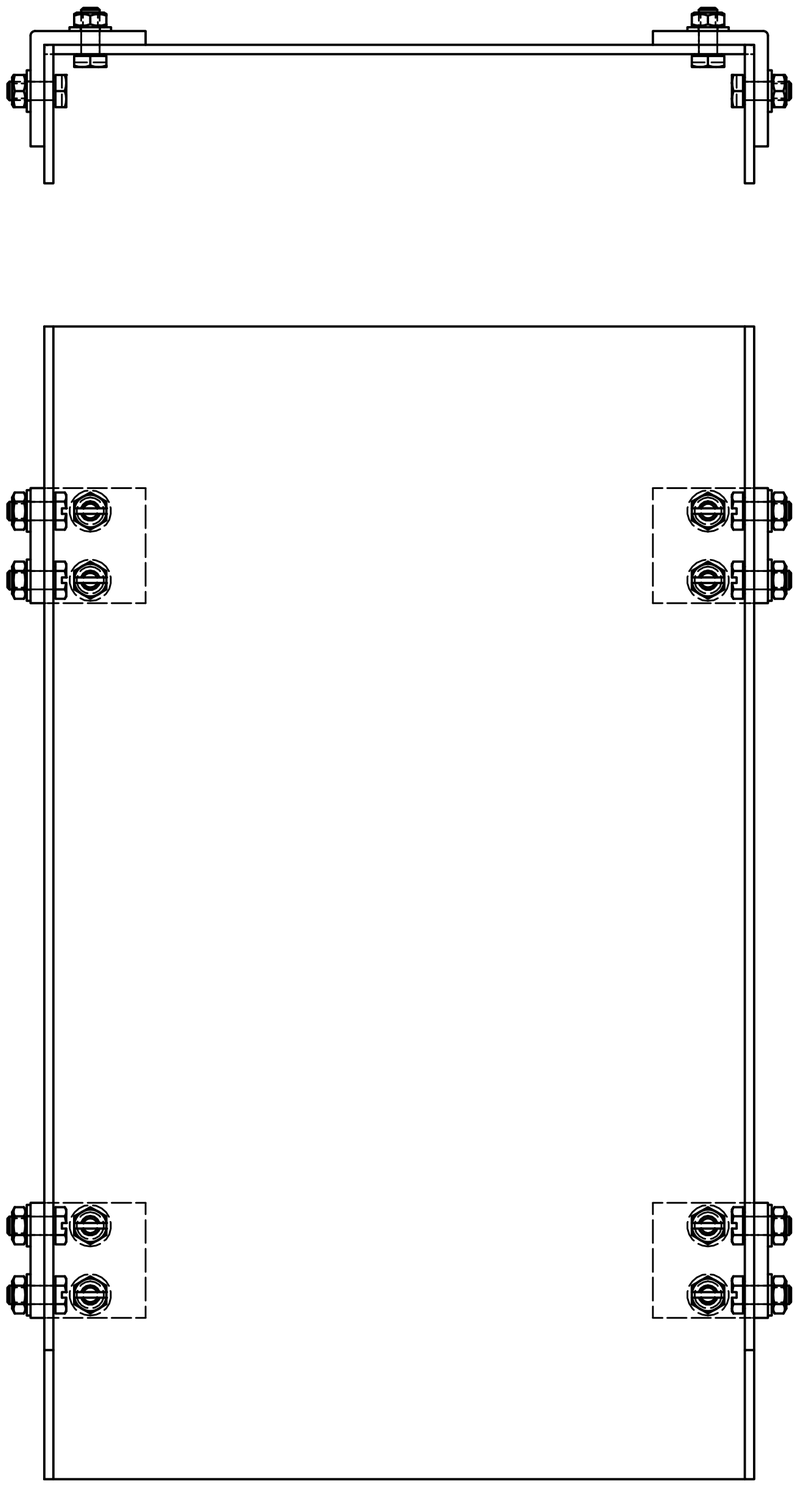


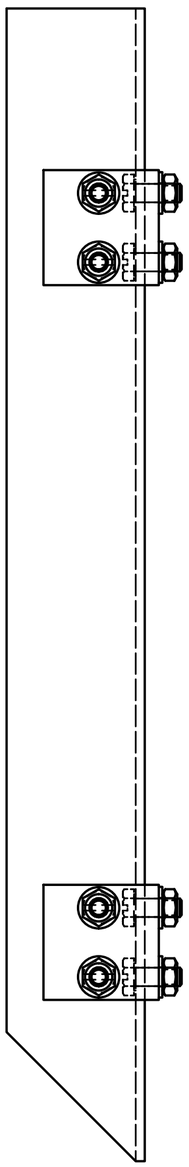


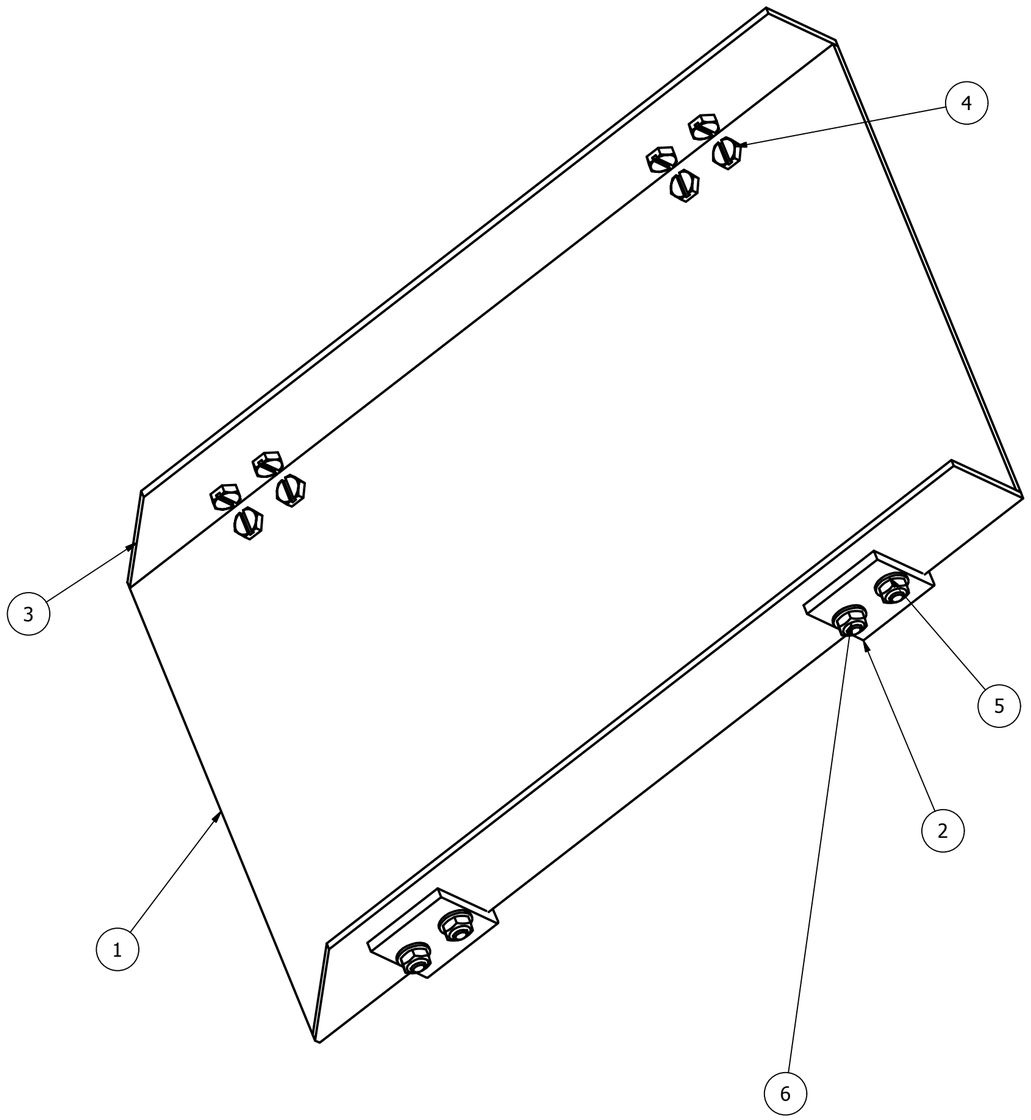


PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	Tray	
2	2	Tray_Plate_1	
3	2	slider	
4	1	Tray_Supporting_Angular_Plate	
5	1	Tray_Supporting_Angular_Plate_2	

DRAWN Pankaj Kumar Verma	20-01-2015	
CHECKED		TITLE Tray Full Assembly
QA		3rd ANGLE PROJECTION
MFG		
APPROVED		
		SIZE C / DWG NO / REV
		SCALE / SHEET 1 OF 1

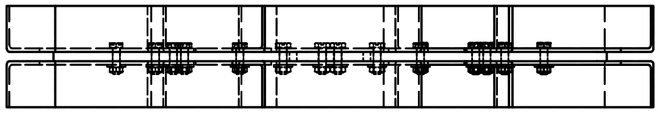


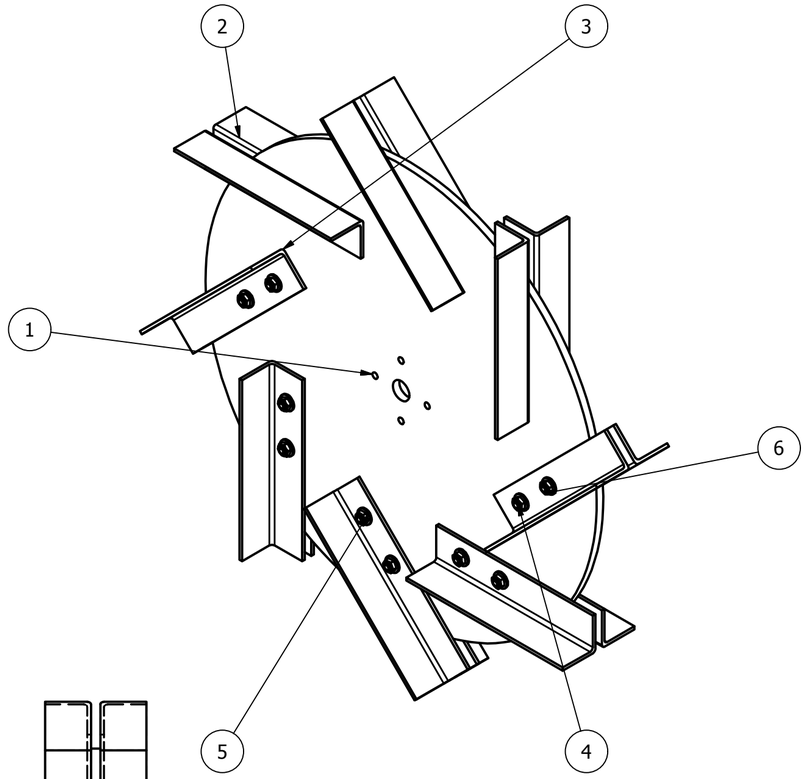


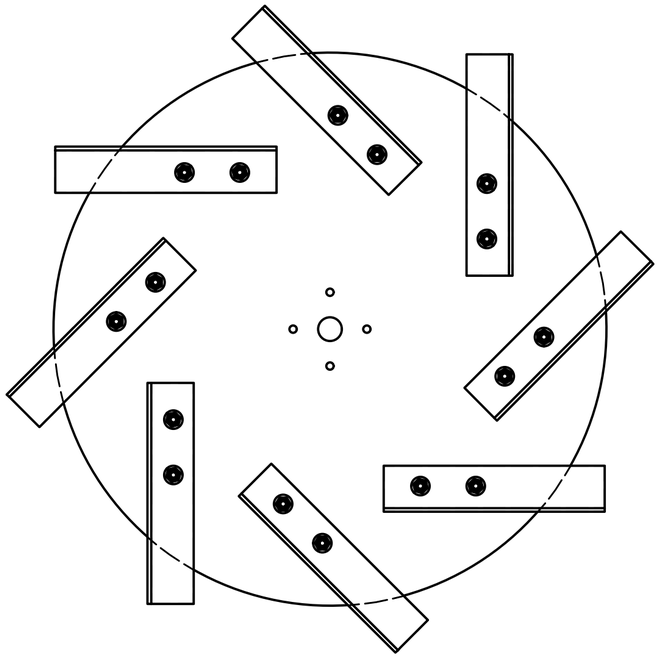


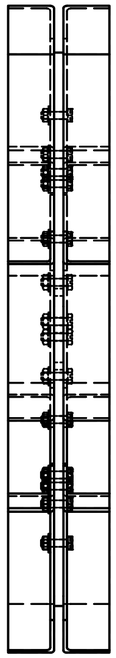
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Tray_Lower_Part	
2	4	Tray_angle	
3	2	Tray_Side	
4	16	Bolt GB 29.1 M4 x 10	Hexagon bolts with slot on head - Product A and B
5	16	ISO 7089 - 4 - 140 HV	Plain washers - Normal series - Product grade A
6	16	ISO 4032 - M4	Hexagon nuts, style 1 - Product grades A and B

DRAWN Pankaj Kumar Verma	20-01-2015	
CHECKED		TITLE Tray
QA		3rd ANGLE PROJECTION
MFG		SIZE C / DWG NO / REV
APPROVED		SCALE / SHEET 1 OF 1



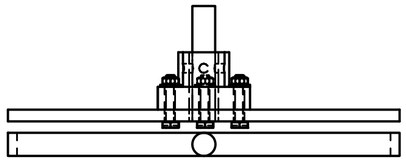


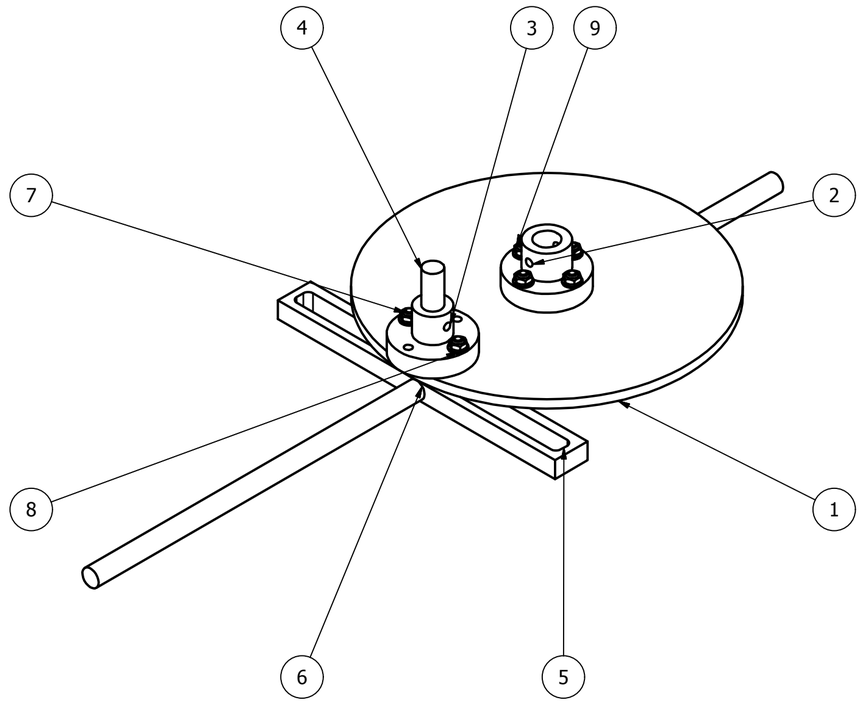


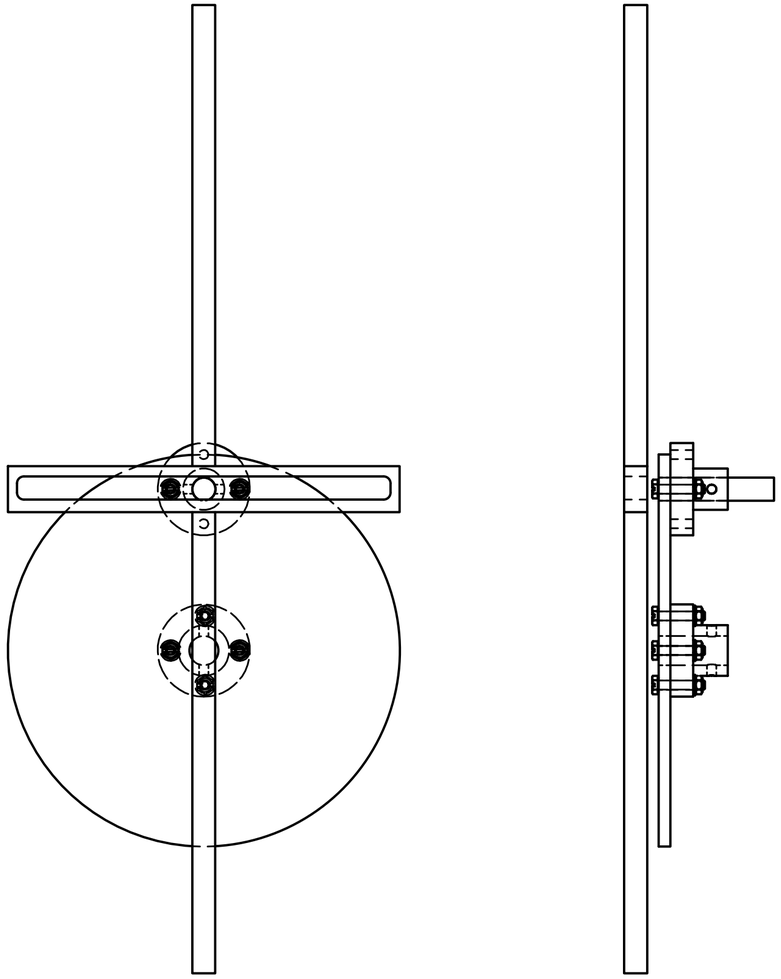


PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Wheel_Plate	
2	16	Wheel_Angle_50mm	
3	16	Wheel_Angle_50mm_MIR	
4	16	Bolt GB 29.1 M4 x 14	Hexagon bolts with slot on head - Product A and B
5	16	ISO 7091 - ST 4 - 100 HV	Plain washers - Normal series - Product grade C
6	16	ISO 4032 - M4	Hexagon nuts, style 1 - Product grades A and B

DRAWN Pankaj Kumar Verma	20-01-2015	
CHECKED		TITLE Wheel Assembly
QA		3rd ANGLE PROJECTION
MFG		SIZE C / DWG NO / REV
APPROVED		SCALE / SHEET 1 OF 1

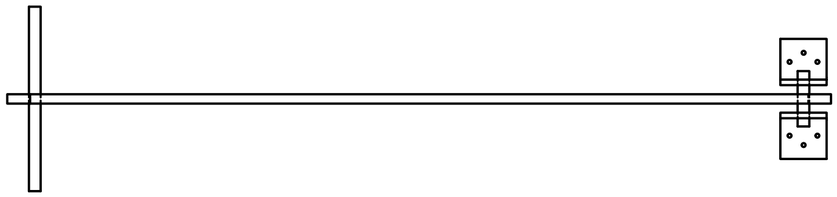


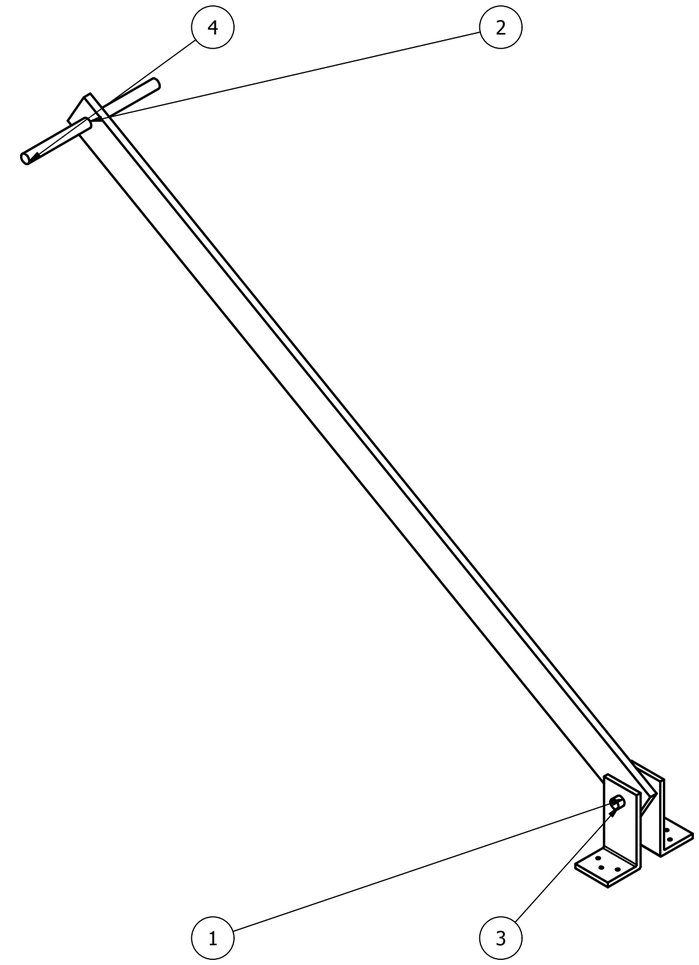


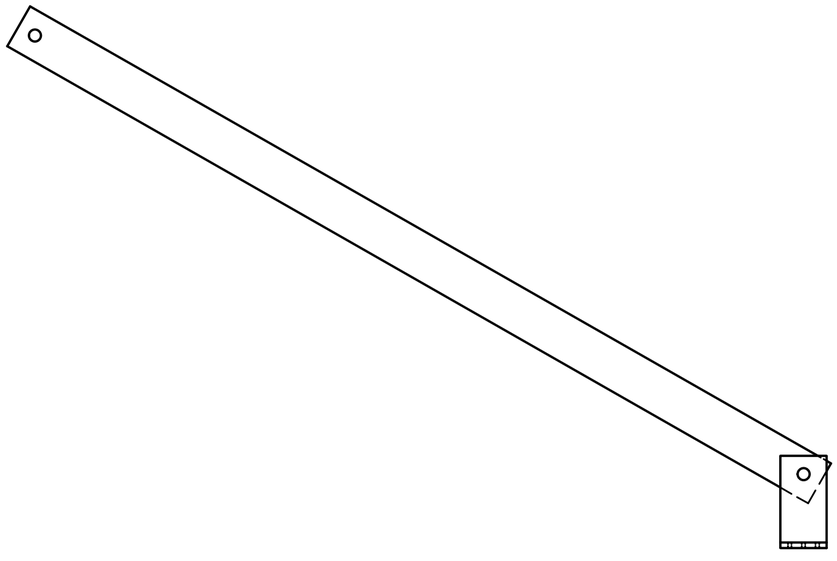


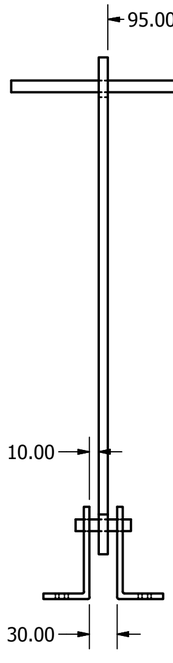
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Translation_mechanism_Circular_Plate	
2	1	Translation_mechanism_Hub 1	
3	1	Translation_mechanism_Hub 2	
4	1	Translation_mechanism_Rod_6mm	
5	1	Translation_mechanism_Groove_rod	
6	2	Translation_mechanism_Rod_10mm	
7	6	Bolt GB 29.1 M4 x 20	Hexagon bolts with slot on head - Product A and B
8	6	ISO 7089 - 4 - 140 HV	Plain washers - Normal series - Product grade A
9	6	ISO 4032 - M4	Hexagon nuts, style 1 - Product grades A and B

DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Translational Mechanism - Whitworth Mechanism
CHECKED		3rd ANGLE PROJECTION
QA		SIZE C / DWG NO / REV
MFG		SCALE / SHEET 1 OF 1
APPROVED		







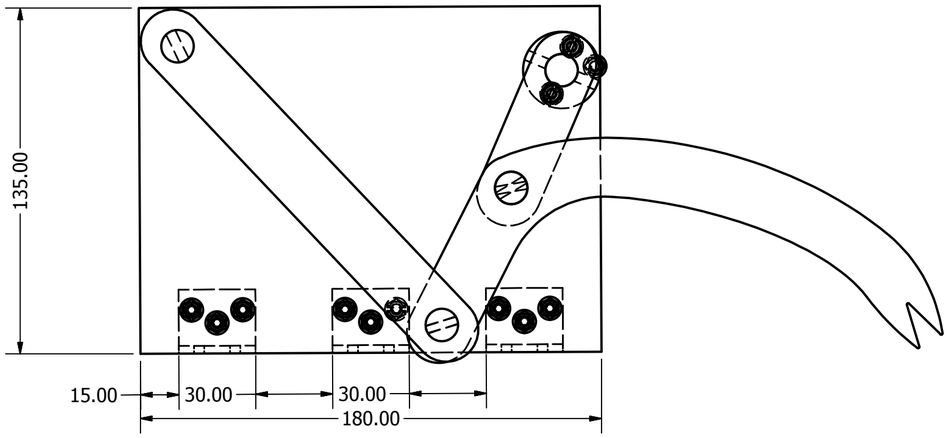


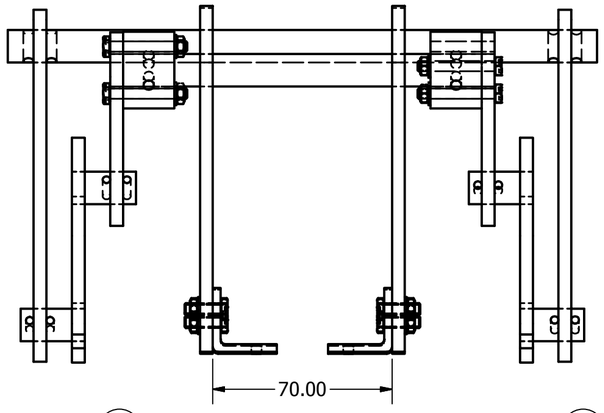
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	Pulling_Mechanism_Angle	
2	1	Pulling_Sqaure_Rod	
3	1	Shaft_60mm	
4	1	Shaft_180mm	

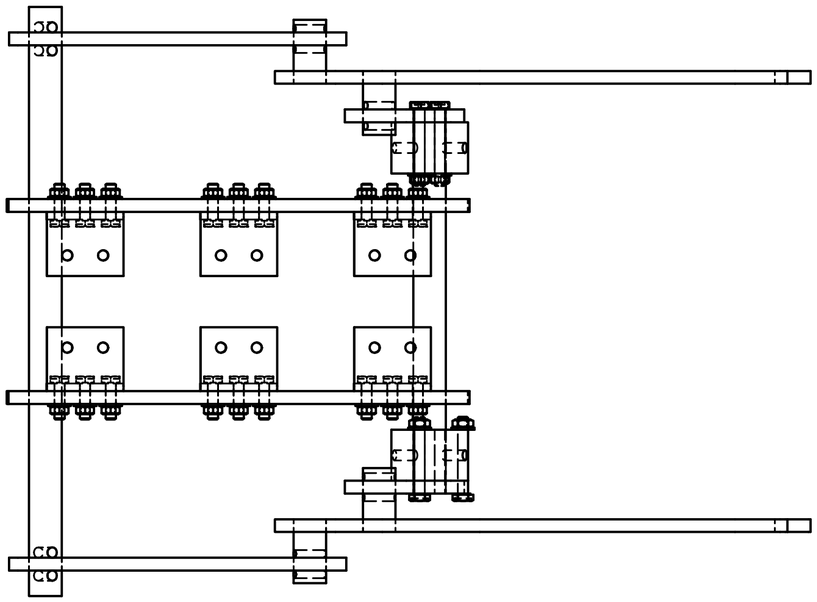
DRAWN Pankaj Kumar Verma	20-01-2015		
CHECKED		TITLE Pulling Mechanism	
QA			
MFG			
APPROVED		3rd ANGLE PROJECTION	
		SIZE C / DWG NO / REV	
		SCALE / SHEET 1 OF 1	

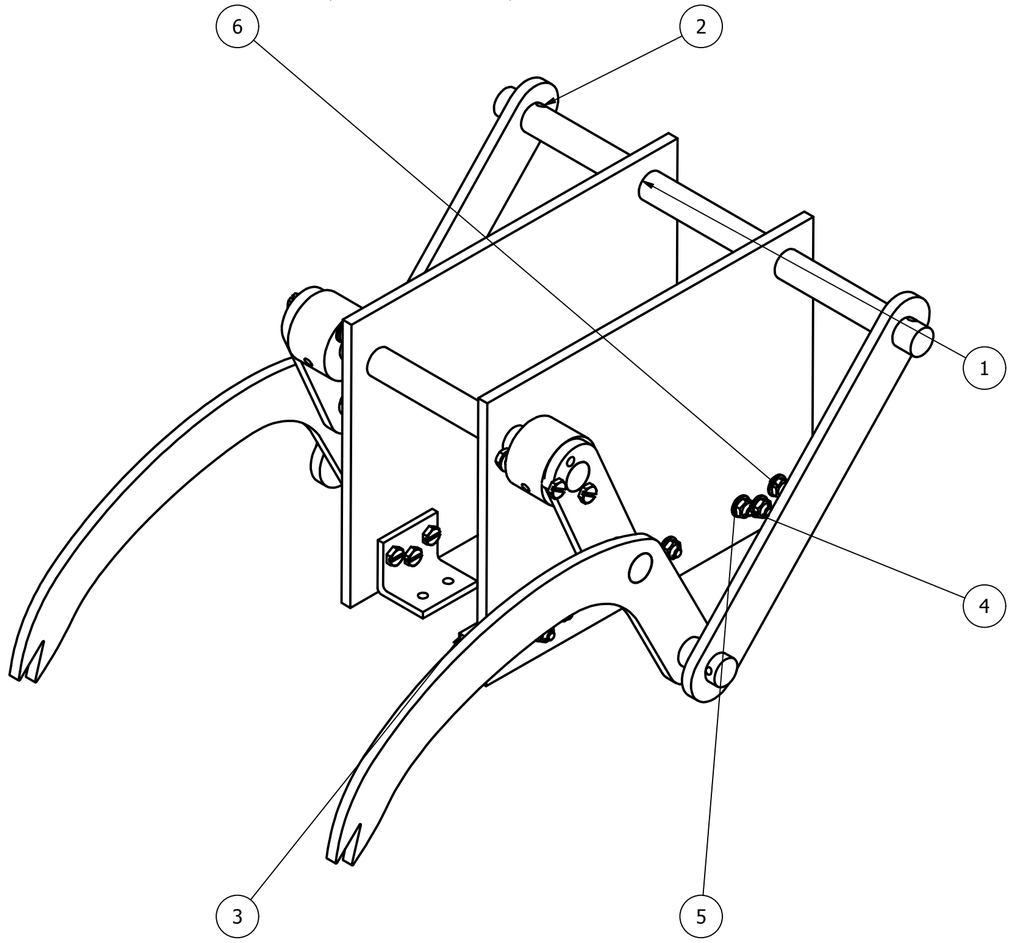
APPENDIX – 3

Isometric Drawing of Planting Unit Assembly and Parts



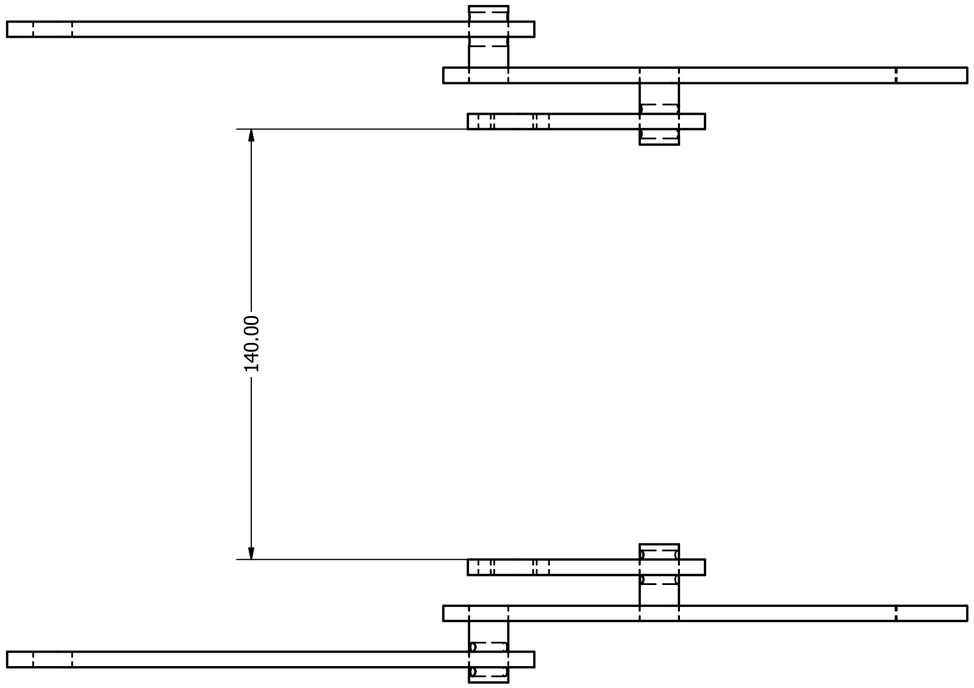


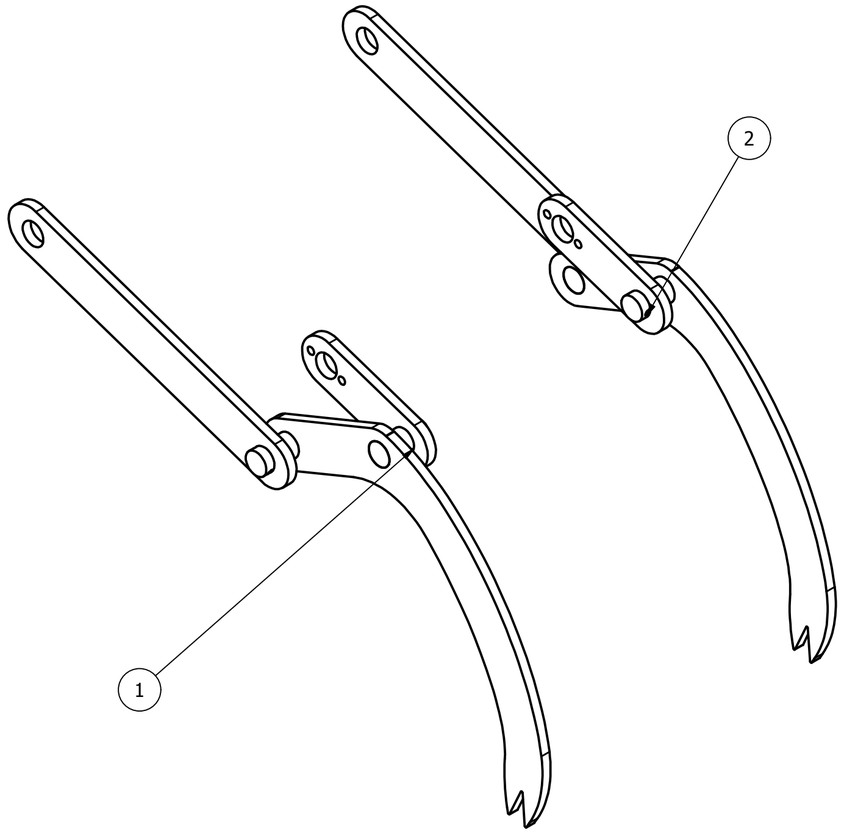


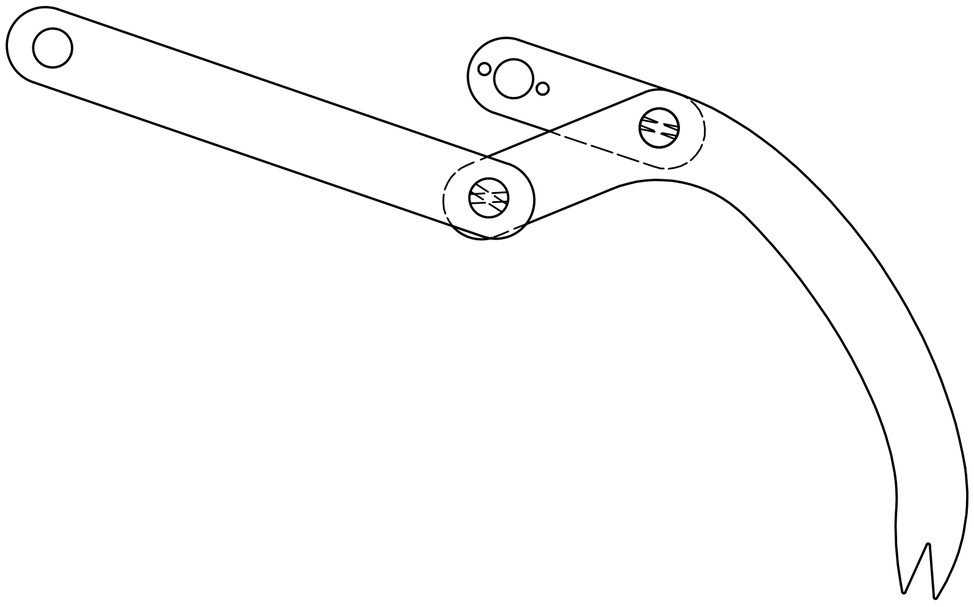


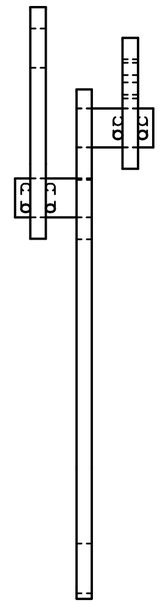
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	Picking_Mechanism_Supporting_Wall	
2	1	Picking_Mechanism_1.0	
3	6	Picking_mechanism_Support_Angle_1	
4	18	Bolt GB 29.1 M4 x 14	Hexagon bolts with slot on head - Product A and B
5	18	ISO 7089 - 4 - 140 HV	Plain washers - Normal series - Product grade A
6	18	ISO 4032 - M4	Hexagon nuts, style 1 - Product grades A and B

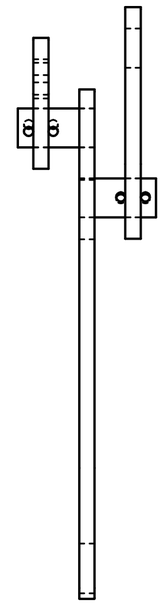
DRAWN Pankaj Kumar Verma	19-01-2015	
CHECKED		TITLE Picking and Planting Mechanism with Support wall
QA		3rd ANGLE PROJECTION
MFG		All dimensions are in mm
APPROVED		SIZE C / DWG NO Picking_Mechanism_with_supporting_W / REV
		SCALE / SHEET 1 OF 1





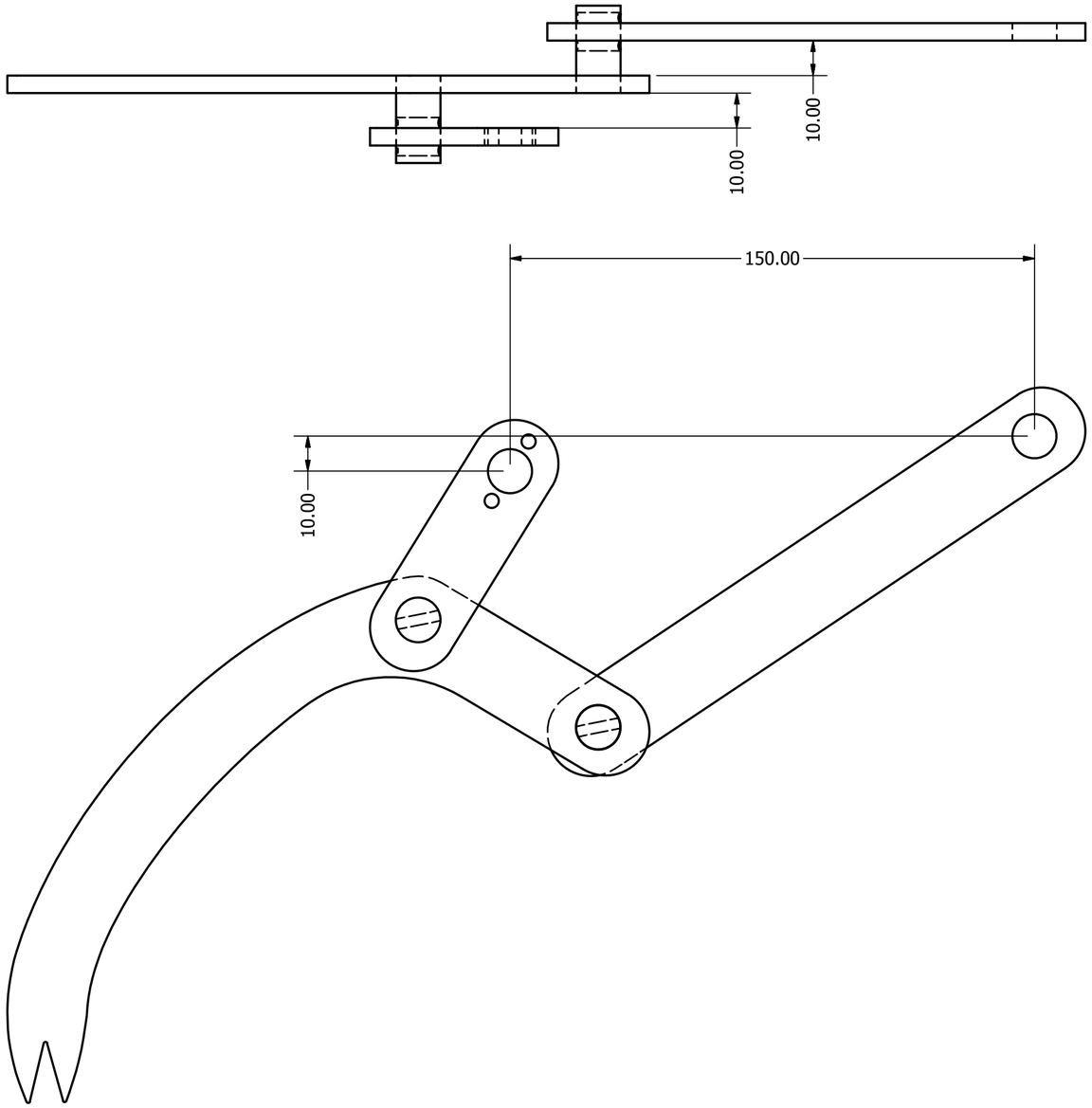


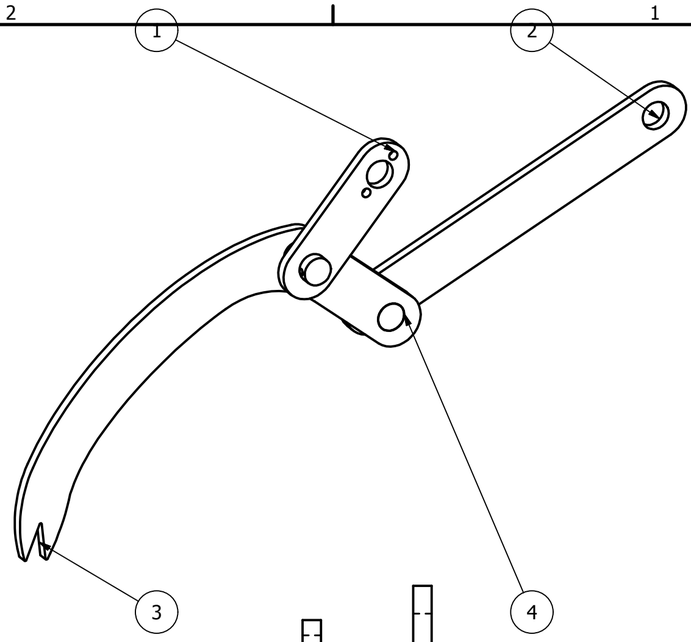


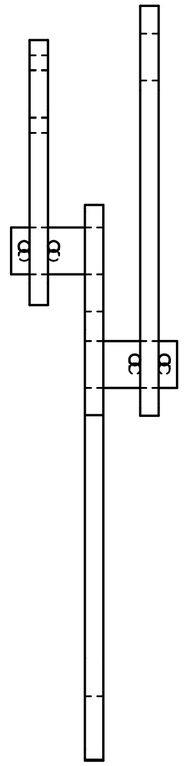


PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Picking_Mechanism_Left	
2	1	Picking_Mechanism_Right	

DRAWN Pankaj Kumar Verma	20-01-2015		
CHECKED			
QA		TITLE Picking Mechanism	
MFG		3rd ANGLE PROJECTION	
APPROVED		SIZE C	DWG NO / REV
		SCALE	SHEET 1 OF 1



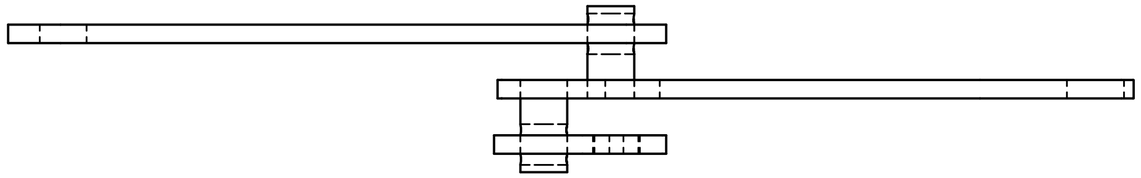


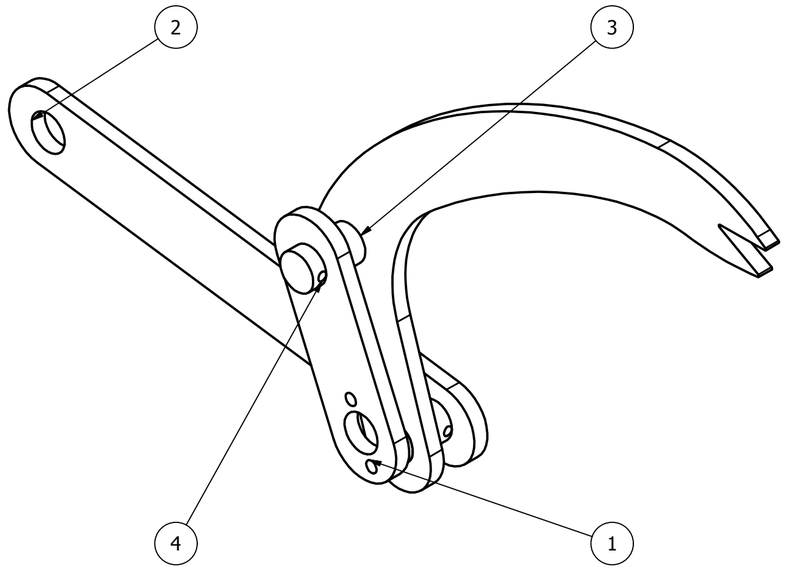


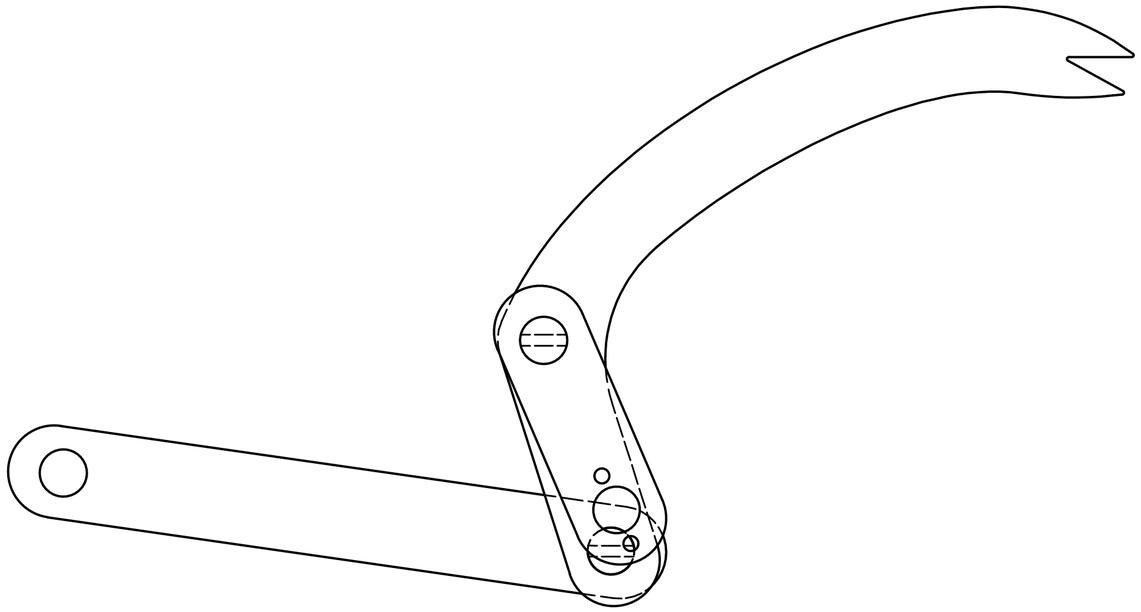
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Picking_Arm_1	
2	1	Picking_Arm_2	
3	1	Picking_Arm_3	
4	2	Picking_Arm_Shaft_1	

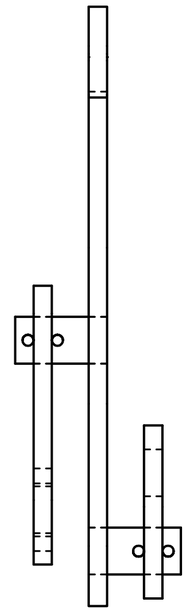
DRAWN Pankaj Kumar Verma	20-01-2015		
CHECKED		TITLE Picking Mechanism Left	
QA			
MFG			
APPROVED			
		SIZE C	DWG NO / REV
		SCALE	SHEET 1 OF 1

3rd ANGLE PROJECTION





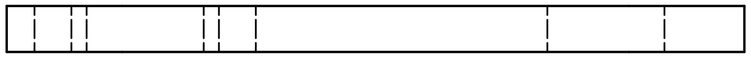


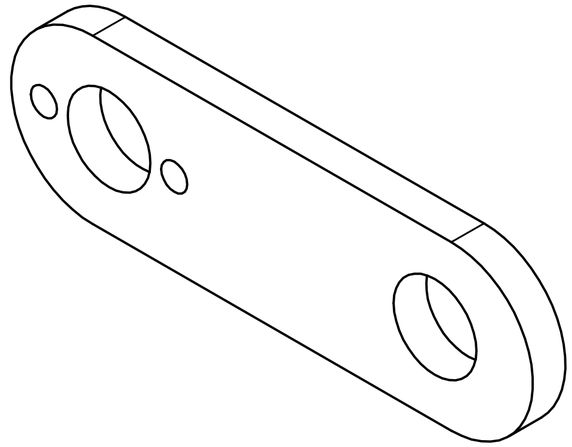


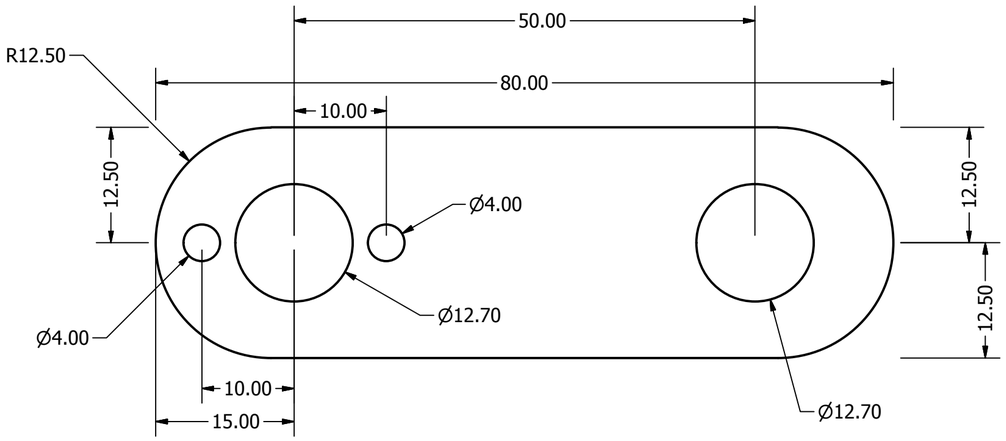
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Picking_Arm_1	
2	1	Picking_Arm_2	
3	1	Picking_Arm_3	
4	2	Picking_Arm_Shaft_1	

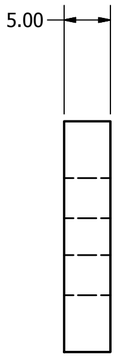
DRAWN Pankaj Kumar Verma	20-01-2015	TITLE: Picking Mechanism Right
CHECKED		
QA		
MFG		
APPROVED		
		SIZE C | DWG NO | REV
		SCALE | SHEET 1 OF 1

3rd ANGLE PROJECTION



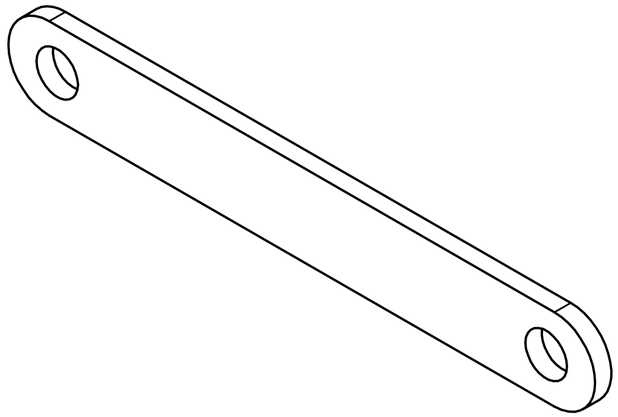


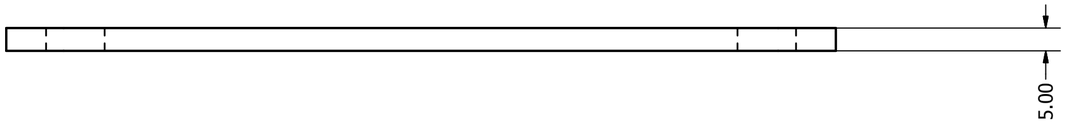


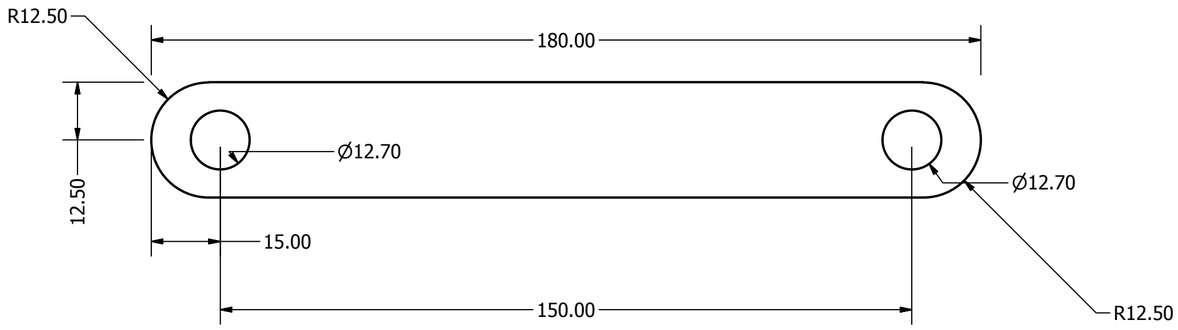


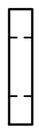
Material Required: 25mm * 5mm * 80mm Mild Steel Flat
Quantity: 2

DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Picking Arm 1	
CHECKED		3rd ANGLE PROJECTION	
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Picking_Arm_1 / REV
		SCALE	SHEET 1 OF 1





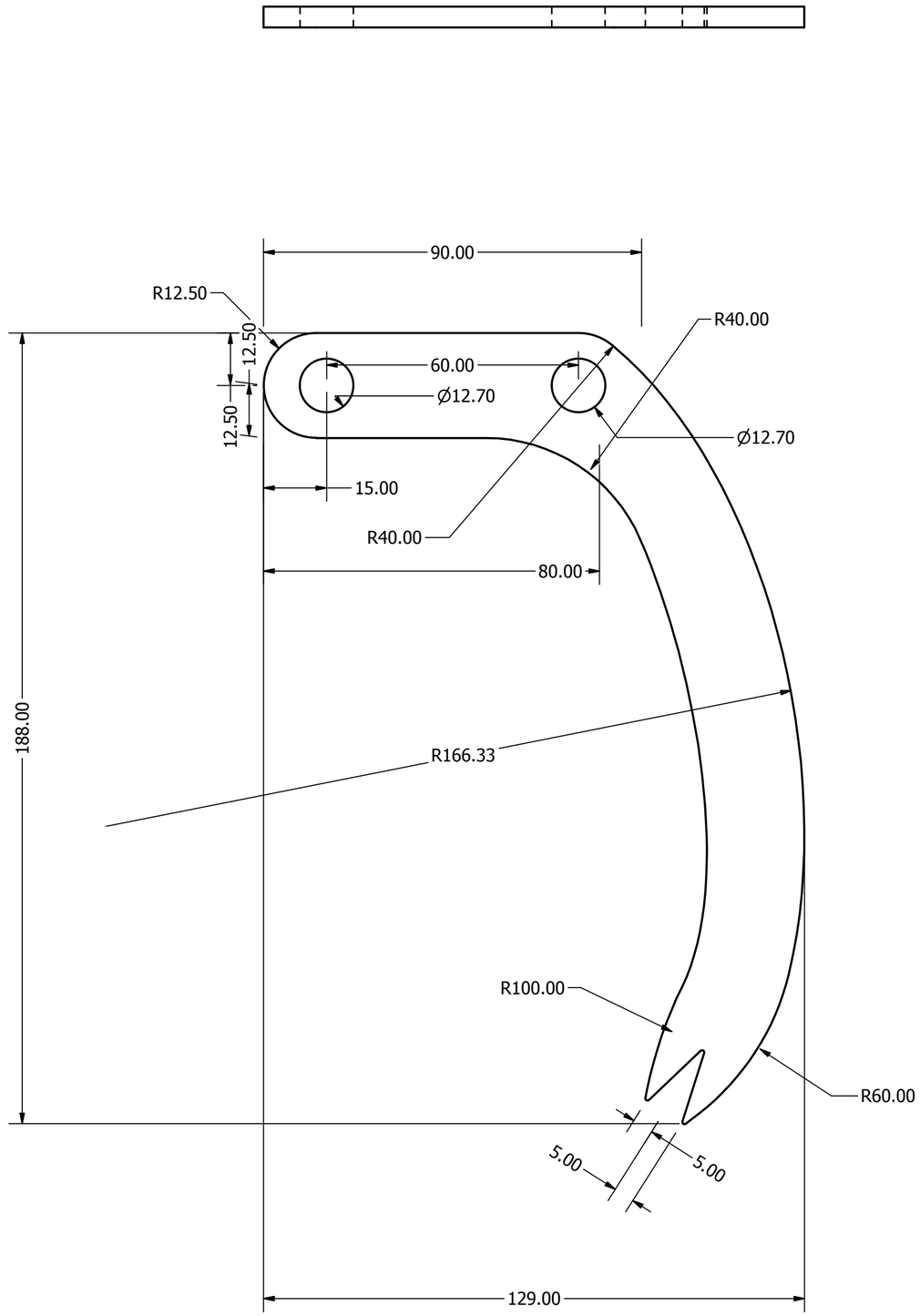


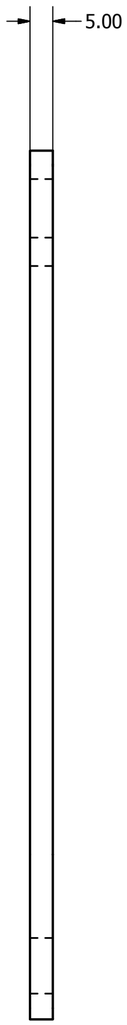


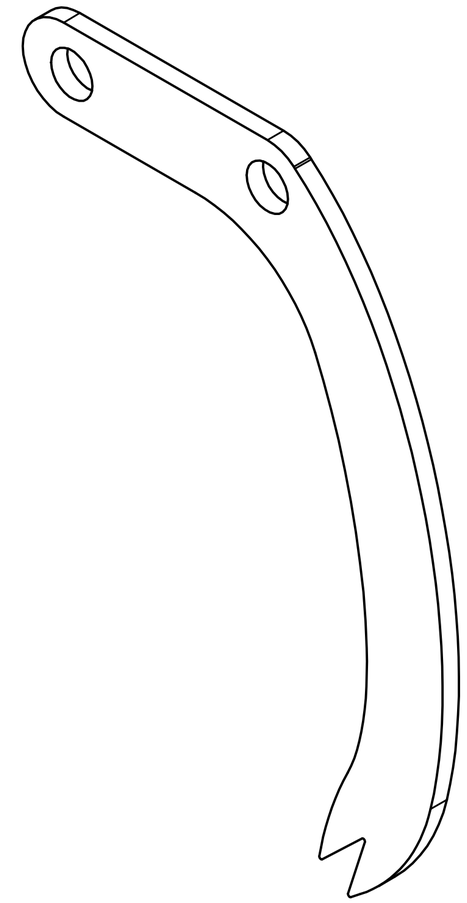
Material Required: 25mm * 5mm * 180mm Mild Steel Flat
Quantity: 2

DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Picking Arm 2	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Picking_Arm_2 / REV
		SCALE	SHEET 1 OF 1

3rd ANGLE PROJECTION

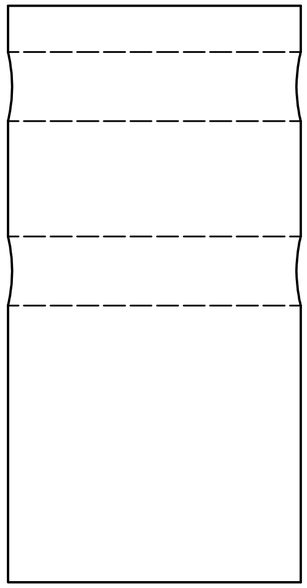


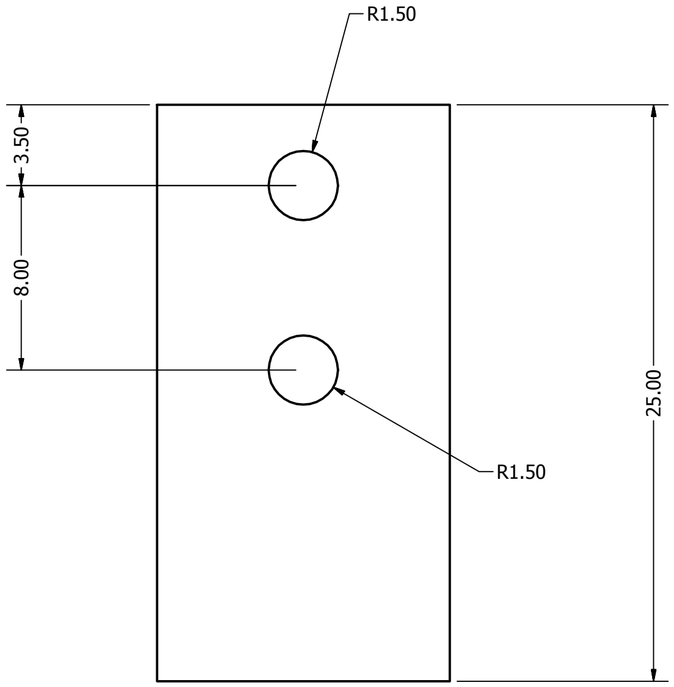


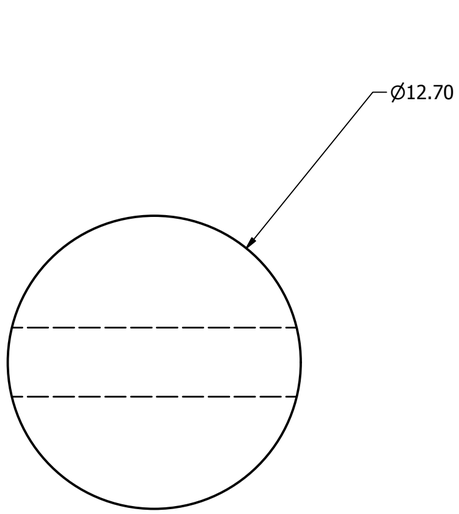


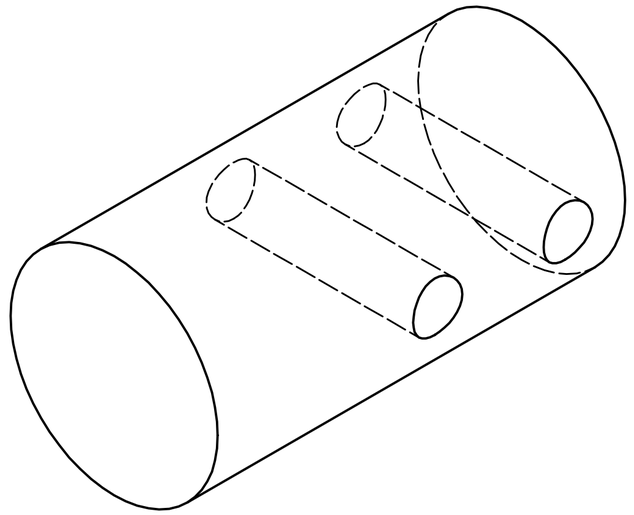
Material Required: 5mm * 200mm * 140mm Mild Steel Sheet
Quantity: 2

DRAWN Pankaj Kumar Verma	20-01-2015	
CHECKED		TITLE Picking Arm 3
QA		3rd ANGLE PROJECTION
MFG		
APPROVED		SIZE C / DWG NO Picking_Arm_3 / REV
		SCALE / SHEET 1 OF 1





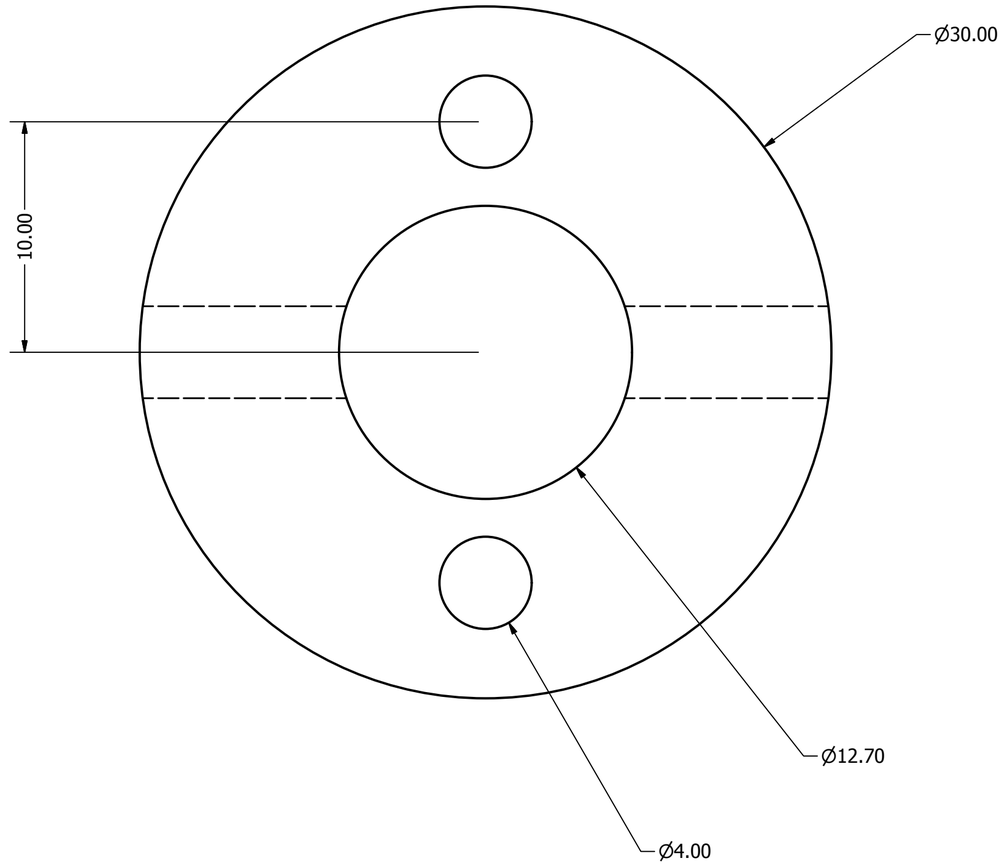


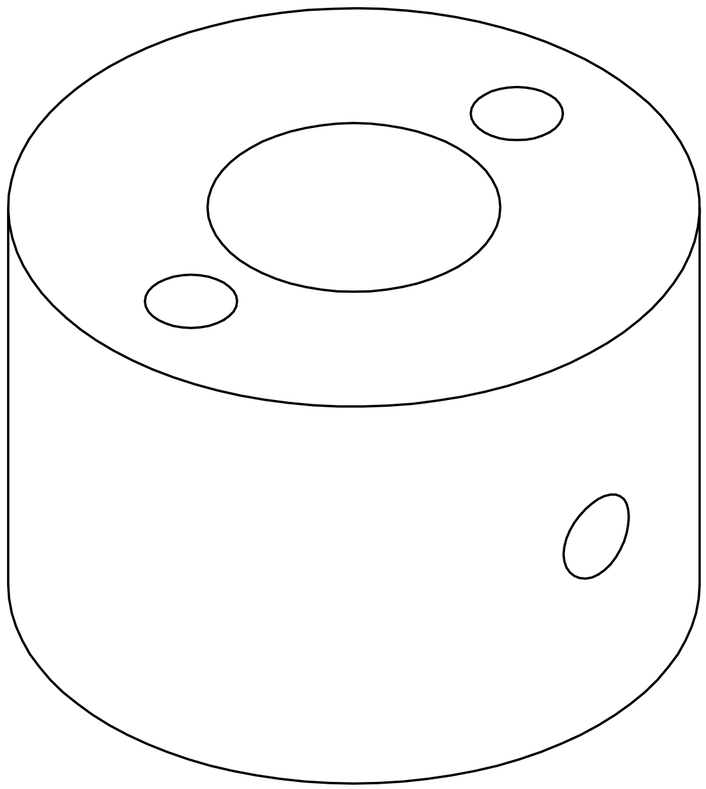


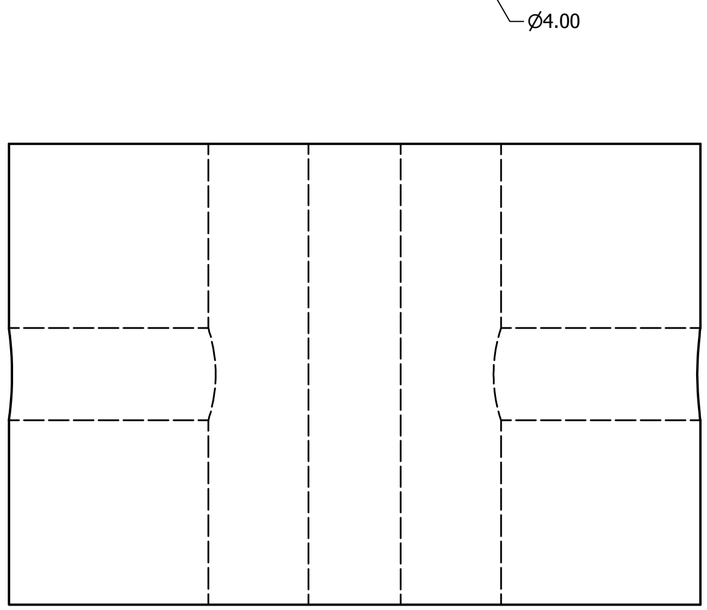
Material Required: 12.7mm Dia * 25mm Mild Steel Rod
Quantity: 4

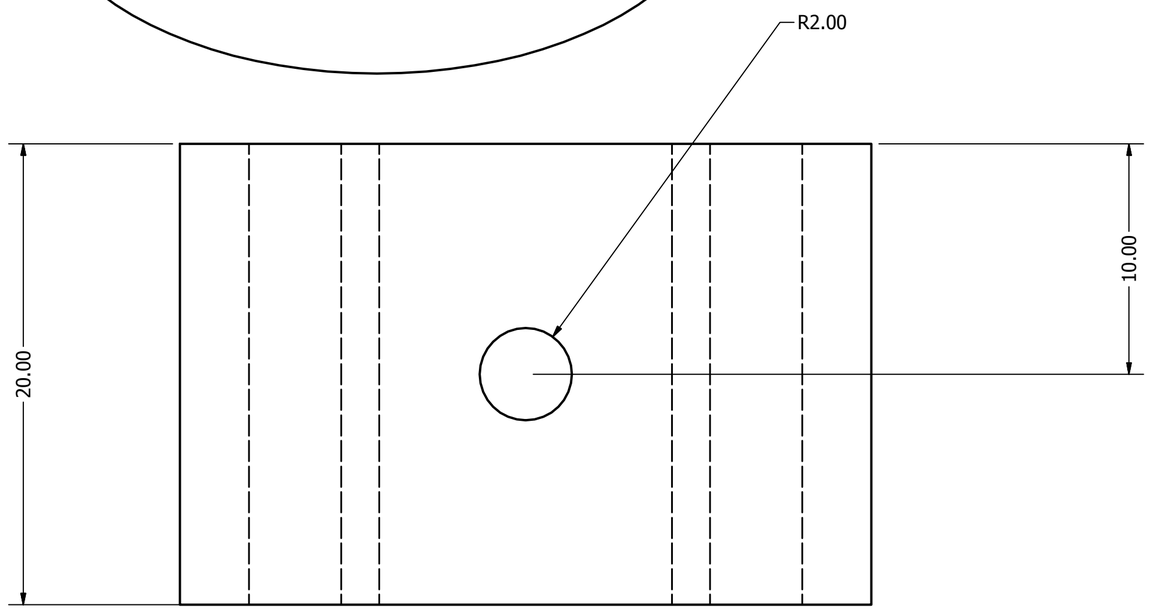
DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Picking Arm Shaft 1.0		
CHECKED				
QA				
MFG				
APPROVED				
		SIZE C	DWG NO Picking_Arm_Shaft_1	REV
		SCALE	SHEET 1 OF 1	

3rd ANGLE PROJECTION





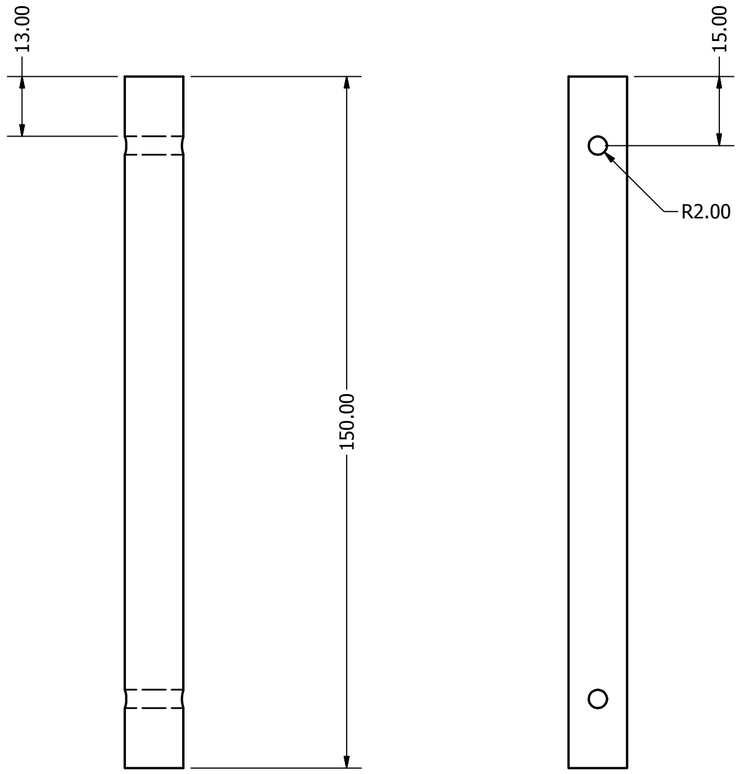


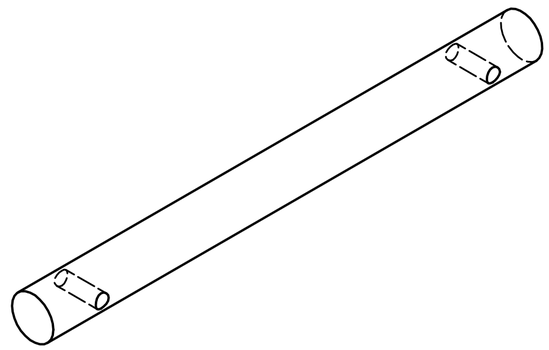


Material Reqiured: 35mm Dia * 25mm Length
Quantity: 2

DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Picking Mechanism Coupler	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Picking_Mechanism_Hub_1 / REV
		SCALE	SHEET 1 OF 1

3rd ANGLE PROJECTION

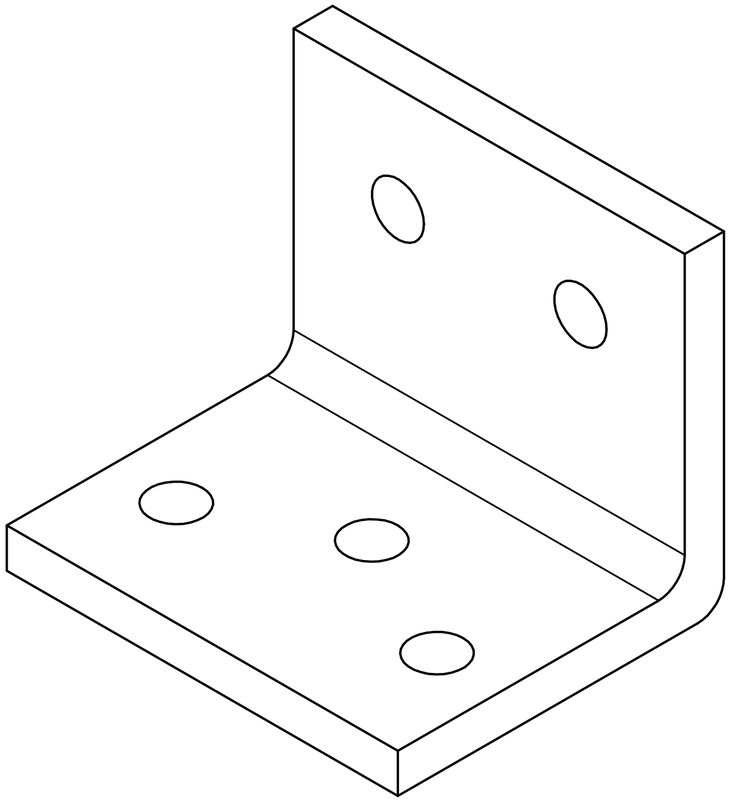


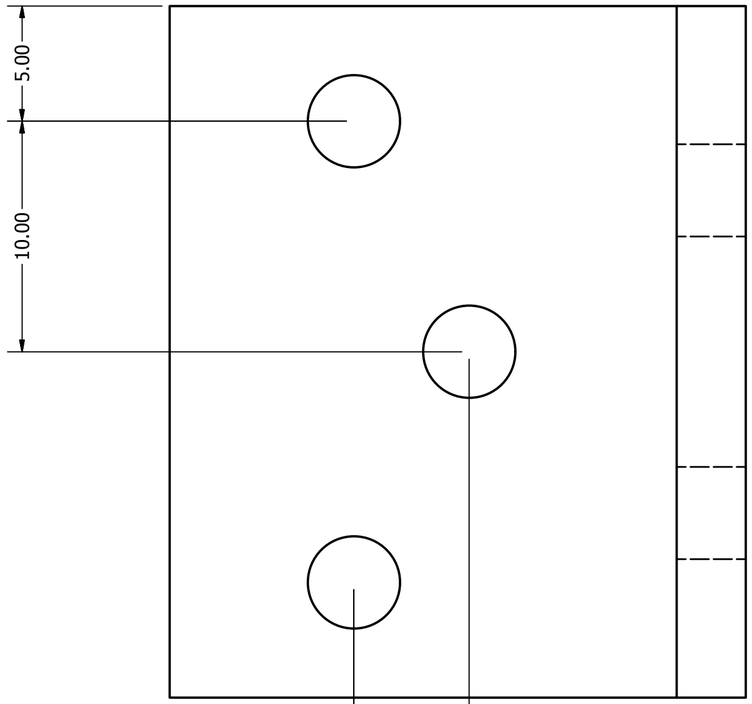


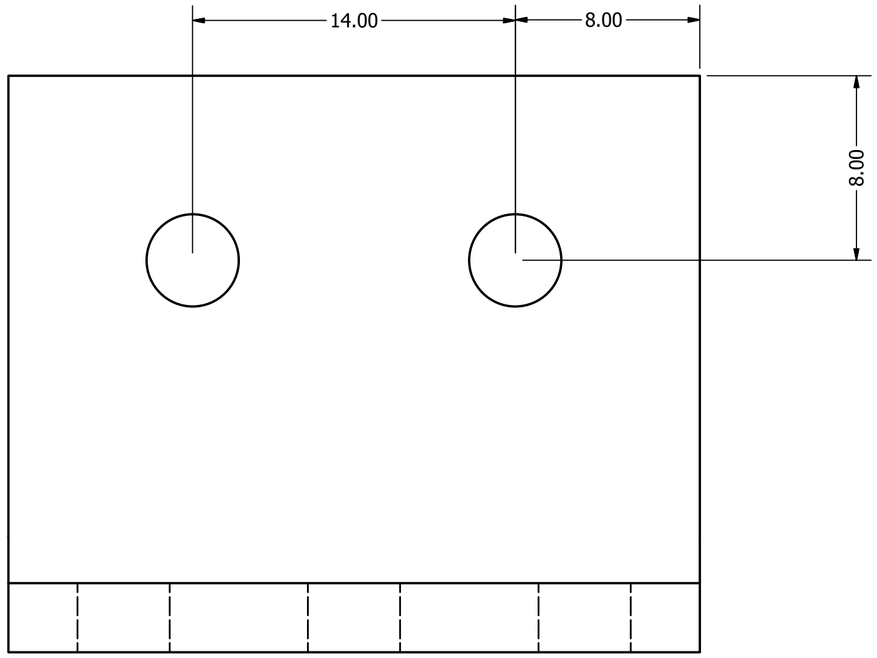
Material Required: 12.7mm * 150 mm Mild Steel Rod
Quantity: 1

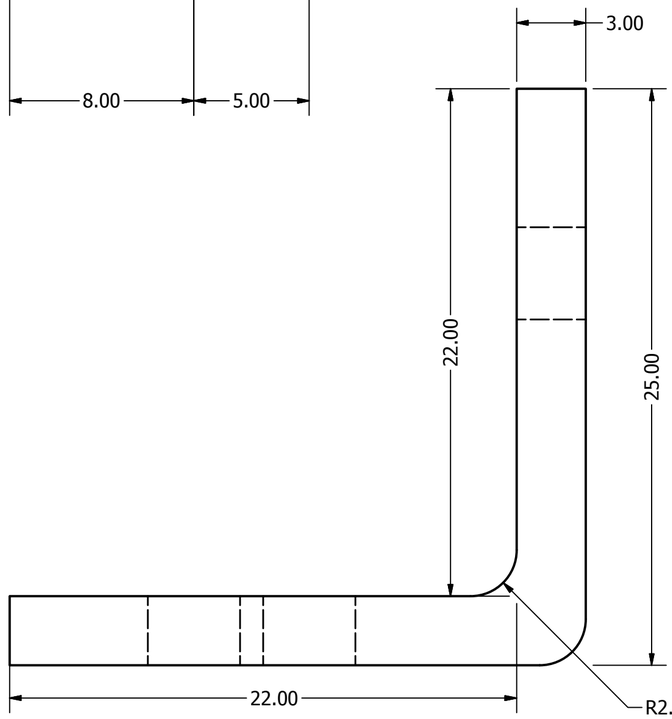
DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Picking Mechanism Shaft 2		
CHECKED				
QA				
MFG				
APPROVED				
		SIZE C	DWG NO Picking_Mechanism_Shaft_2	REV
		SCALE	SHEET 1 OF 1	

3rd ANGLE PROJECTION



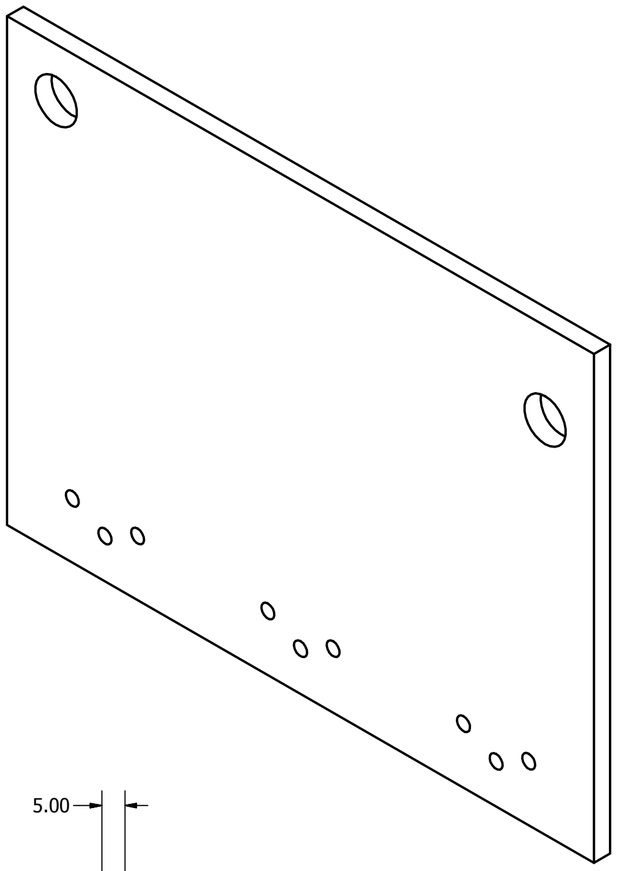


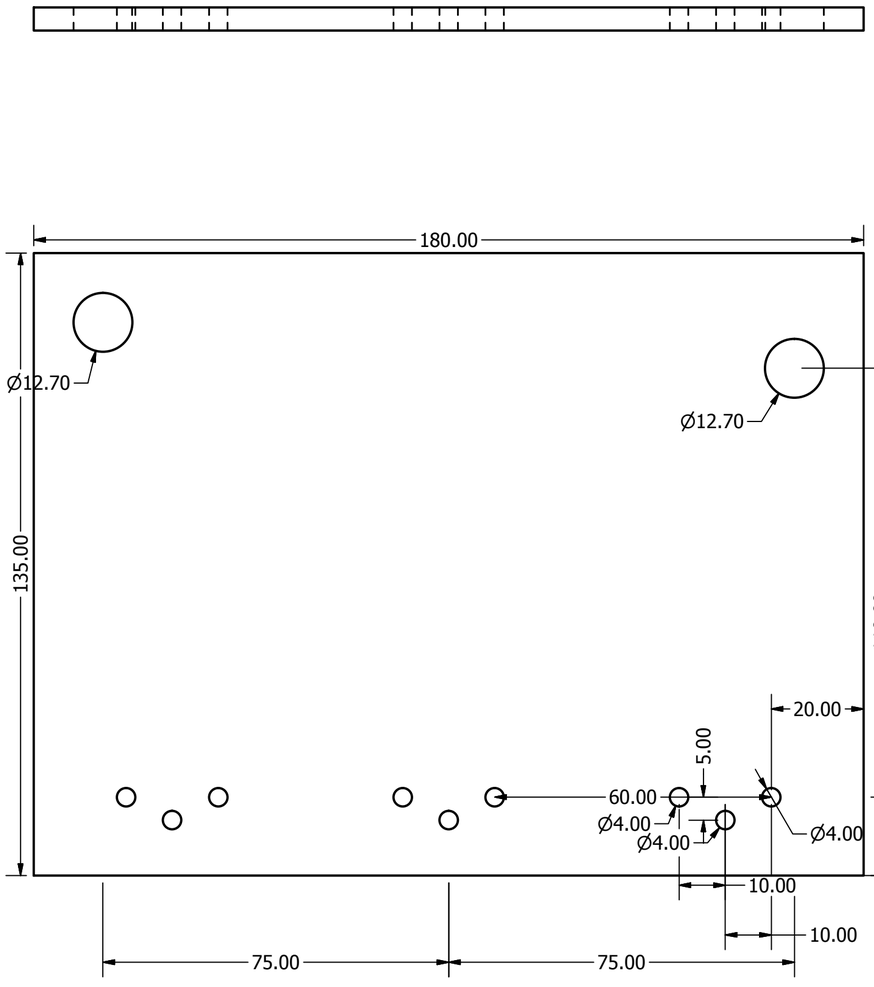


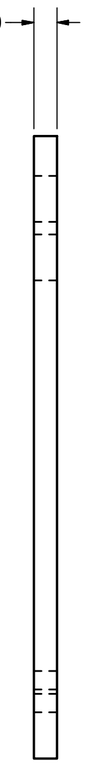


Material Required: 25mm * 25mm * 3mm Mild Steel Angle
Quantity: 6

DRAWN Pankaj Kumar Verma	19-01-2015	
CHECKED		
QA		
MFG		
APPROVED		
		TITLE: Picking Mechanism Support Angle
		3rd ANGLE PROJECTION
		SIZE: C | DWG NO: Picking_mechanism_Support_Angle_1 | REV
		SCALE | SHEET 1 OF 1



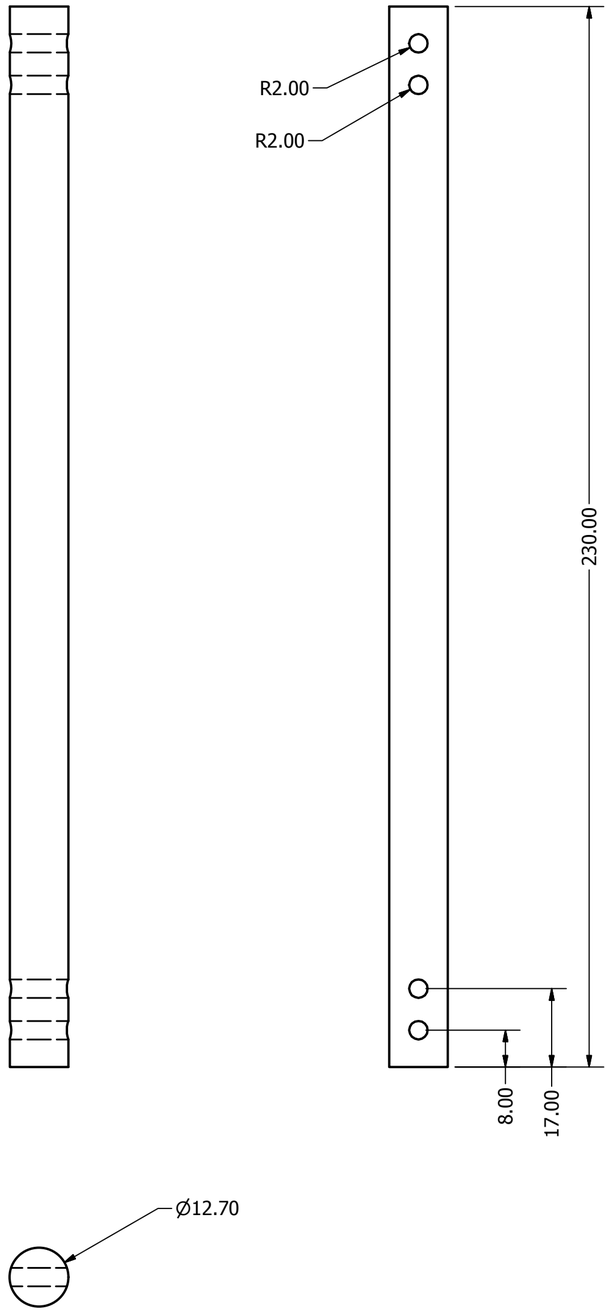


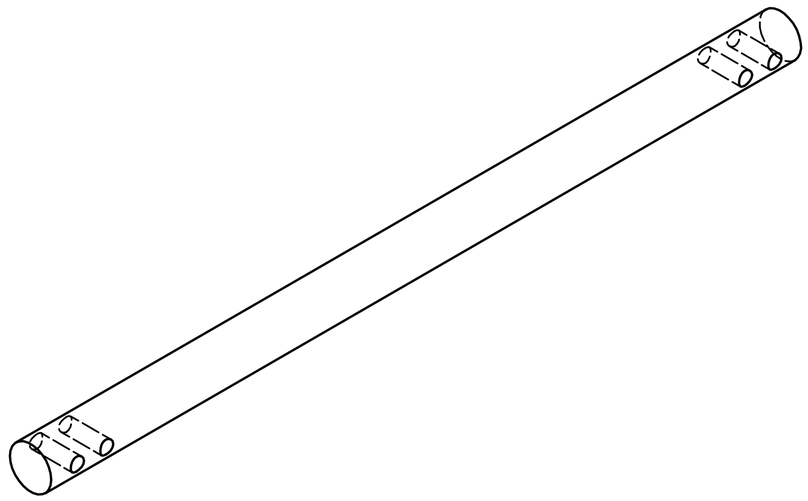


Material Required: 135mm * 180mm * 5mm Mild Steel Sheet
Quantity: 2

DRAWN Pankaj Kumar Verma	19-01-2015	TITLE: Picking Mechanism Supporting Wall
CHECKED		
QA		
MFG		
APPROVED		
		SIZE: C; DWG NO: Picking_Mechanism_Supporting_Wall; REV
		SCALE; SHEET 1 OF 1

3rd ANGLE PROJECTION



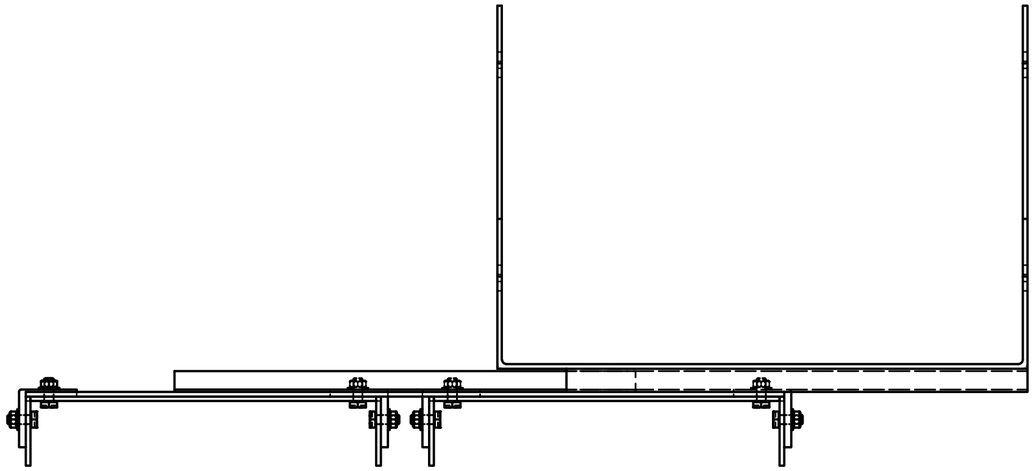


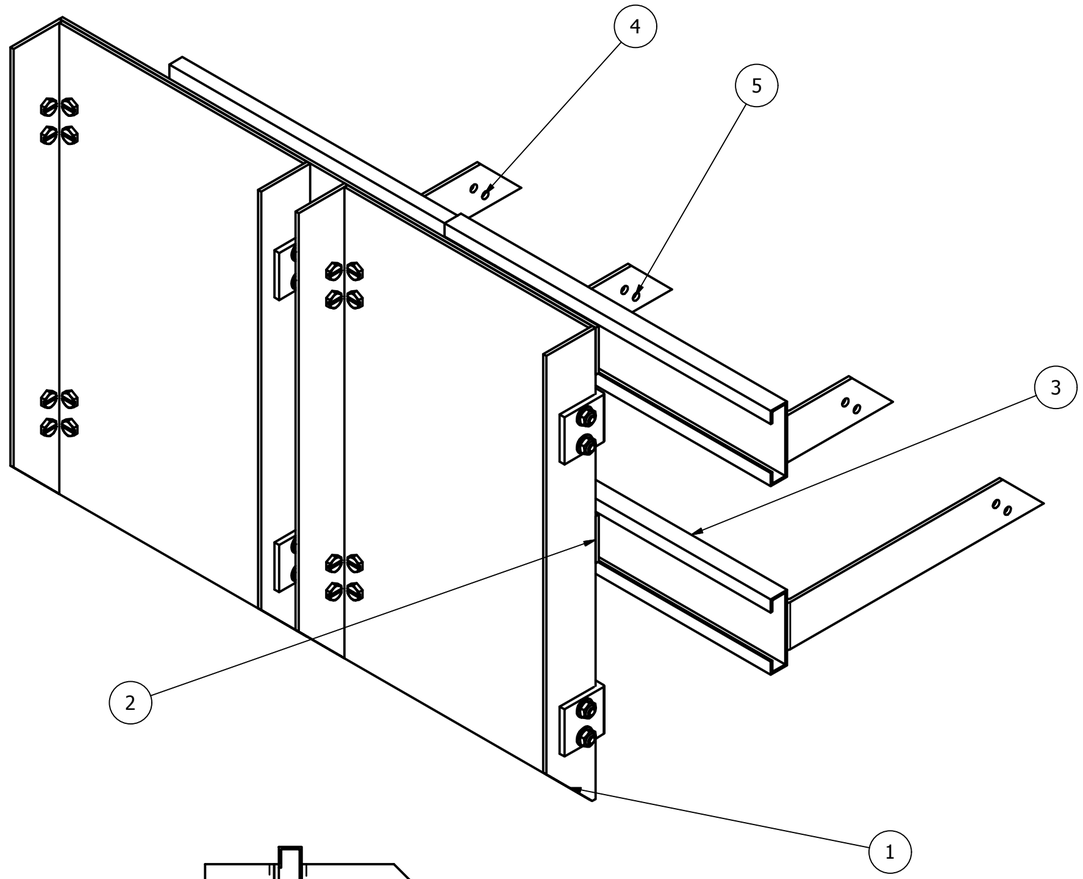
Material Required: 12.7mm Dia * 230mm Mild Steel Rod
Quantity: 1

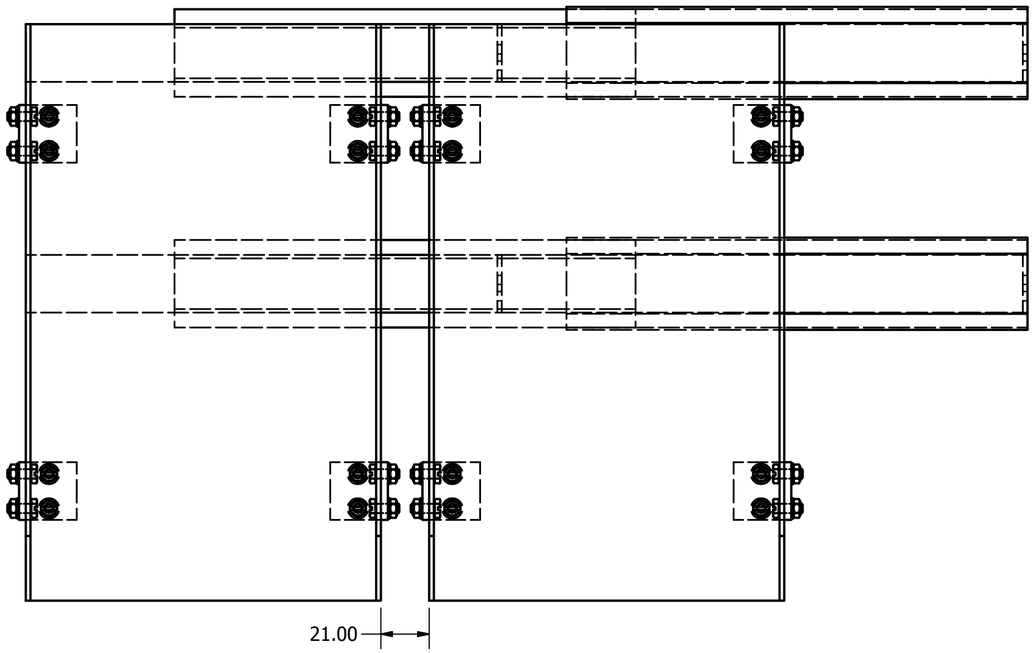
DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Picking Mechanism Shaft 1	
CHECKED		3rd ANGLE PROJECTION	
QA			
MFG			
APPROVED		SIZE C	DWG NO Picking_Mechnism_Shaft_1 REV
		SCALE	SHEET 1 OF 1

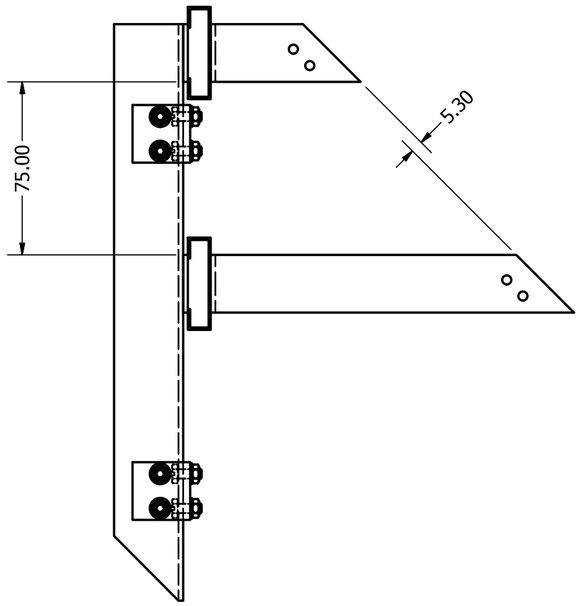
APPENDIX – 4

Isometric Drawing of Tray Assembly and Parts



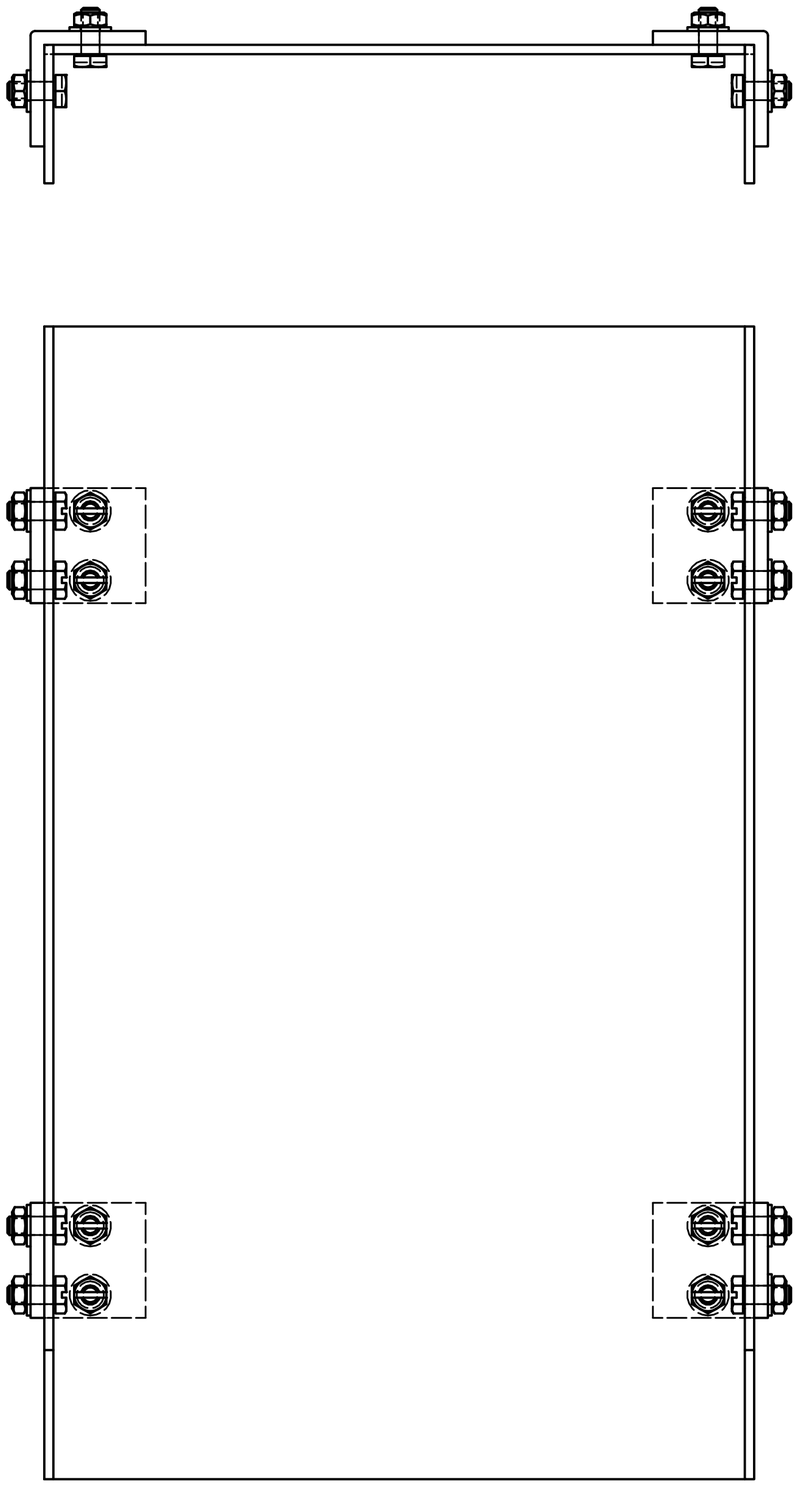


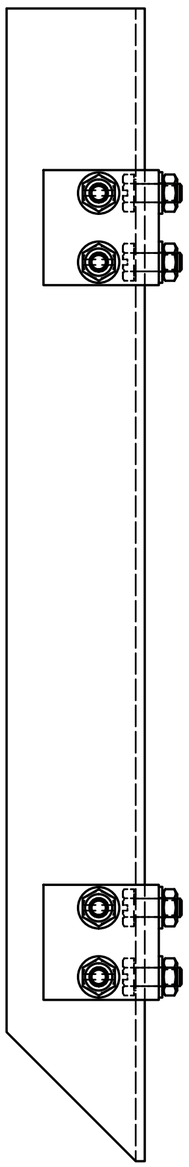


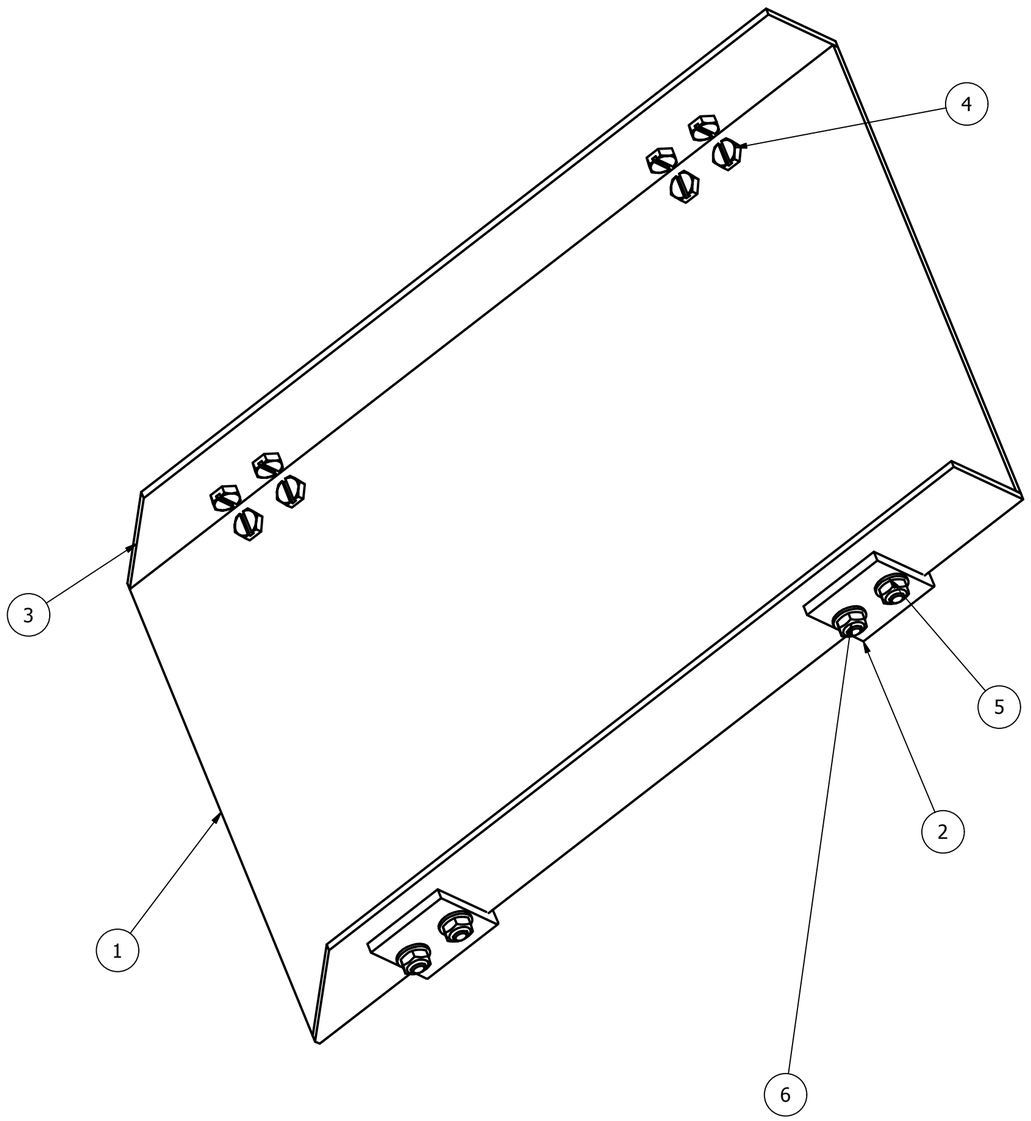


PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	Tray	
2	2	Tray_Plate_1	
3	2	slider	
4	1	Tray_Supporting_Angular_Plate	
5	1	Tray_Supporting_Angular_Plate_2	

DRAWN Pankaj Kumar Verma	20-01-2015	
CHECKED		TITLE Tray Full Assembly
QA		3rd ANGLE PROJECTION
MFG		
APPROVED		
		SIZE C / DWG NO / REV
		SCALE / SHEET 1 OF 1

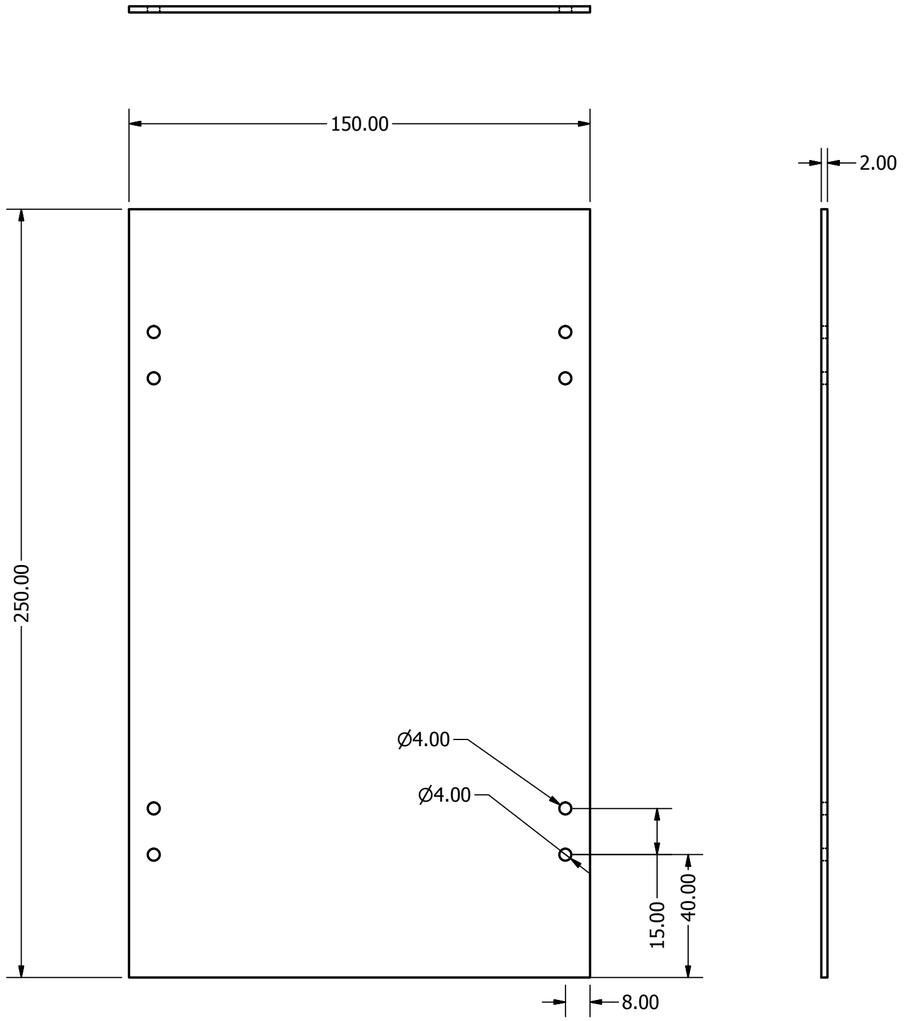


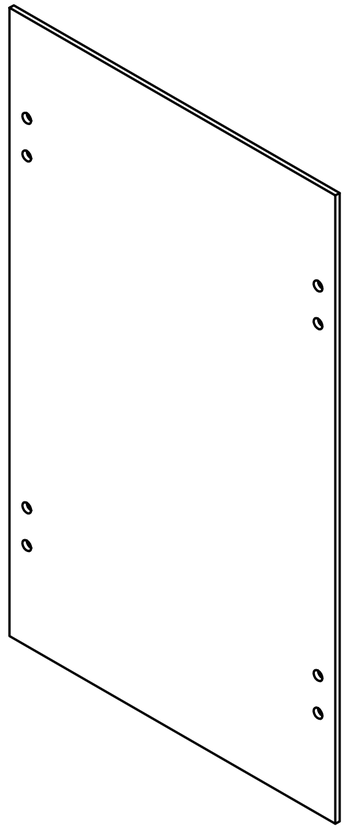




PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Tray_Lower_Part	
2	4	Tray_angle	
3	2	Tray_Side	
4	16	Bolt GB 29.1 M4 x 10	Hexagon bolts with slot on head - Product A and B
5	16	ISO 7089 - 4 - 140 HV	Plain washers - Normal series - Product grade A
6	16	ISO 4032 - M4	Hexagon nuts, style 1 - Product grades A and B

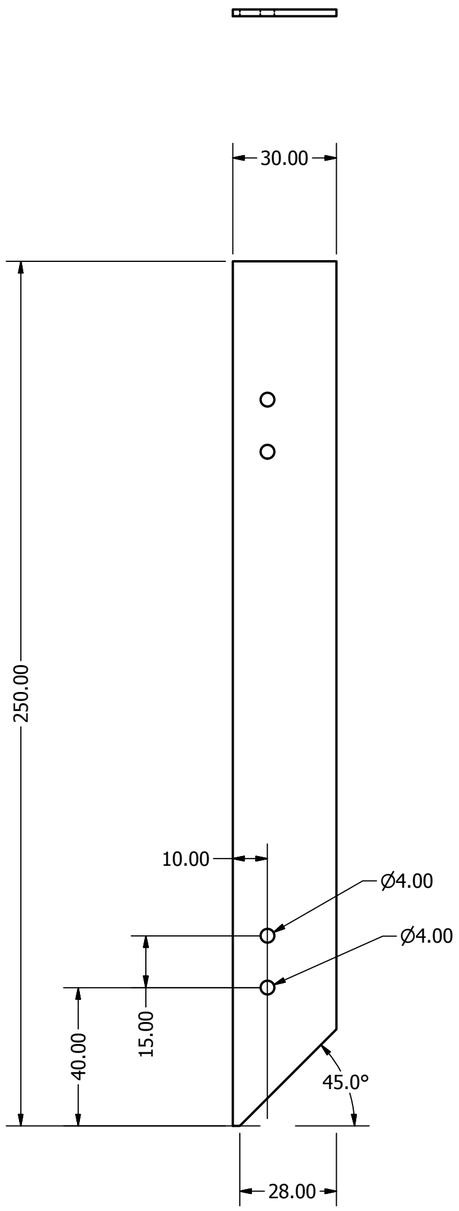
DRAWN Pankaj Kumar Verma	20-01-2015	
CHECKED		TITLE Tray
QA		3rd ANGLE PROJECTION
MFG		SIZE C / DWG NO / REV
APPROVED		SCALE / SHEET 1 OF 1

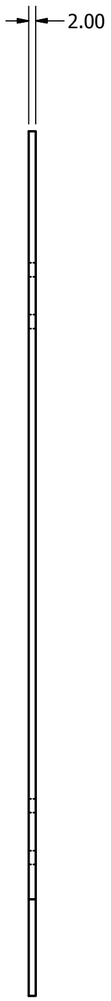


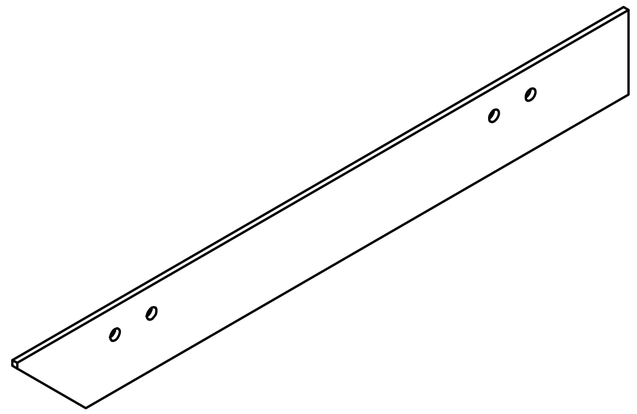


Material Required: 250mm * 150mm * 2mm Mild Steel Sheet
Quantity: 2

DRAWN Pankaj Kumar Verma	20-01-2015	
CHECKED		
QA		TITLE Tray Lower Part
MFG		3rd ANGLE PROJECTION
APPROVED		SIZE C | DWG NO Tray_Lower_Part | REV
		SCALE | SHEET 1 OF 1



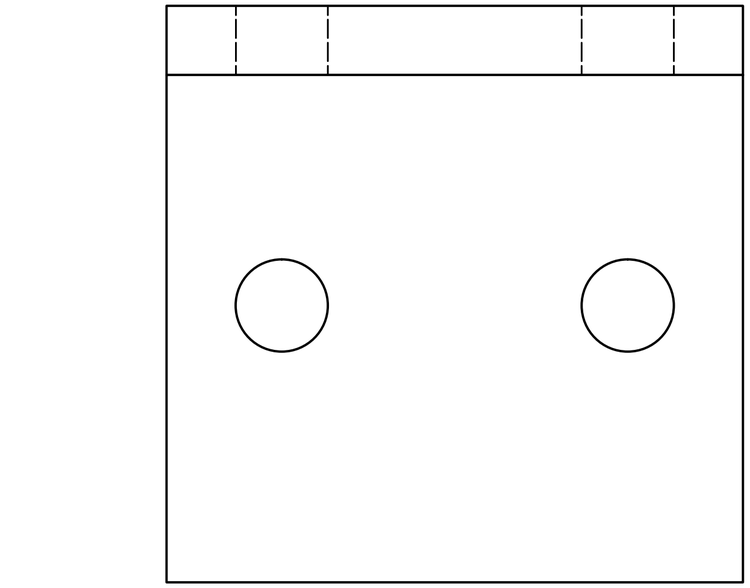


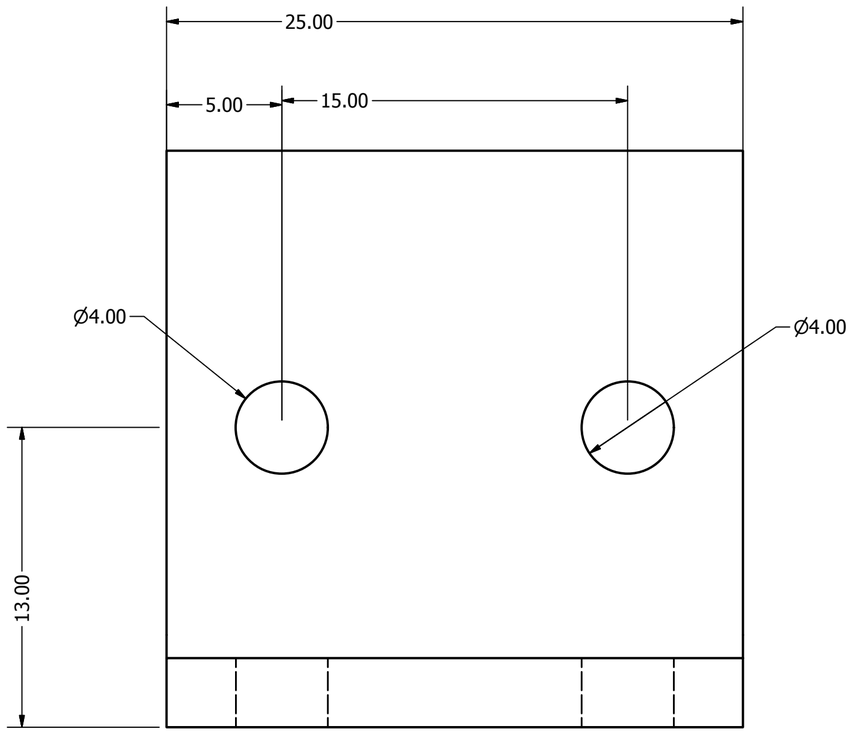


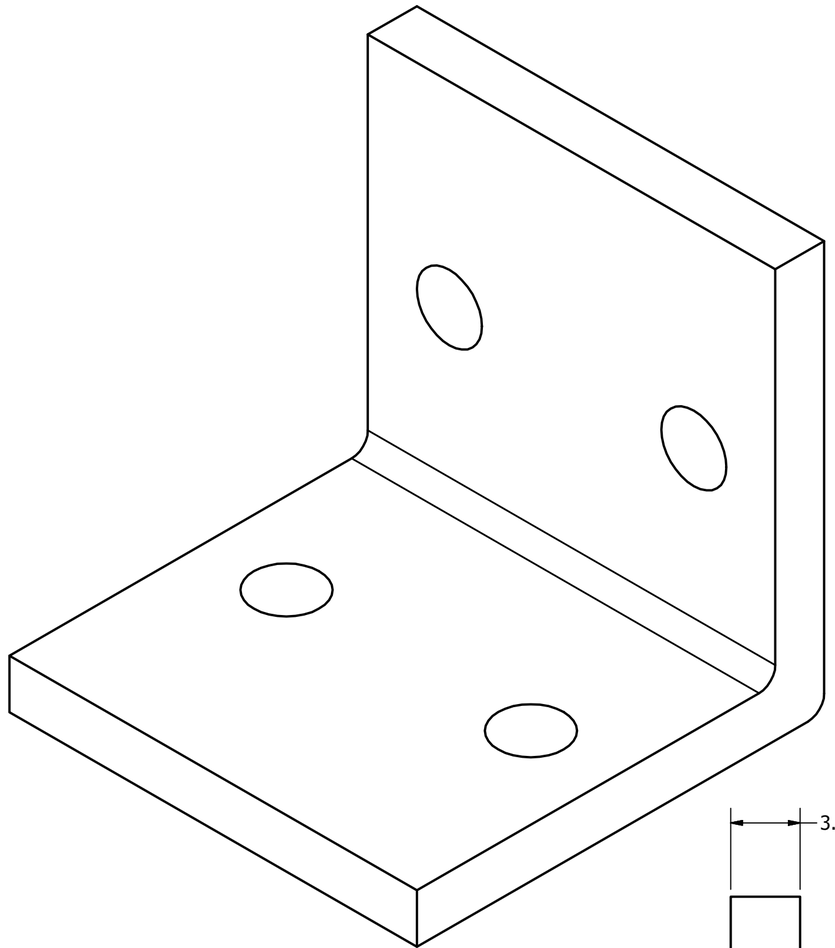
Material Required: 30mm * 250mm * 2mm Mild Steel Plate
Quantity: 4

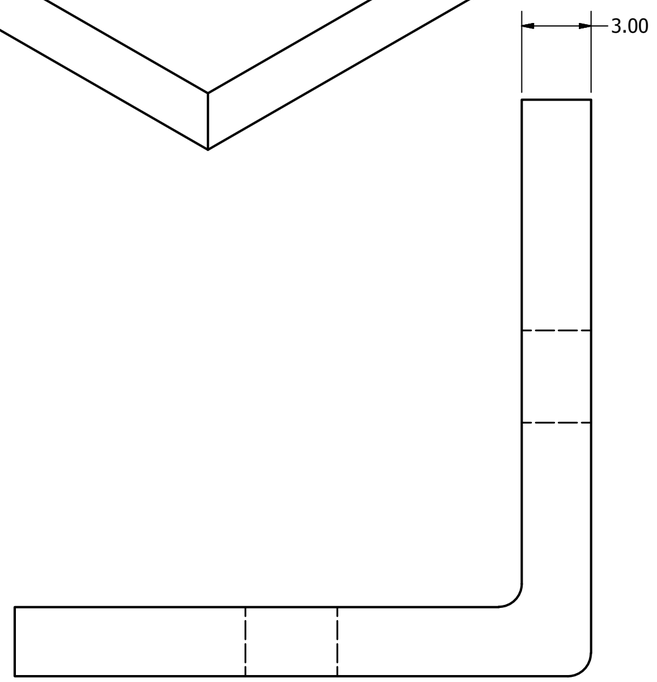
DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Tray Side Wall		
CHECKED				
QA				
MFG				
APPROVED				
		SIZE C	DWG NO Tray_Side	REV
		SCALE	SHEET 1 OF 1	

3rd ANGLE PROJECTION





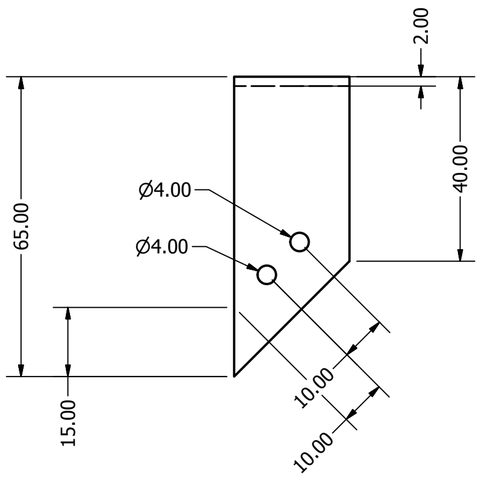


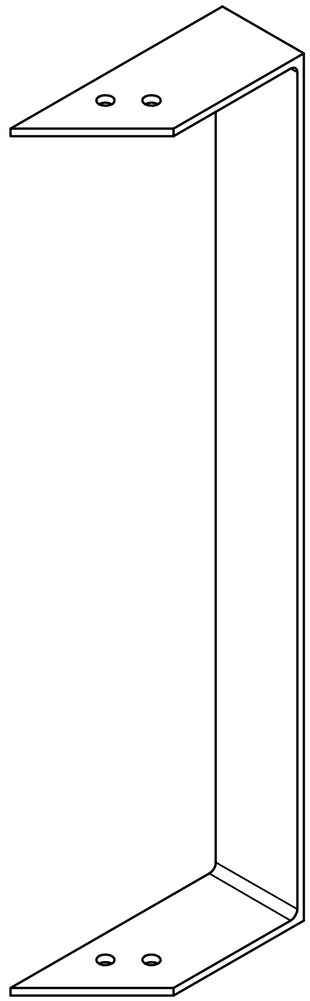


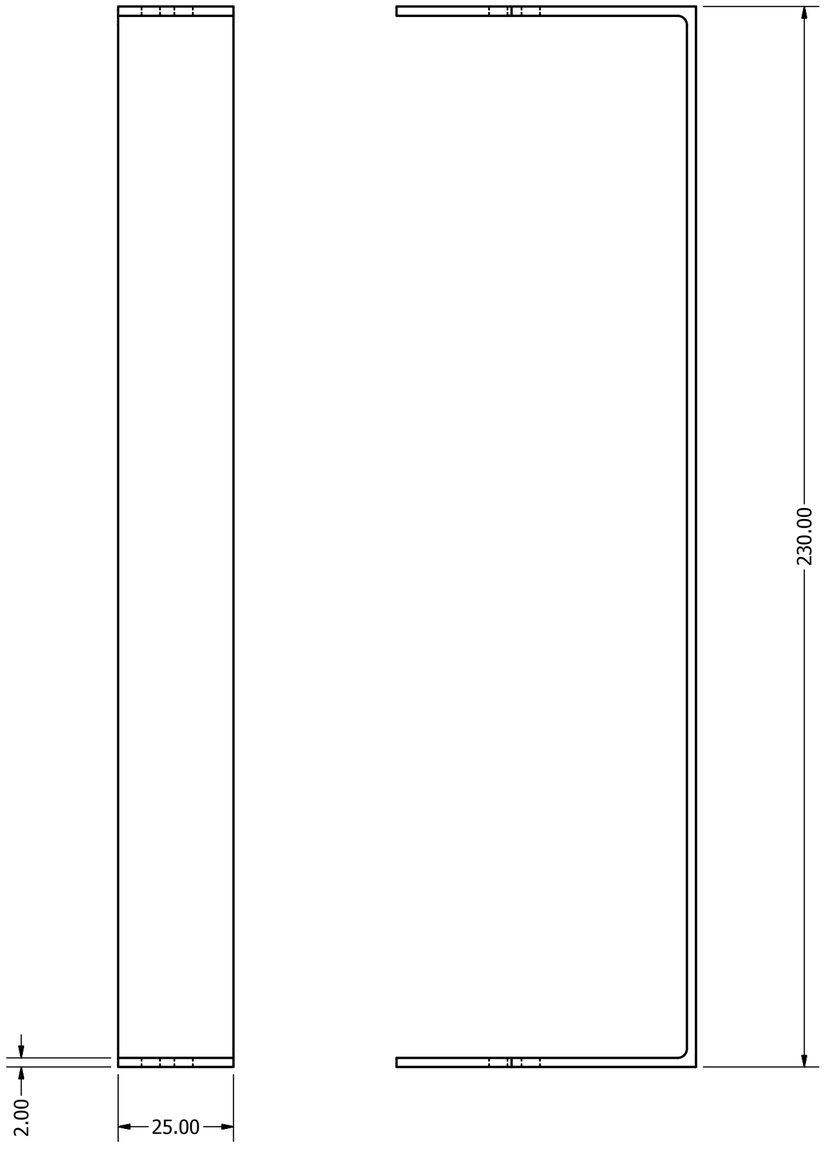
Material Required: 25mm * 25mm * 3mm Mild Steel Angle
Quantity: 8

DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Tray Angle	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Tray_angle
		SCALE	SHEET 1 OF 1

3rd ANGLE PROJECTION



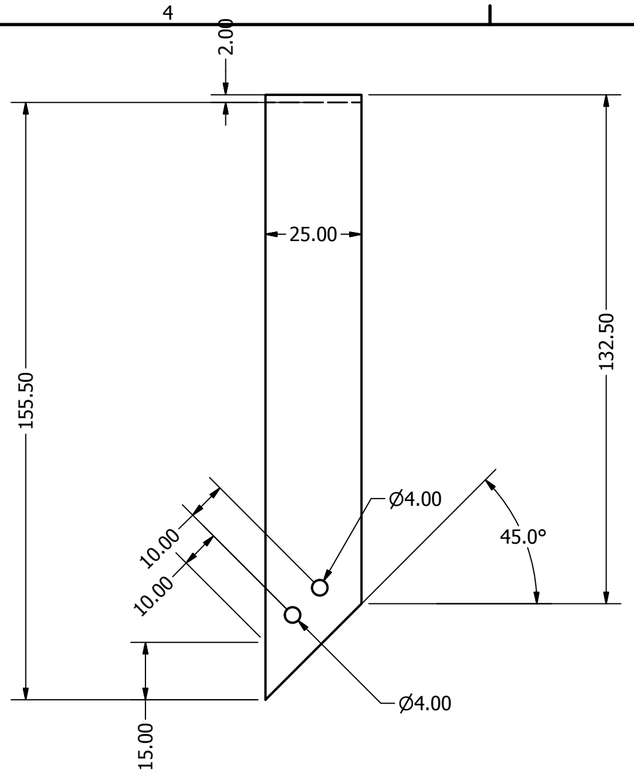


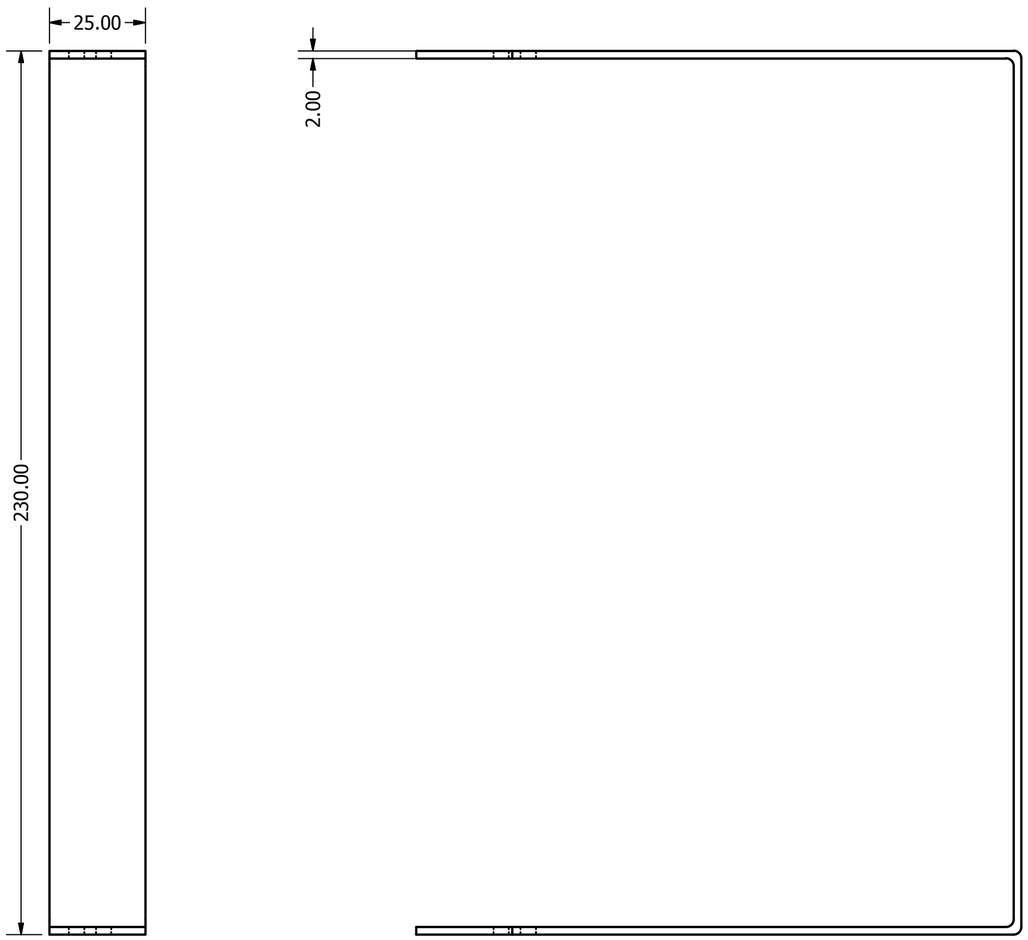


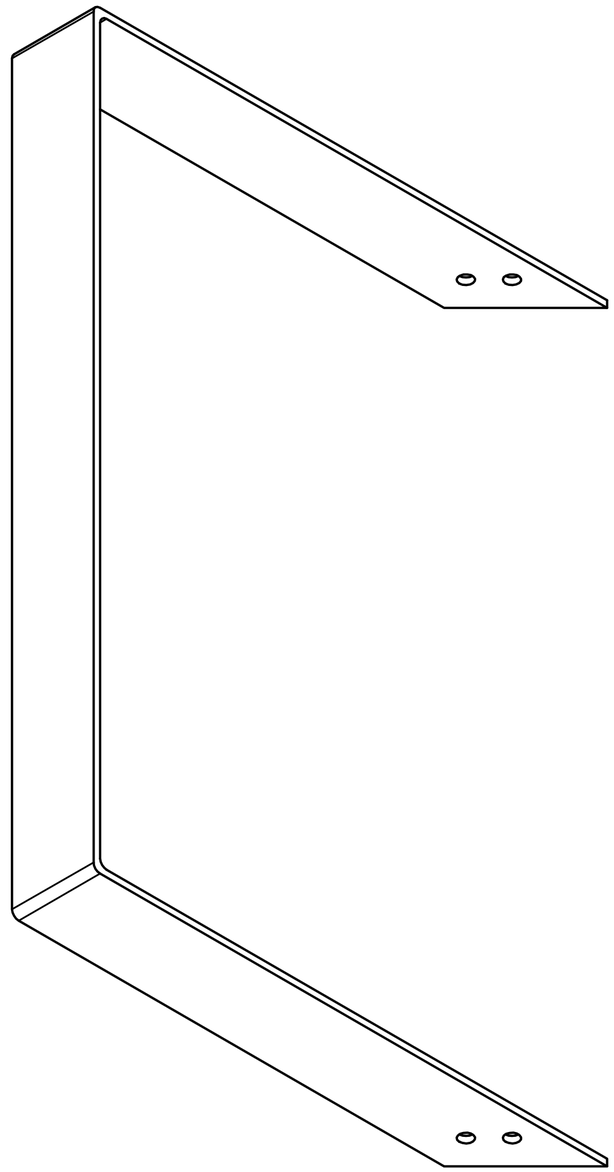
Material Required: 25mm * 360mm * 2mm Mild Steel Flat
Quantity: 1

DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Tray Supporting Angular Plate 1	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Tray_anglular_Plate
		SCALE	SHEET 1 OF 1

3rd ANGLE PROJECTION







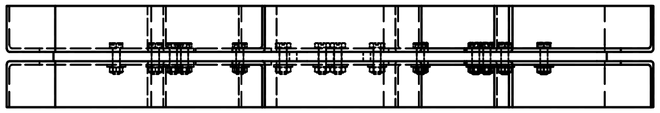
Material Required: 25mm * 2mm * 550mm Mild Steel Plate
Quantity: 1

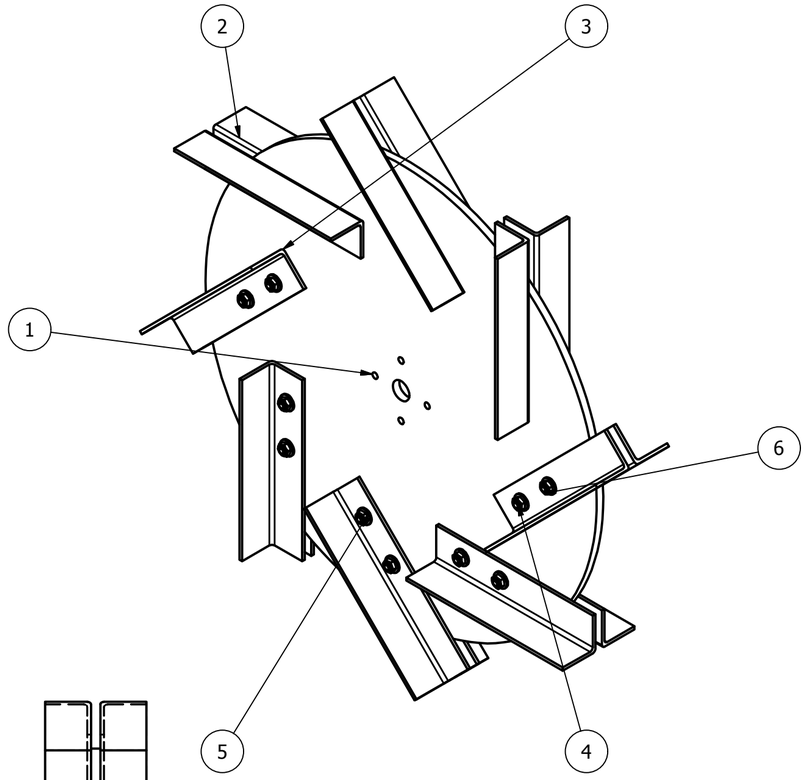
DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Tray Supporting Angular Plate 2	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Tray_Supporting_Angular_Plate_2
		SCALE	SHEET 1 OF 1

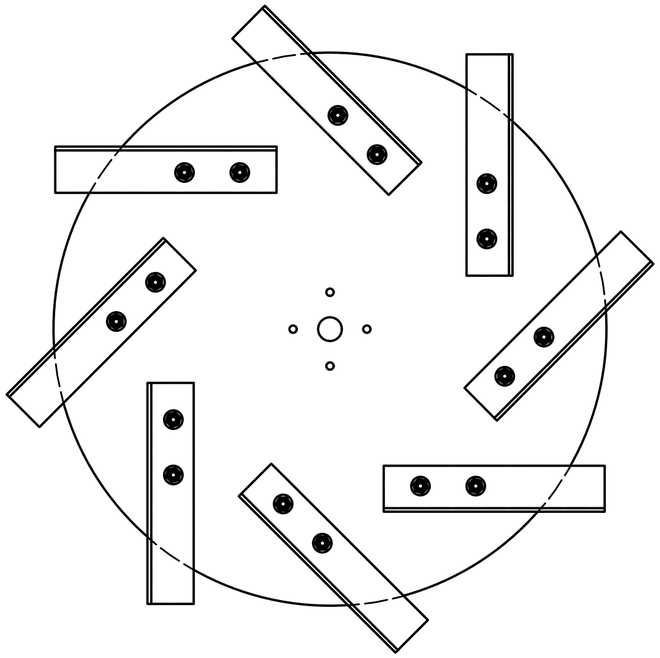
3rd ANGLE PROJECTION

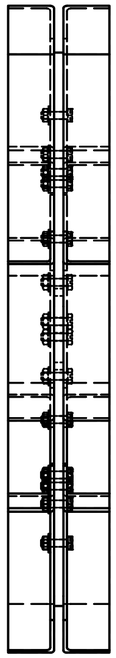
APPENDIX – 5

Isometric Drawing of Wheel Assembly and Parts



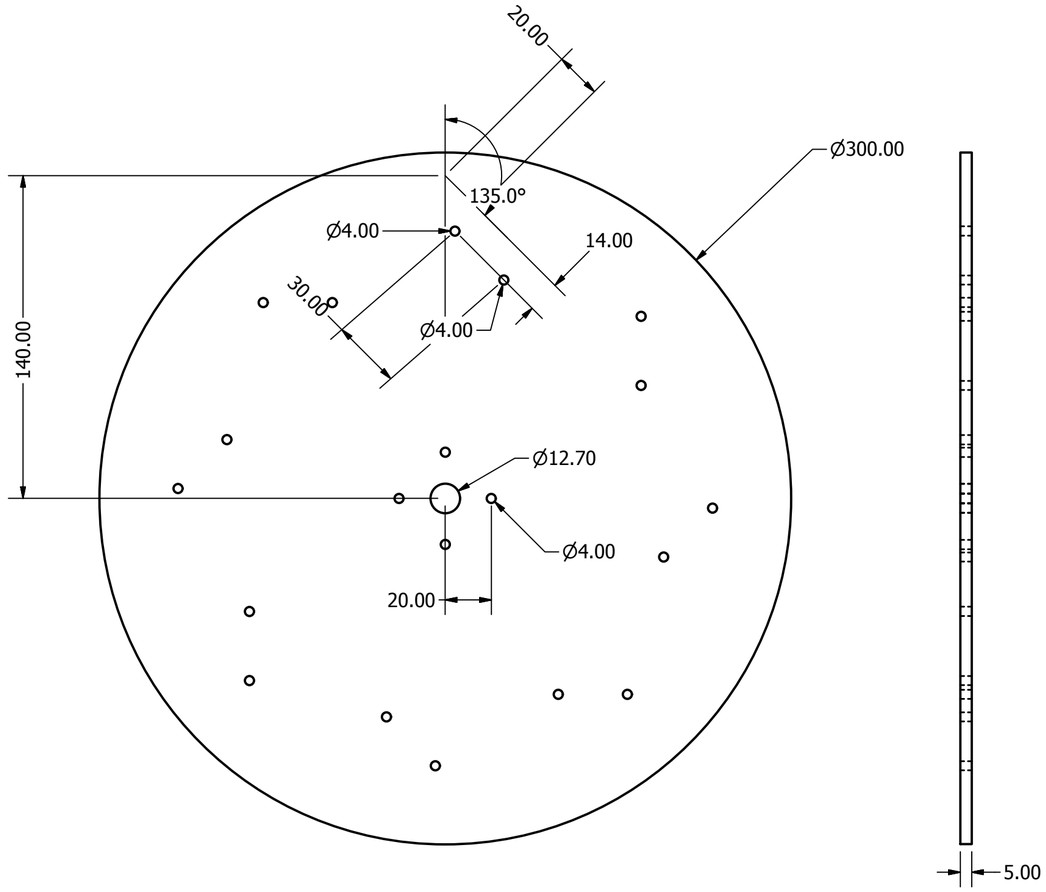


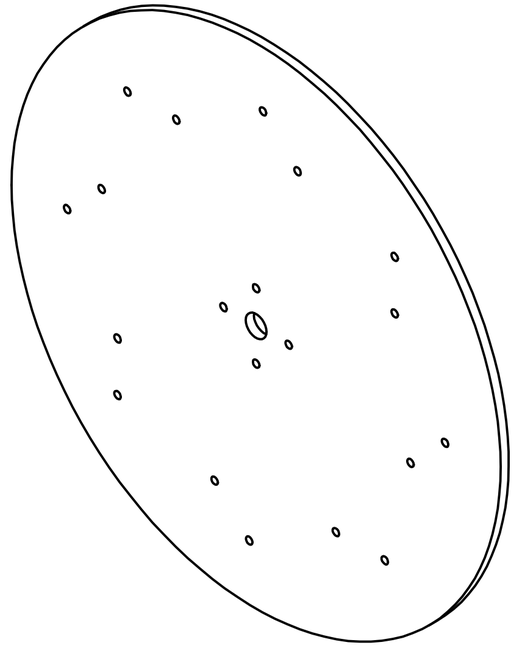




PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Wheel_Plate	
2	16	Wheel_Angle_50mm	
3	16	Wheel_Angle_50mm_MIR	
4	16	Bolt GB 29.1 M4 x 14	Hexagon bolts with slot on head - Product A and B
5	16	ISO 7091 - ST 4 - 100 HV	Plain washers - Normal series - Product grade C
6	16	ISO 4032 - M4	Hexagon nuts, style 1 - Product grades A and B

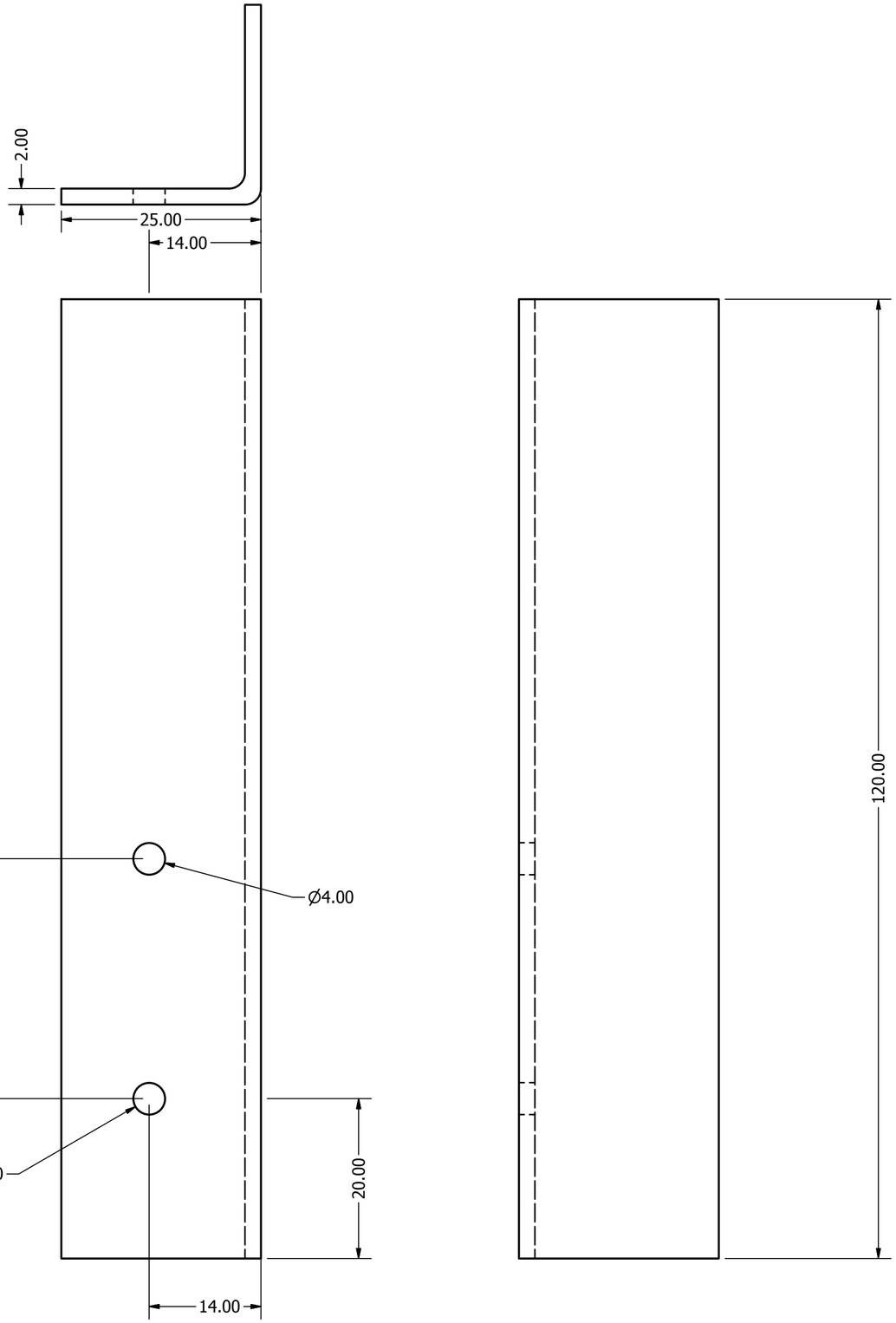
DRAWN Pankaj Kumar Verma	20-01-2015		
CHECKED		TITLE Wheel Assembly	
QA		3rd ANGLE PROJECTION	
MFG			
APPROVED			
		SIZE C	DWG NO / REV
		SCALE	SHEET 1 OF 1

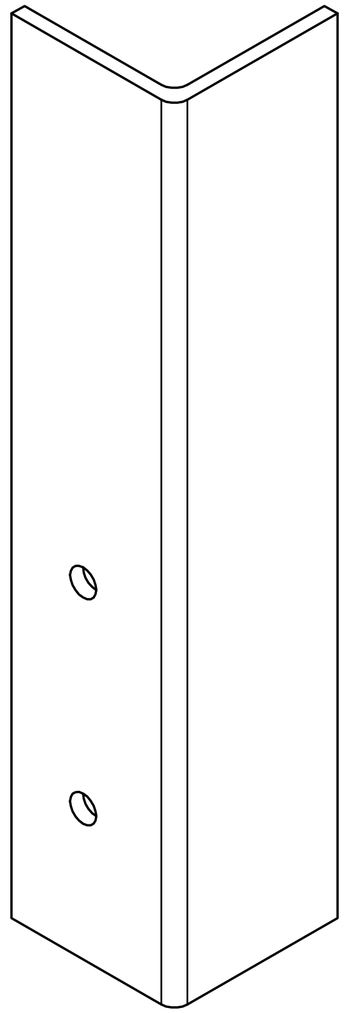




Material Required: 300mm * 300mm * 5mm Mild Steel Rod
Quantity: 2

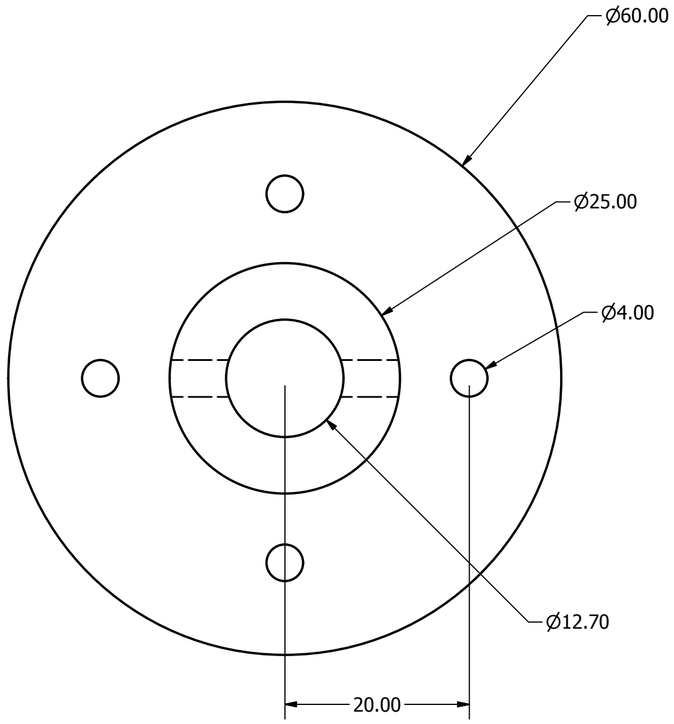
DRAWN Pankaj Kumar Verma	20-01-2015	
CHECKED		TITLE Wheel Plate
QA		3rd ANGLE PROJECTION
MFG		
APPROVED		SIZE C / DWG NO Wheel_Plate / REV
		SCALE / SHEET 1 OF 1

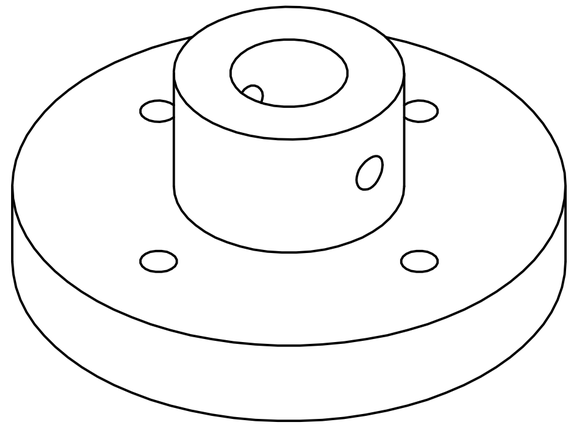


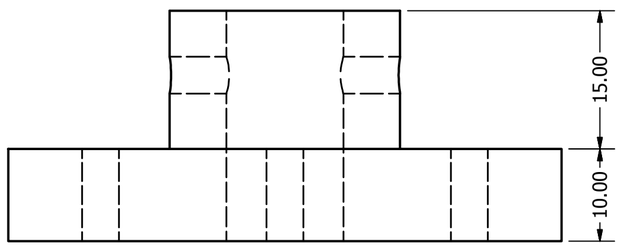


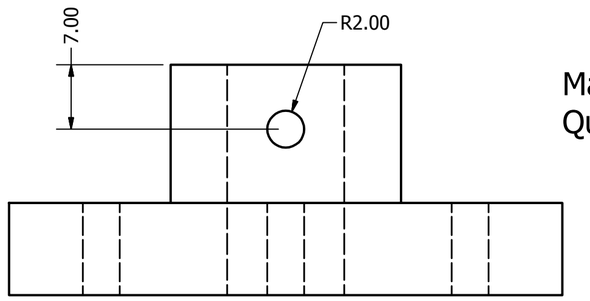
Material Required: 25mm * 25mm * 2mm * 120mm long Mild Steel Angle
Quantity: 32

DRAWN Pankaj Kumar Verma	20-01-2015		
CHECKED		TITLE Wheel Angle	
QA		3rd ANGLE PROJECTION	
MFG			
APPROVED		SIZE C	DWG NO Wheel_Angle_50mm / REV
		SCALE	SHEET 1 OF 1









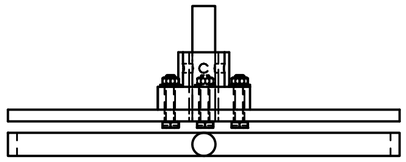
Material Required: 60mm Dia * 30mm Mild Steel Rod
Quantity: 2

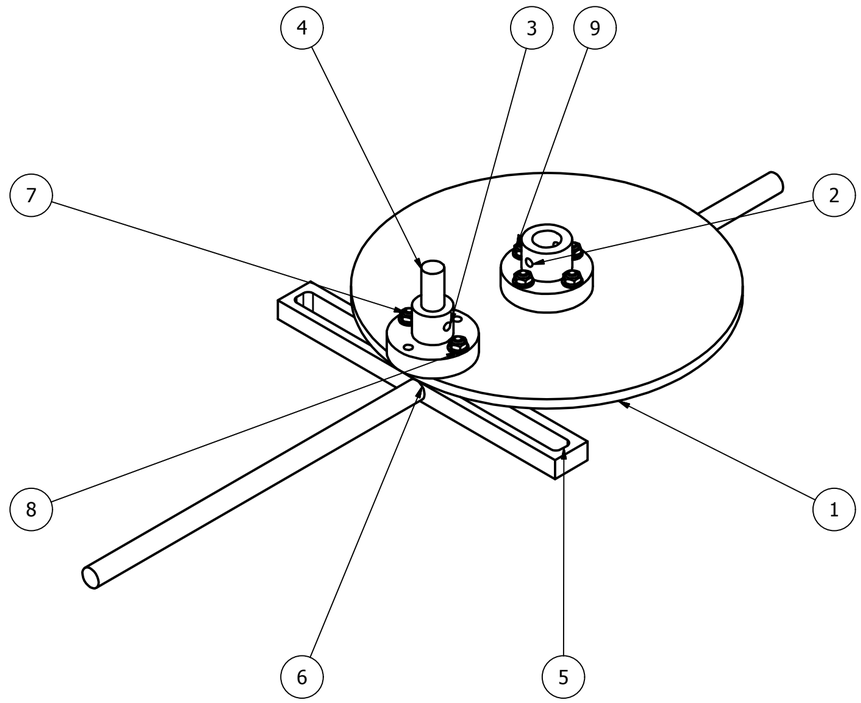
DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Wheel Coupler/Hub	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Wheel_Hub
		SCALE	SHEET 1 OF 1

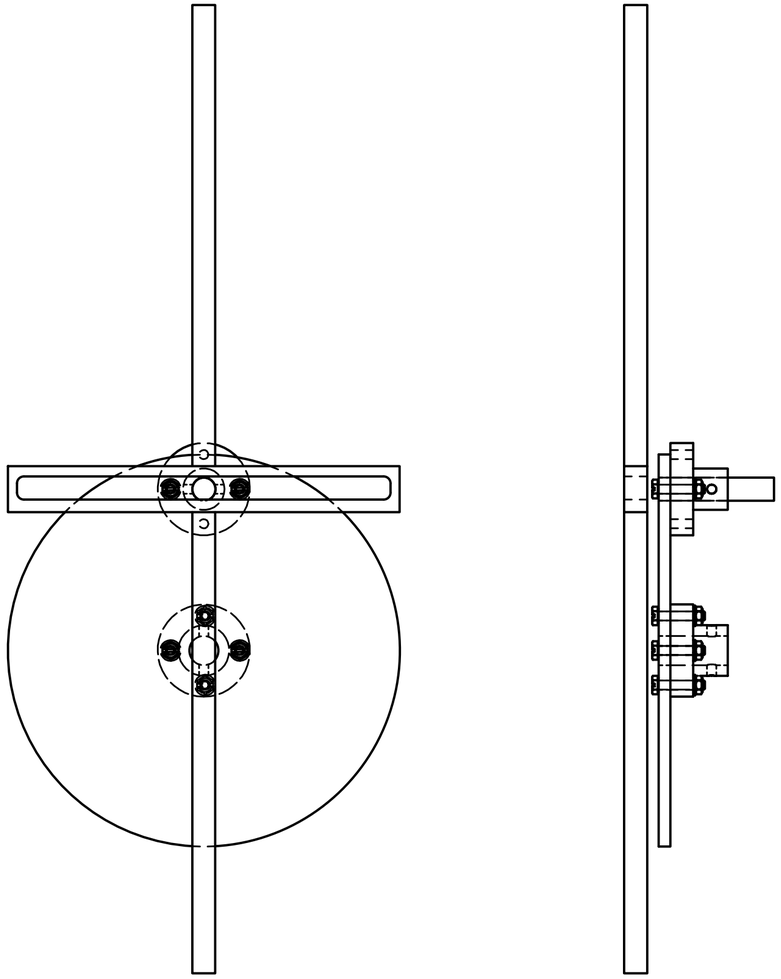
3rd ANGLE PROJECTION

APPENDIX – 6

Isometric Drawing of With-Worth Mechanism Assembly and Parts

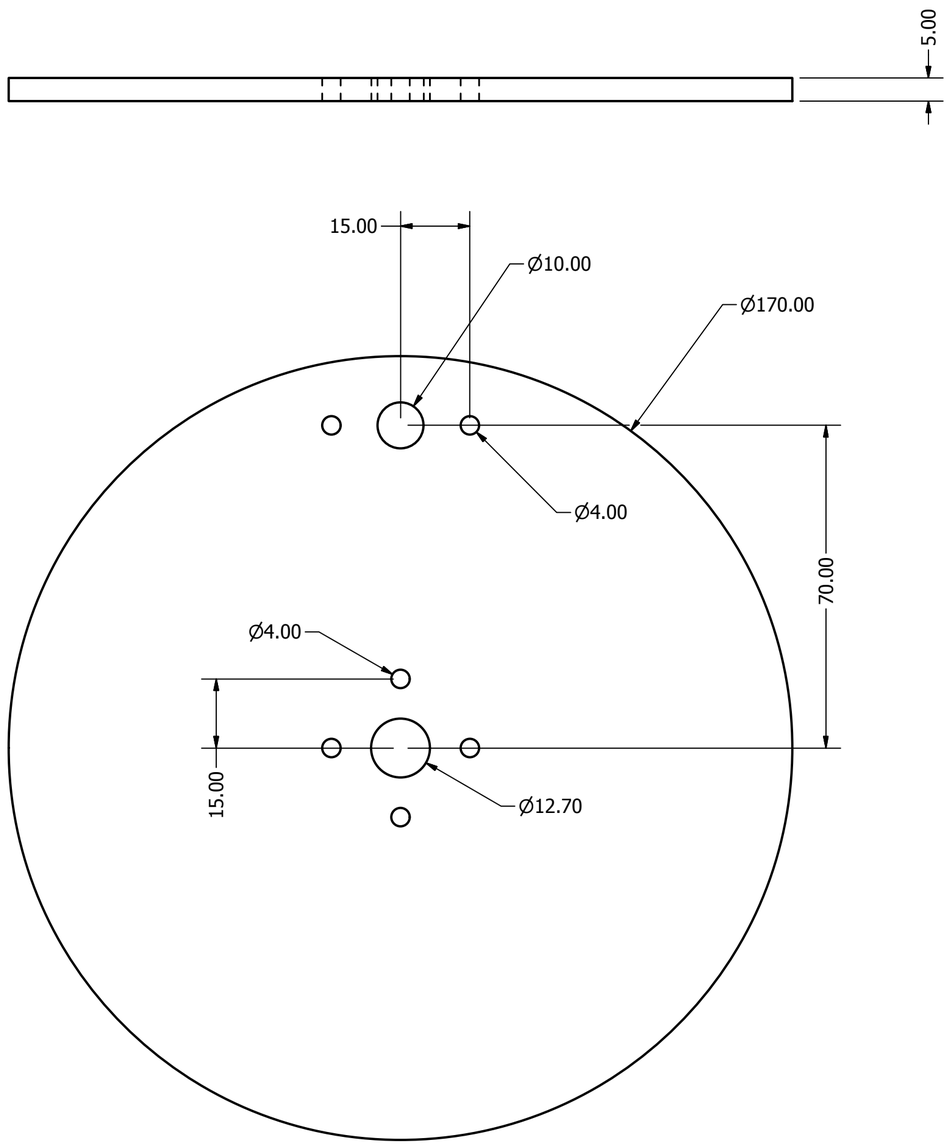


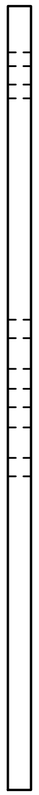


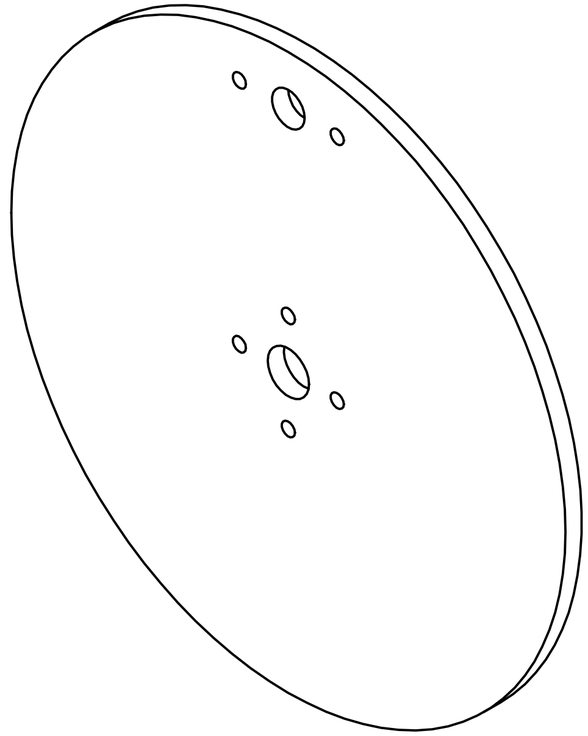


PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Translation_mechanism_Circular_Plate	
2	1	Translation_mechanism_Hub 1	
3	1	Translation_mechanism_Hub 2	
4	1	Translation_mechanism_Rod_6mm	
5	1	Translation_mechanism_Groove_rod	
6	2	Translation_mechanism_Rod_10mm	
7	6	Bolt GB 29.1 M4 x 20	Hexagon bolts with slot on head - Product A and B
8	6	ISO 7089 - 4 - 140 HV	Plain washers - Normal series - Product grade A
9	6	ISO 4032 - M4	Hexagon nuts, style 1 - Product grades A and B

DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Translational Mechanism - Whitworth Mechanism
CHECKED		3rd ANGLE PROJECTION
QA		SIZE C / DWG NO / REV
MFG		SCALE / SHEET 1 OF 1
APPROVED		

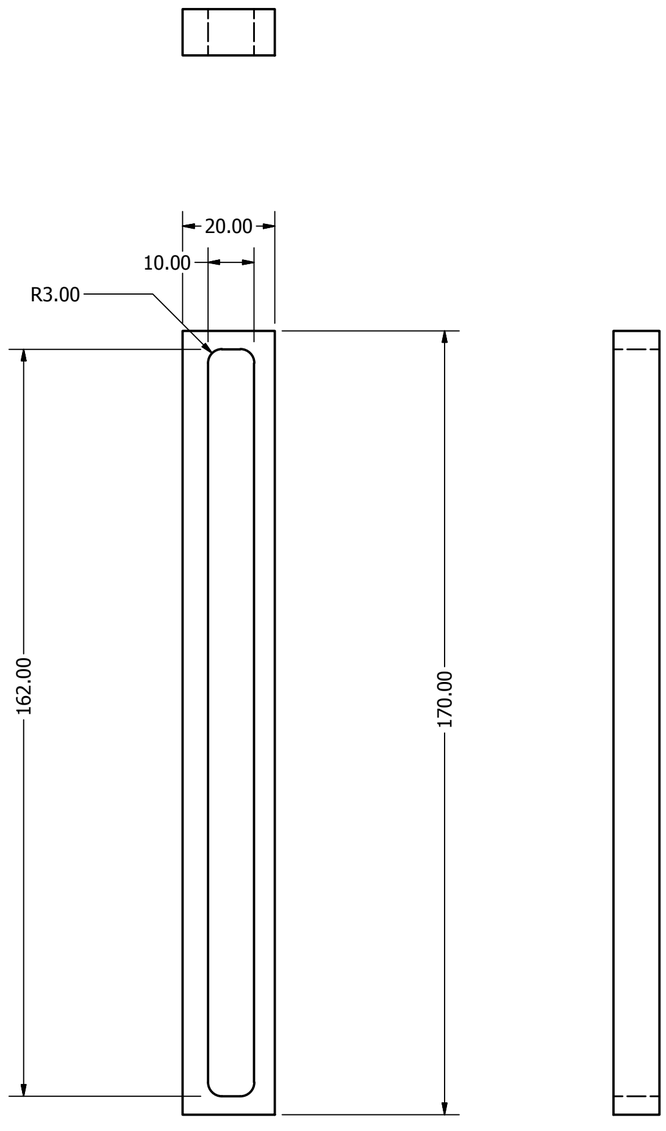


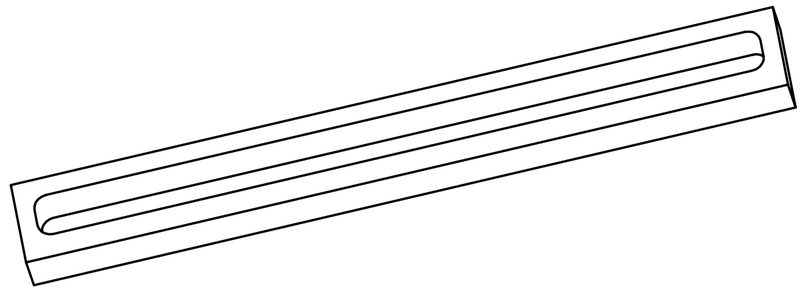




Material Required: 170mm * 170mm * 5mm Mild Steel Sheet
Quantity: 2

DRAWN Pankaj Kumar Verma	20-01-2015	
CHECKED		
QA		TITLE Translation Mechanism Circular Plate
MFG		3rd ANGLE PROJECTION
APPROVED		SIZE C / DWG NO Translation_mechanism_Circular_Plate / REV
		SCALE / SHEET 1 OF 1

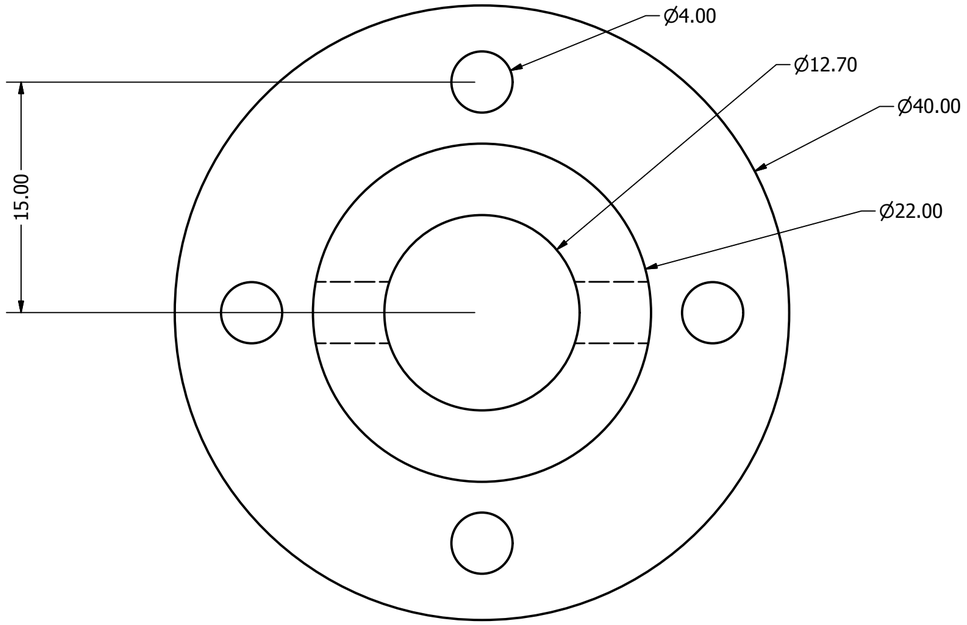


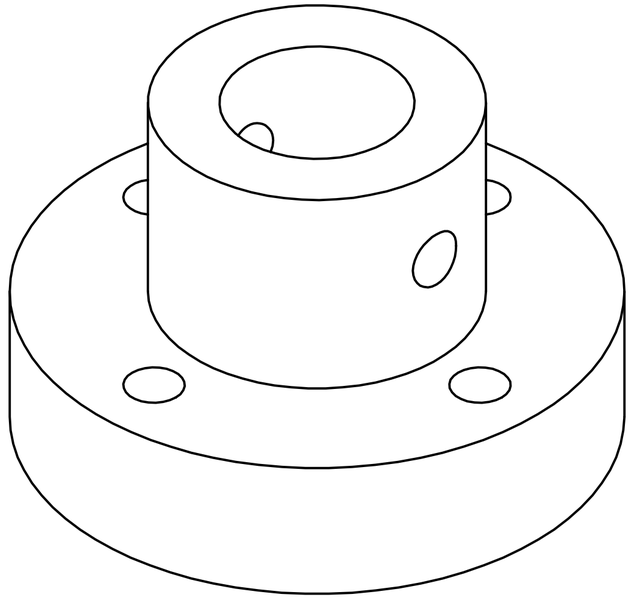


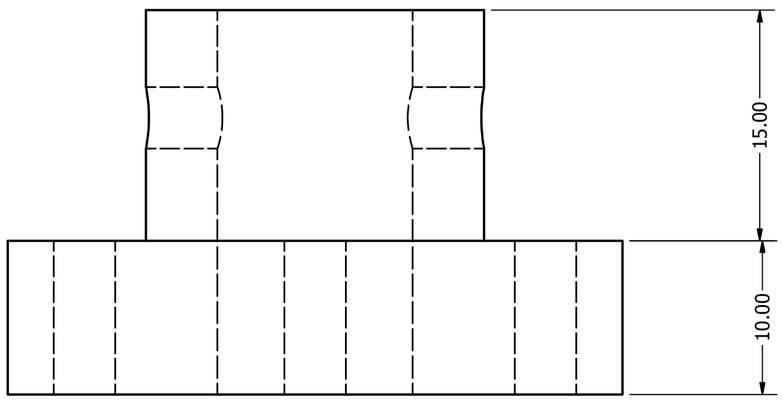
Material Required: 20mm * 10mm * 170 mm Mild Steel Flat
Quantity: 1

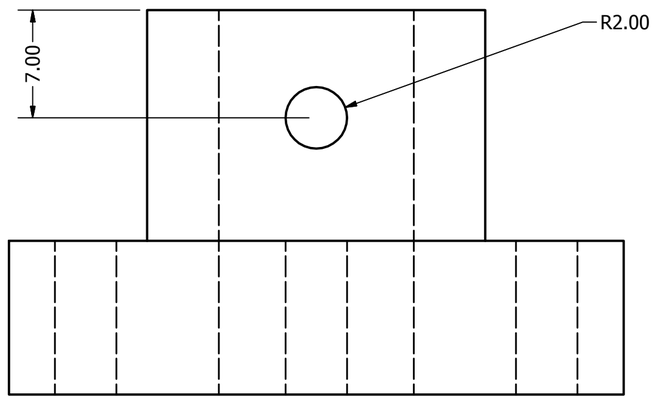
DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Translation Mechanism Groove rod	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Translation_mechanism_Groove_rod
		SCALE	SHEET 1 OF 1

3rd ANGLE PROJECTION





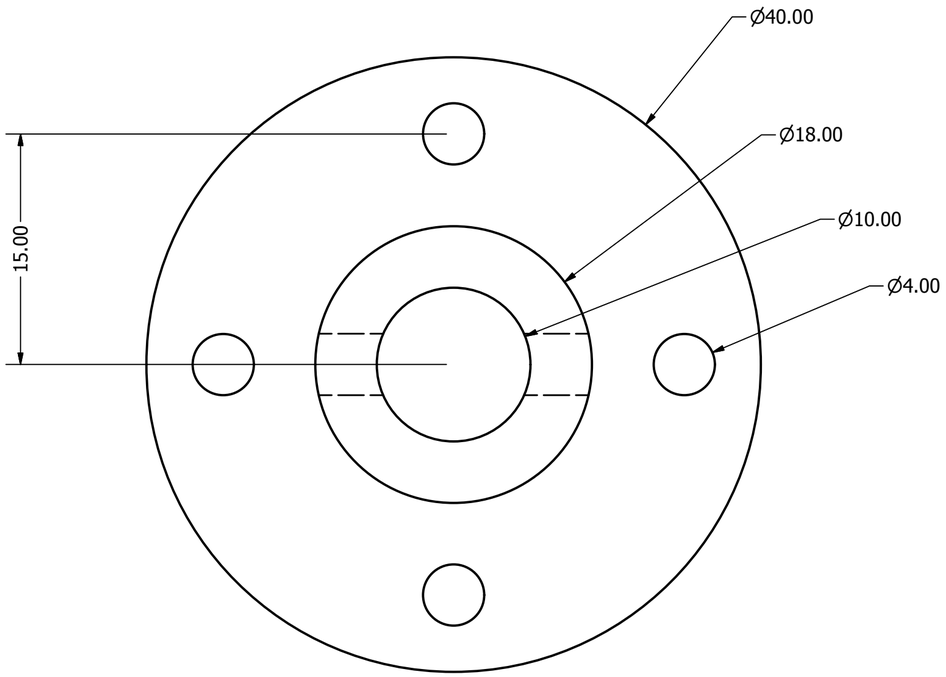


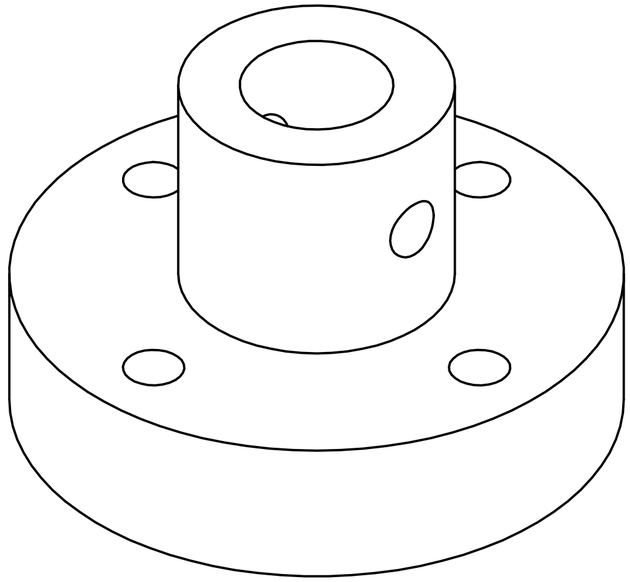


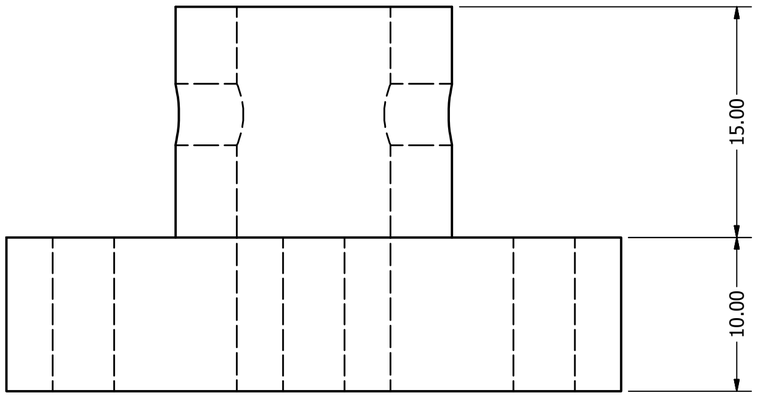
Material Required: 45mm Dia * 35 mm Mild Steel Rod
Quantity: 1

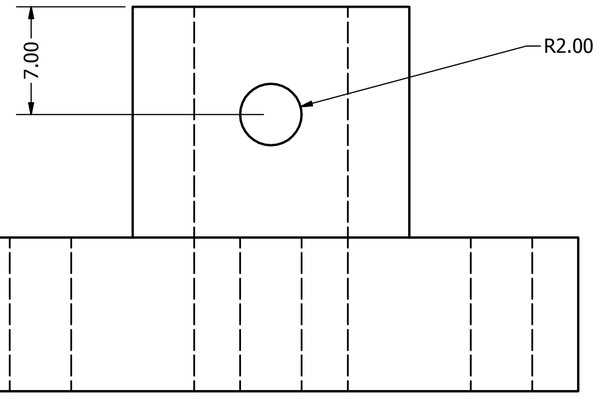
DRAWN Pankaj Kumar Verma	20-01-2015	TITLE: Translation Mechanism Hub/Coupler - 1	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Translation_mechanism_Hub1 / REV
		SCALE	SHEET 1 OF 1

3rd ANGLE PROJECTION





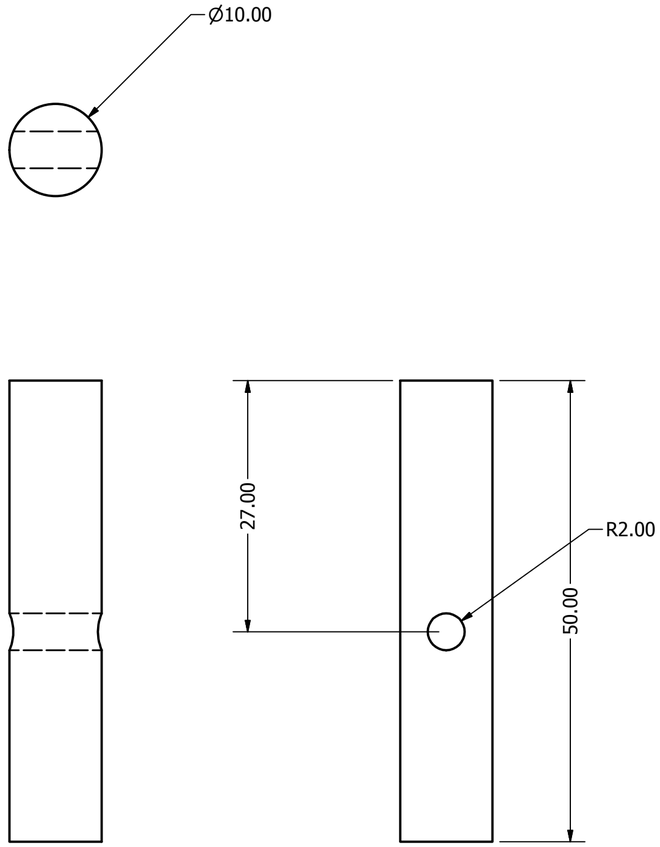


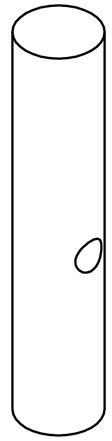


Material Required: 40 mm Dia * 30mm Mild Steel Rod
Quantity: 1

DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Translation Mechanism Hub/Coupler 2	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Translation_mechanism_Hub2 / REV
		SCALE	SHEET 1 OF 1

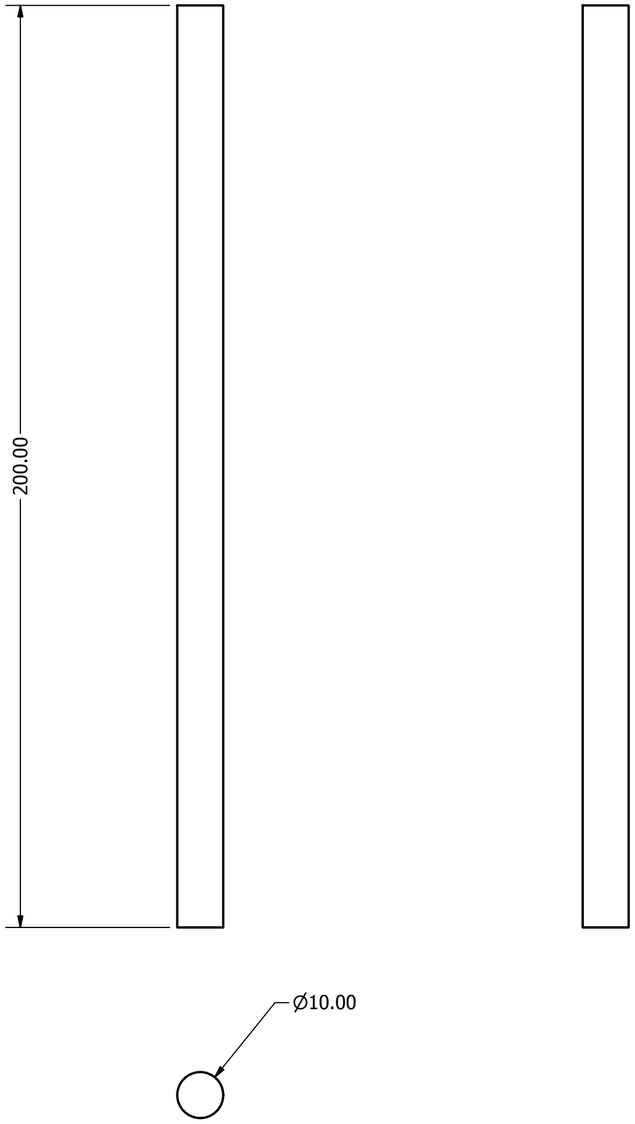
3rd ANGLE PROJECTION





Material Required: 10mm Dia * 50mm Mild Steel Rod
Quantity: 1

DRAWN Pankaj Kumar Verma	20-01-2015	
CHECKED		TITLE Translation Mechanism Rod 10 mm dia 50 mm lenght
QA		
MFG		3rd ANGLE PROJECTION
APPROVED		SIZE C / DWG NO Translation_mechanism_Rod_6mm / REV
		SCALE / SHEET 1 OF 1

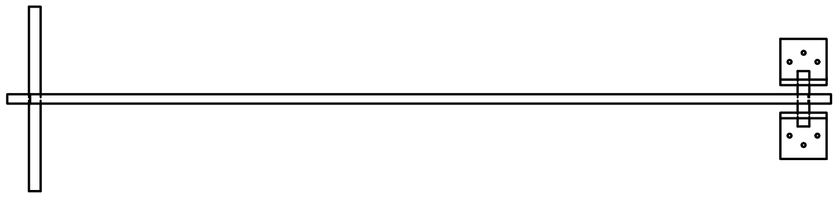


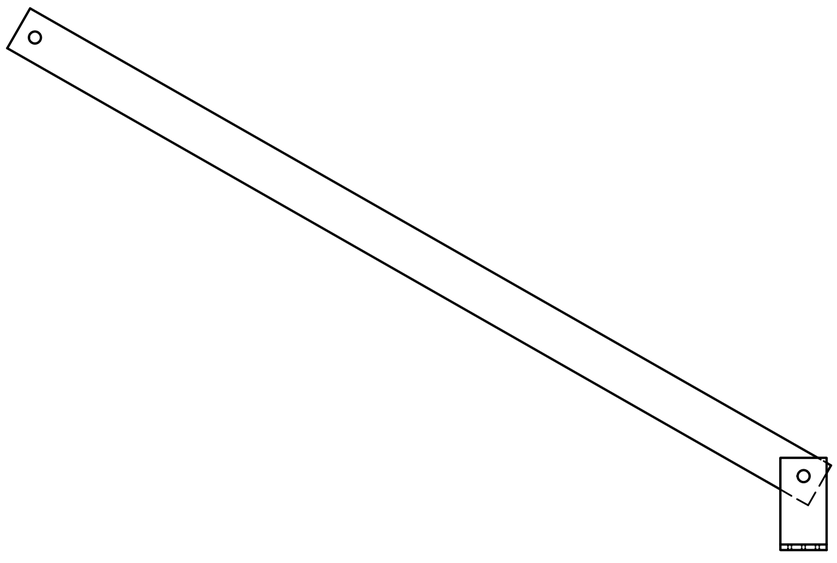
Material Required: 10mm Dia * 200mm Mild Steel Rod
Quantity: 2

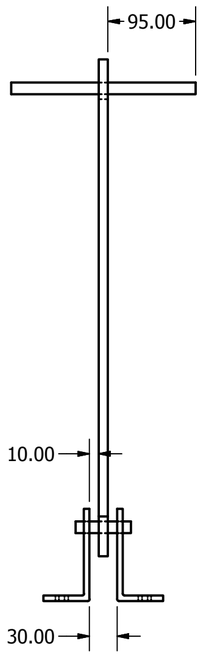
DRAWN Pankaj Kumar Verma	20-01-2015	
CHECKED		
QA		TITLE Translation Mechanism Rod 10 mm dia
MFG		3rd ANGLE PROJECTION
APPROVED		SIZE C | DWG NO Translation_mechanism_Rod_10mm | REV
		SCALE | SHEET 1 OF 1

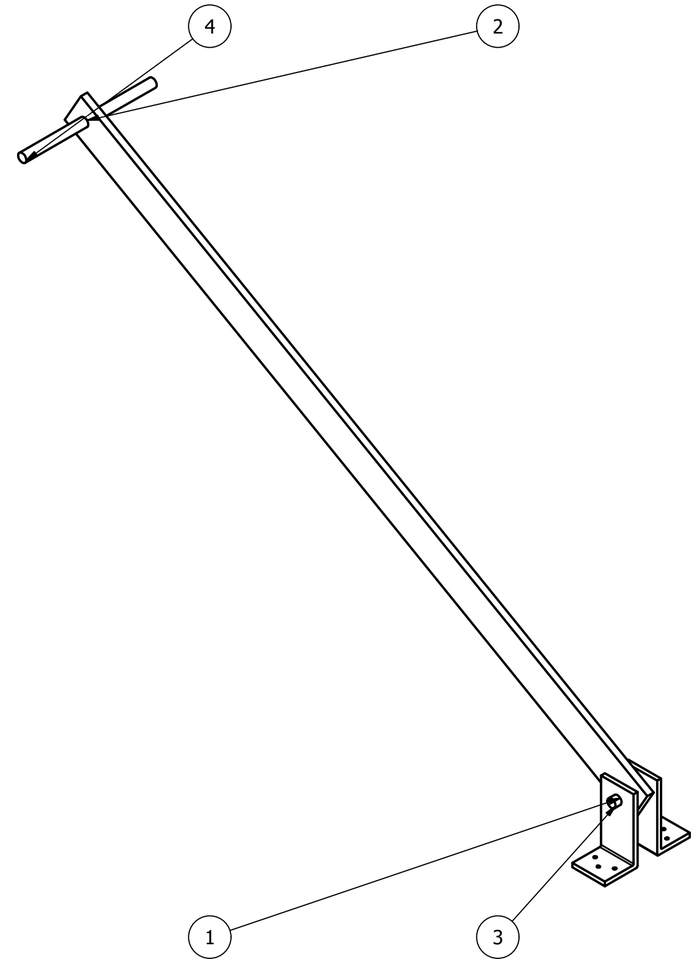
APPENDIX – 7

Isometric Drawing of Pulling Mechanism Assembly and Parts



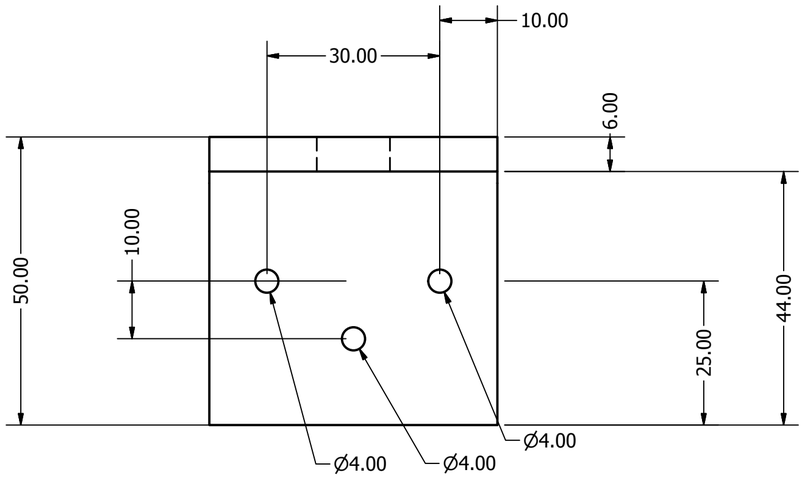


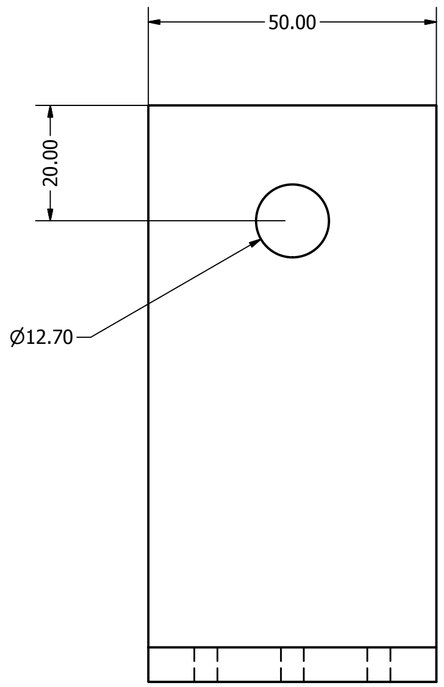


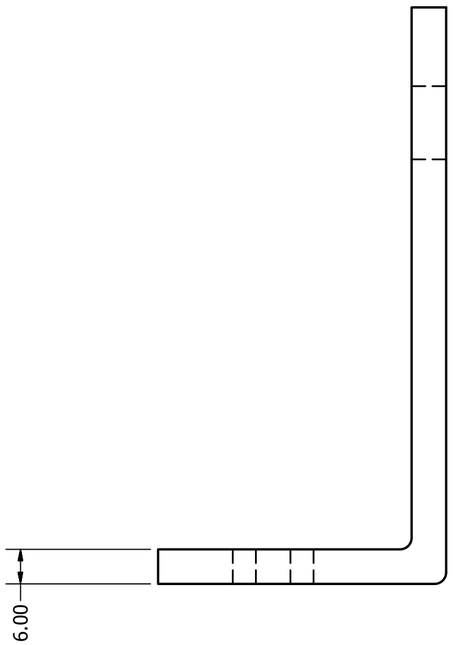


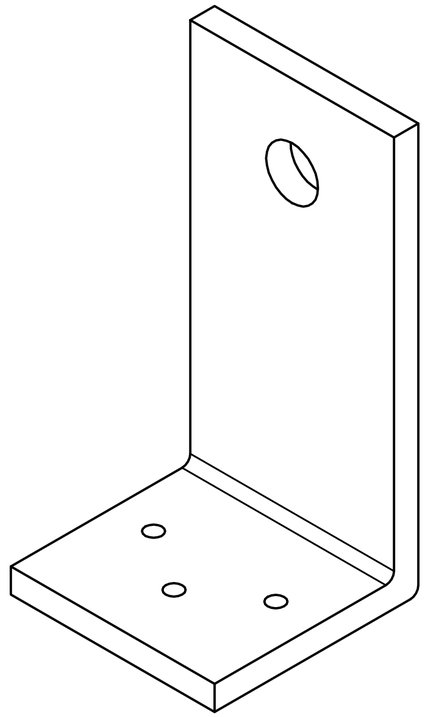
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	Pulling_Mechanism_Angle	
2	1	Pulling_Sqaure_Rod	
3	1	Shaft_60mm	
4	1	Shaft_180mm	

DRAWN Pankaj Kumar Verma	20-01-2015		
CHECKED			
QA		TITLE Pulling Mechanism	
MFG		3rd ANGLE PROJECTION	
APPROVED		SIZE C	DWG NO / REV
		SCALE	SHEET 1 OF 1



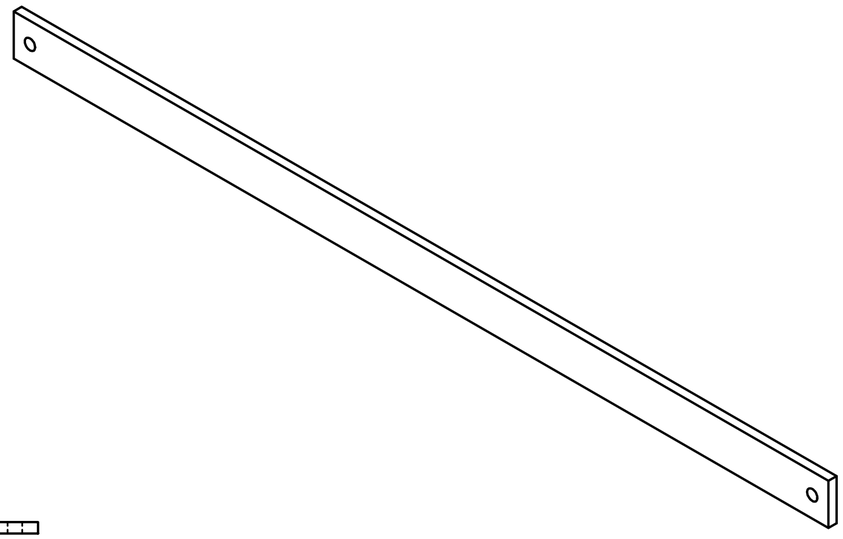


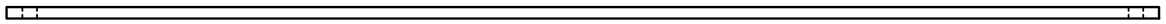


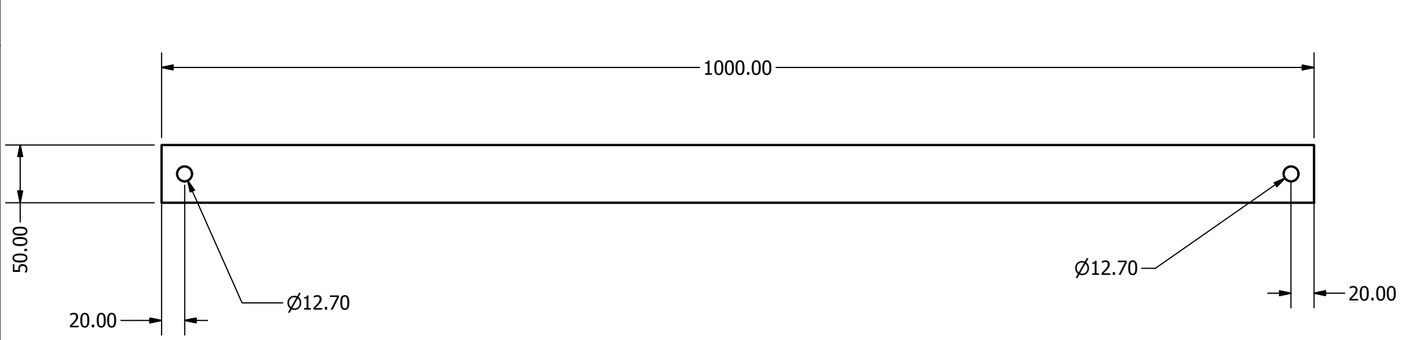


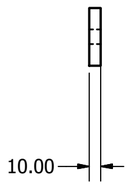
Material Required: 6mm * 50mm * 150mm Mild Steel Sheet
Quantity: 2

DRAWN Pankaj Kumar Verma	20-01-2015	
CHECKED		TITLE Pulling Mechanism Angle
QA		3rd ANGLE PROJECTION
MFG		
APPROVED		SIZE C | DWG NO Pulling_Mechanism_Angle | REV
		SCALE | SHEET 1 OF 1





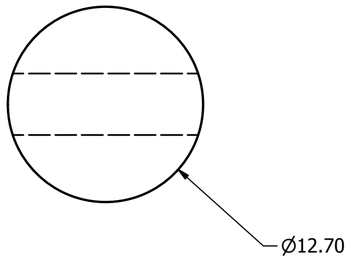


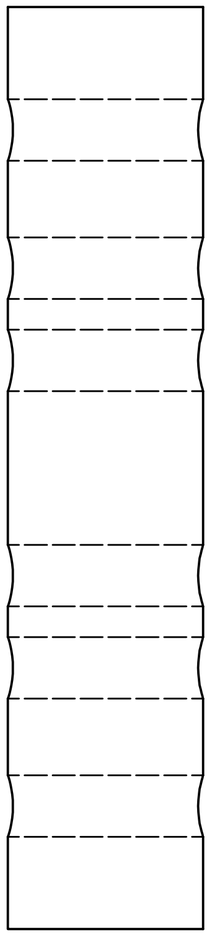


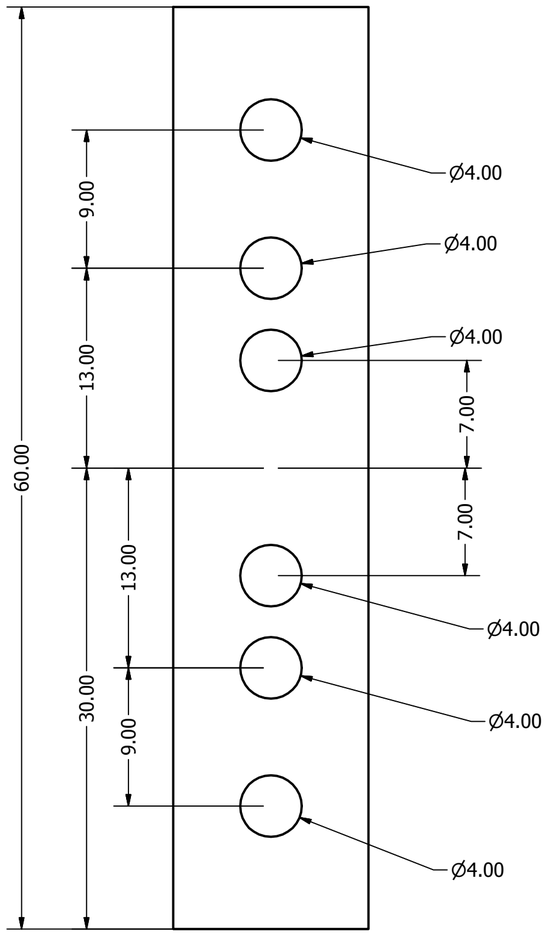
Material Required: 10mm * 50mm * 1000mm Mild Steel Flat
Quantity: 1

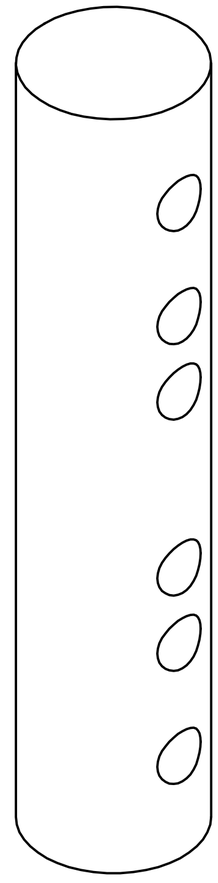
DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Pulling Rod	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Pulling_Sqaure_Rod / REV
		SCALE	SHEET 1 OF 1

3rd ANGLE PROJECTION





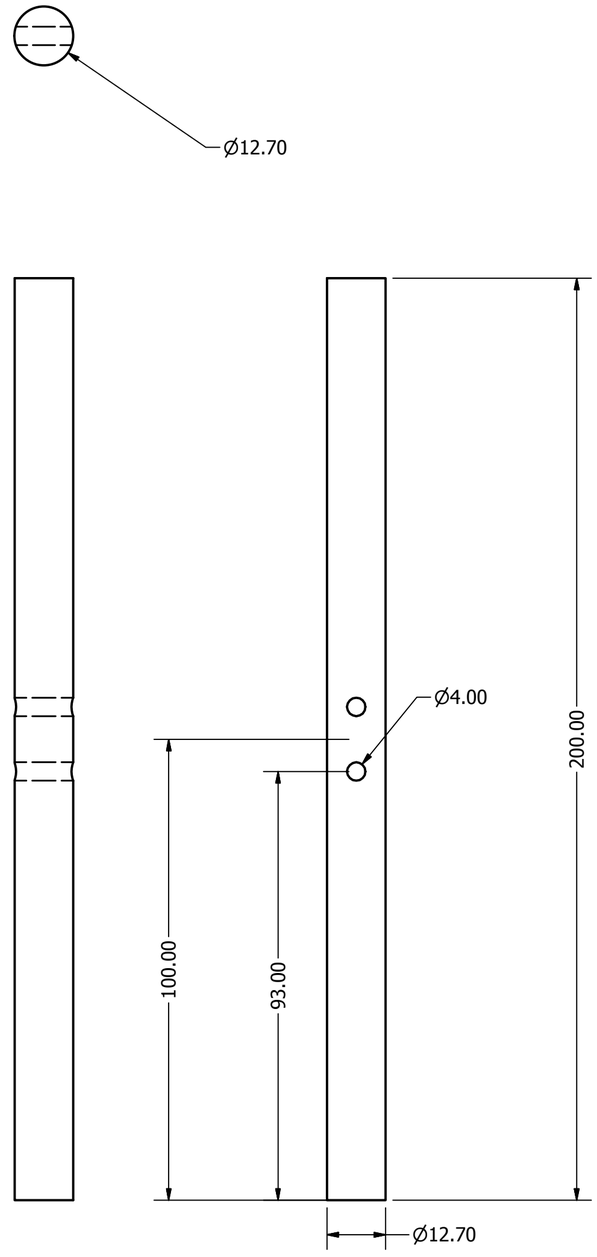


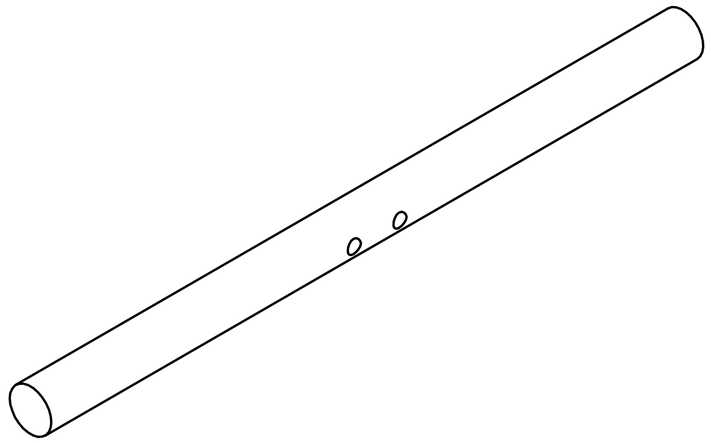


Material Required: 12.7mm Dia * 60mm Mild Steel Rod
Quantity: 1

DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Pulling Mechanism Shaft	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Shaft_60mm
		SCALE	SHEET 1 OF 1

3rd ANGLE PROJECTION



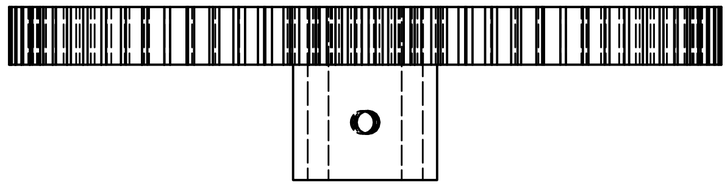


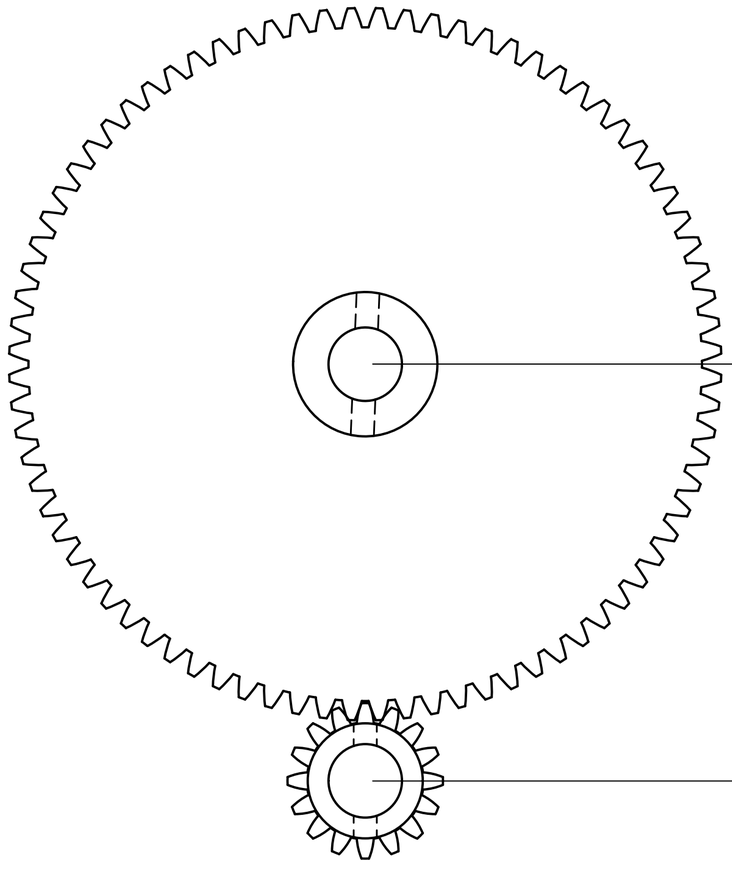
Material Required: 12.7mm Dia * 200mm Mild Steel Rod
Quantity: 1

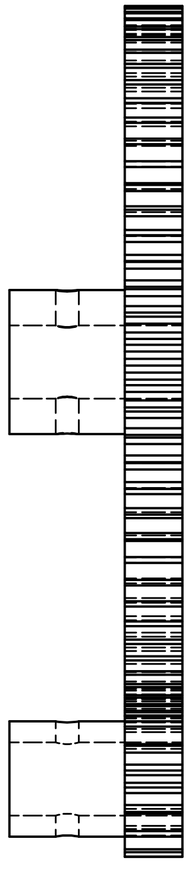
DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Pulling Shaft -2	
CHECKED		3rd ANGLE PROJECTION	
QA			
MFG			
APPROVED		SIZE C / DWG NO Shaft_180mm	REV
		SCALE	SHEET 1 OF 1

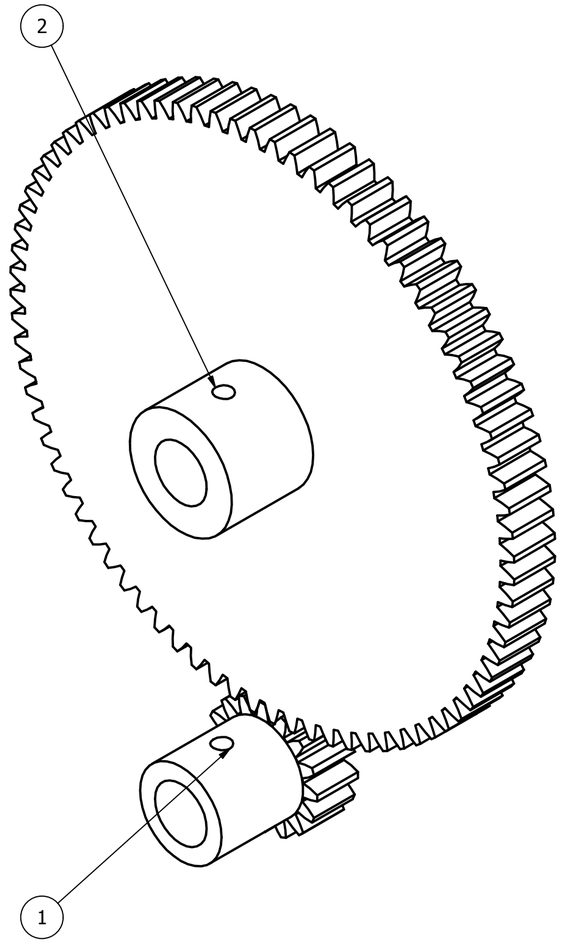
APPENDIX – 8

Isometric Drawing and Calculations of Gears



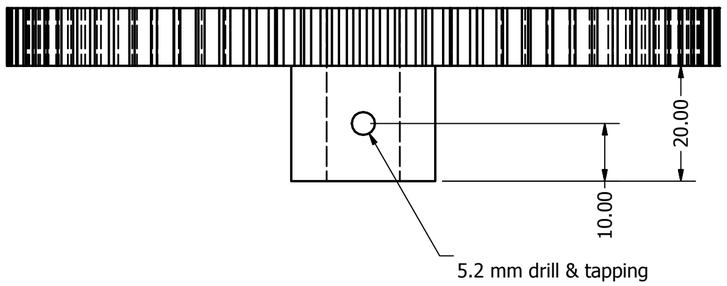


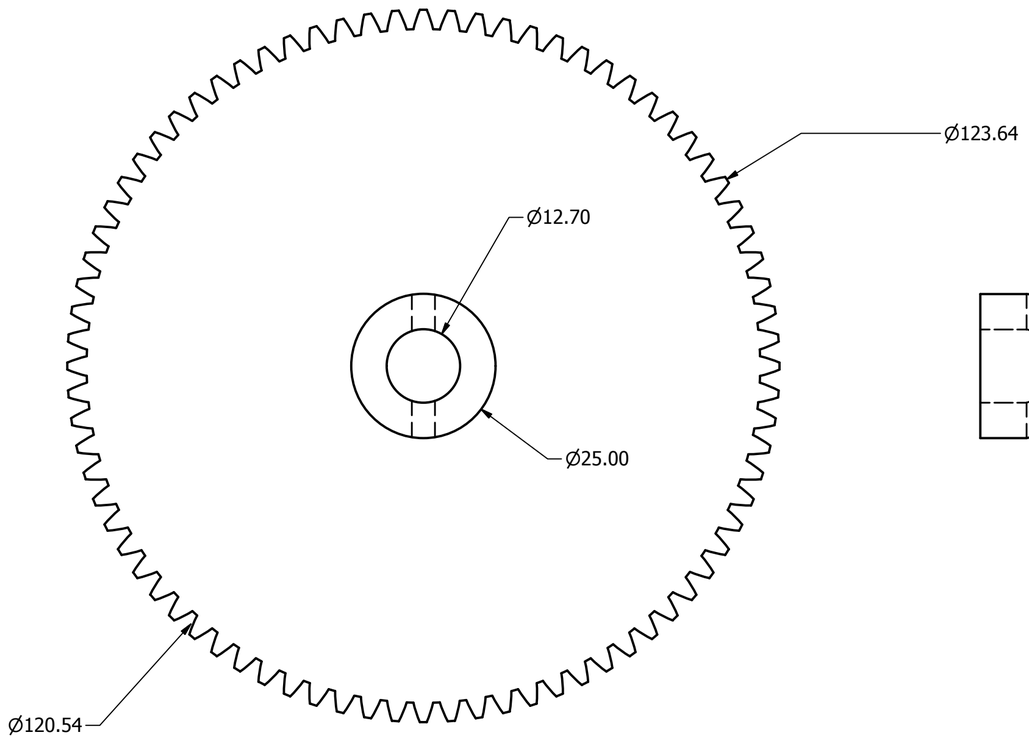


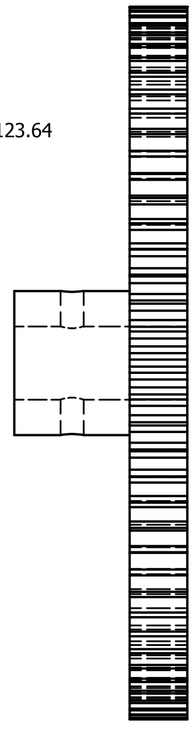


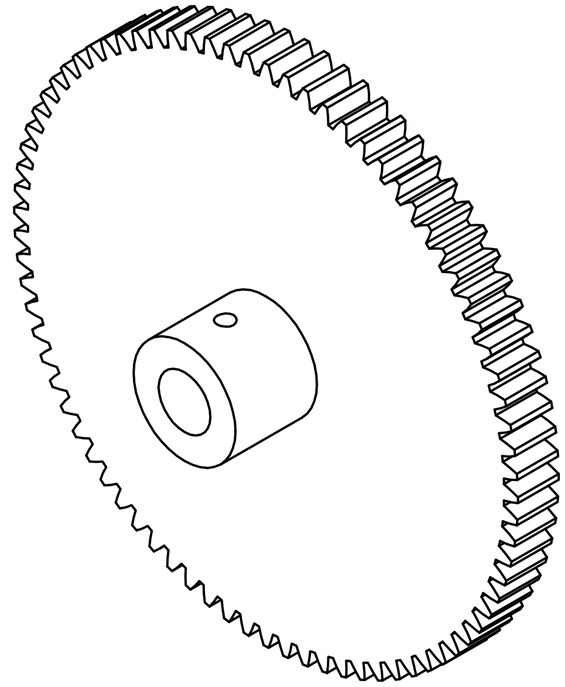
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Spur Gear1	
2	1	Spur Gear2	

DRAWN Pankaj Kumar Verma	20-01-2015		
CHECKED		TITLE Spur Gear Assembly	
QA			
MFG		3rd ANGLE PROJECTION	
APPROVED		SIZE C	DWG NO / REV
		SCALE	SHEET 1 OF 1





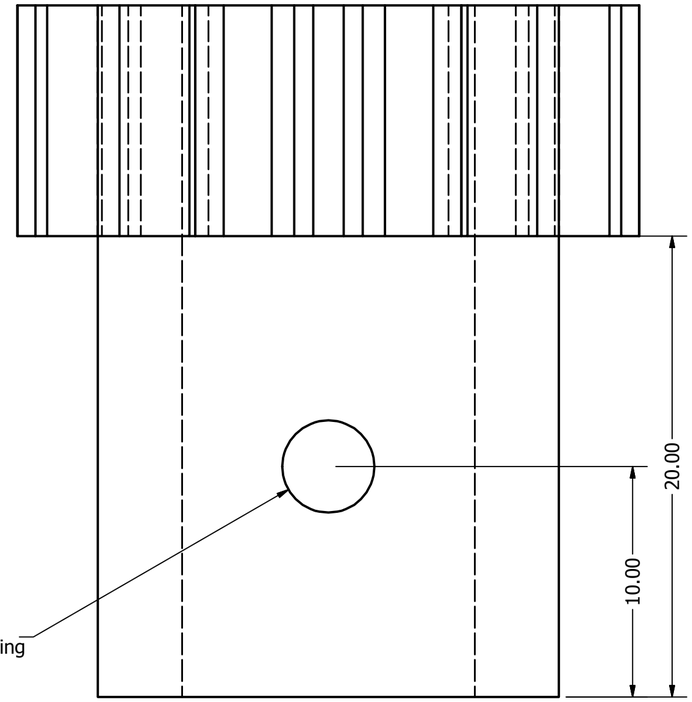


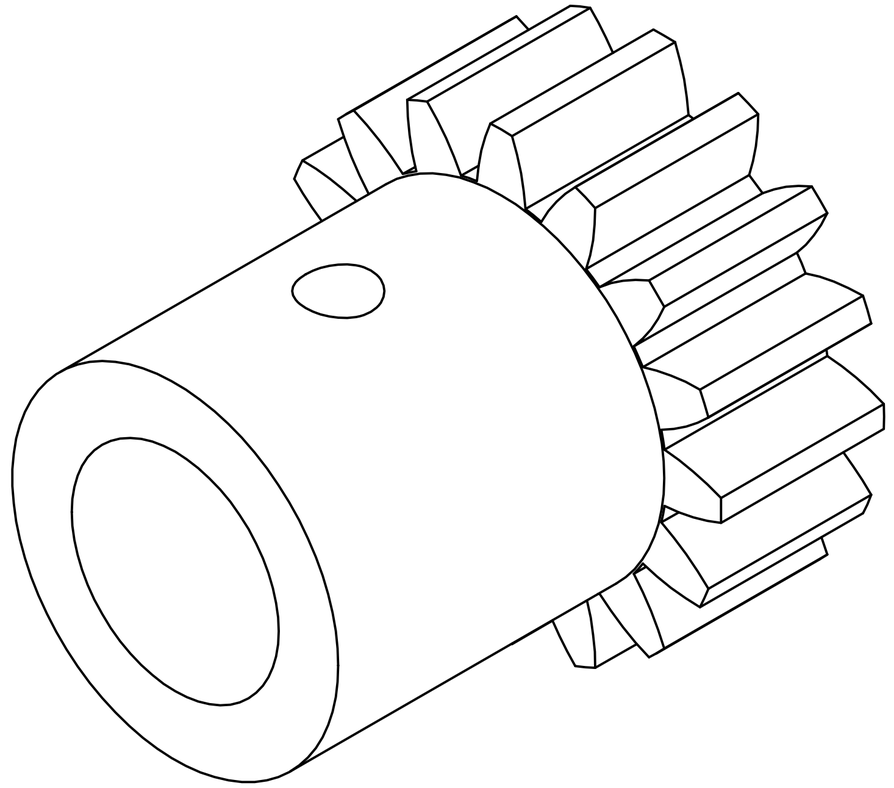


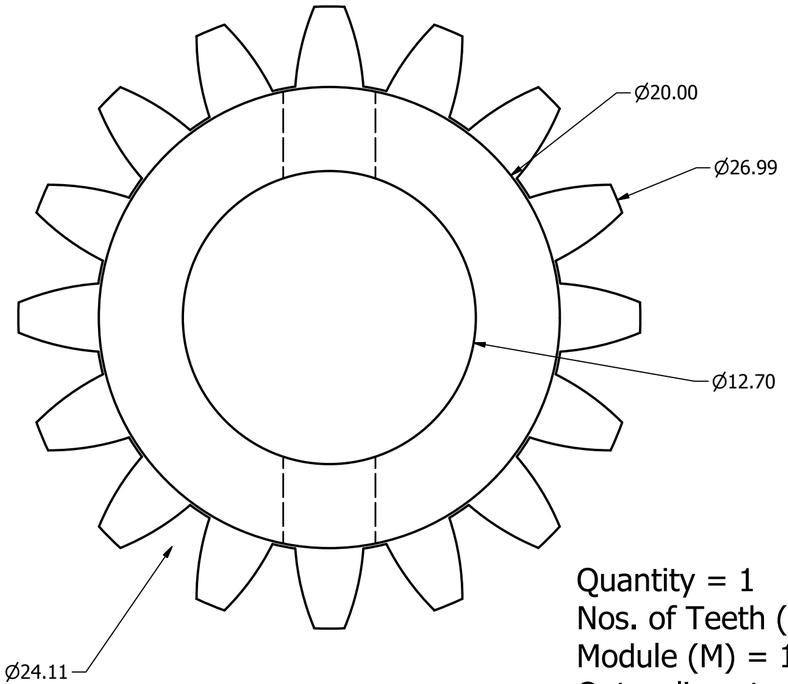
Quantity = 1
Nos. of Teeth (N) = 80
Module (M) = 1.5
Outer diameter (OD) = M (N +2) = 123mm
Rod diameter (ID) = 12.7mm
Depth of cut = 2.157 X M = 3.24mm
Tap hole size = 5.2 mm drill & ¼" tapping
Indexing calculation = 40 / N = 1/2
Material Required: 130mm Dia * 35mm Mild Steel Rod

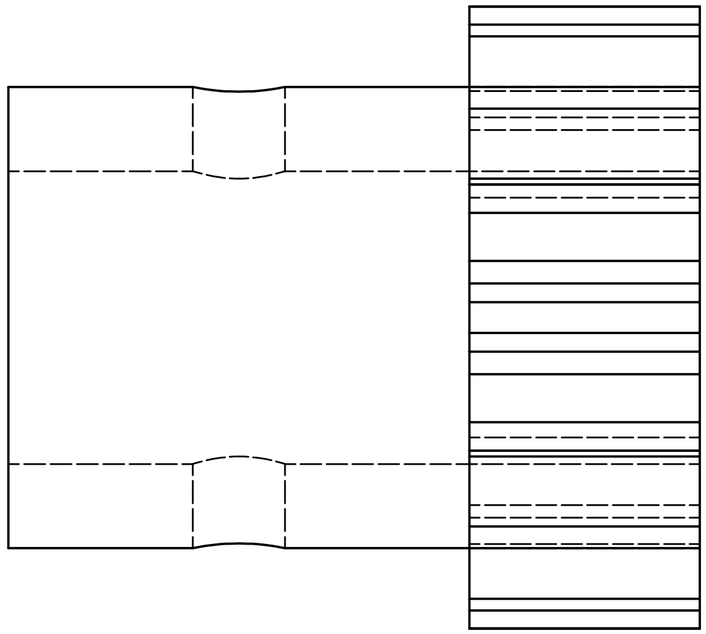
DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Spur Gear 80 teeths	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Spur Gear22 / REV
		SCALE	SHEET 1 OF 1

3rd ANGLE PROJECTION









Quantity = 1
Nos. of Teeth (N) = 16
Module (M) = 1.5
Outer diameter (OD) = M (N +2) = 27mm
Rod diameter (ID) = 12.7mm
Depth of cut = 2.157 X M = 3.23mm
Tap hole size = 5.2 mm drill & ¼" tapping
Indexing calculation = 40 / N = 2*(1/2)

Material Required: 30mm Dia * 35mm Mild Steel Rod
Quantity: 1

DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Spur Gear 16 teeths
CHECKED		
QA		
MFG		
APPROVED		
		SIZE C / DWG NO Spur Gear12 / REV
		SCALE / SHEET 1 OF 1

3rd ANGLE PROJECTION

BEVEL GEAR

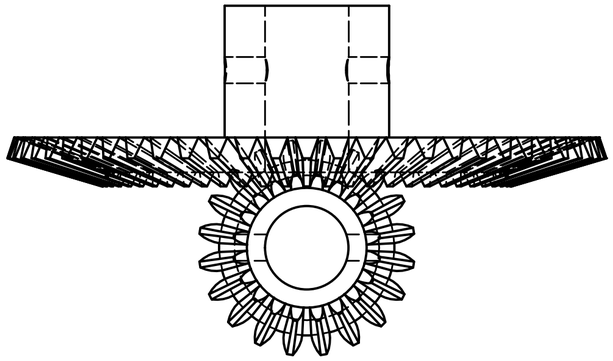
Gear Calculation

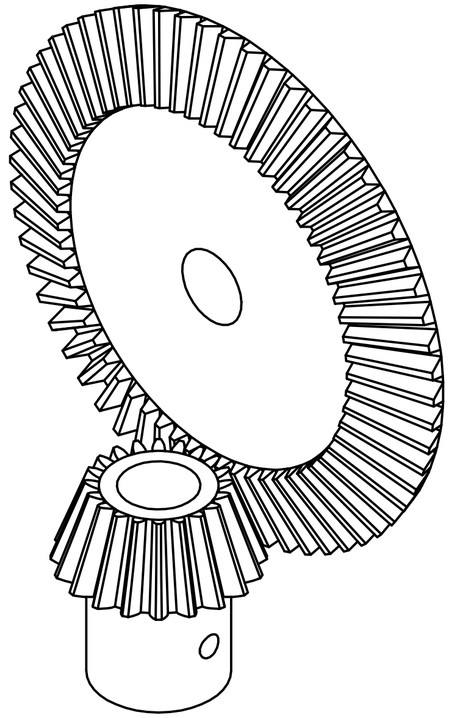
Gear N = 60

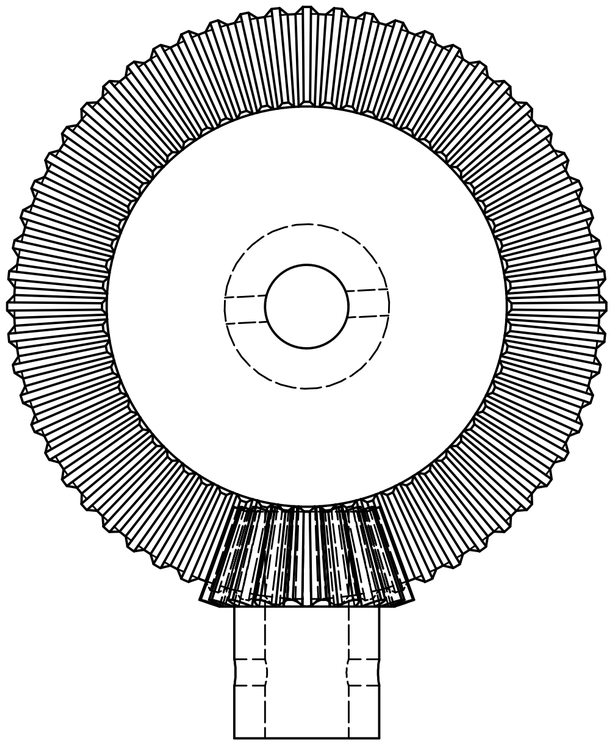
Pinion n = 20

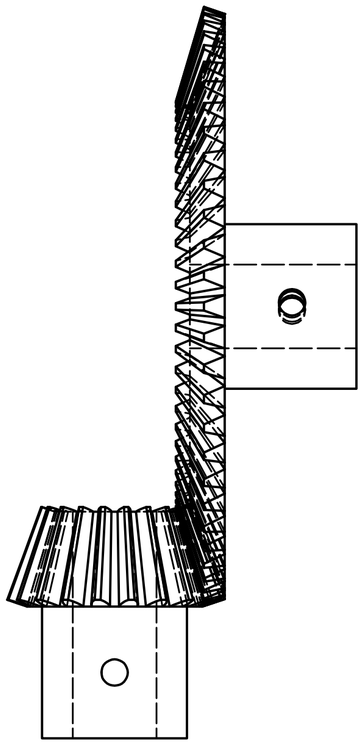
Addendum m = 1.5

- Pitch cone angle of gear tanθ_G = 60/20 = 3
- θ_G = 71.56°
- Pitch cone angle of gear θ_P= 90°- θ_G= 18.435°
- Pitch cone radius of gear and pinion=m/2*sqrt(N*N+n*n)= 47.43 mm
- Addendum angle tan(α) = m/r = 0.0316mm
- α=1.81°
- Dendum = 1.7355mm
- Dendum angle tan(β) = Dendum/R = 0.0366
- β= 2.096°
- Whole depth of large end of tooth = Addendum+ Dendum = 3.23mm
- Tooth thickness at pitch line = 2.3562 mm
- Cutting angle of gear = θ_G - β = 69.464°
- Force angle of gear = θ_G+ α = 73.37°
- Cutting angle of pinion = phi(P) = θ_P – β= 16.34°
- Depth of cut = 3.24 mm
- Pitch Diameter of pinion: 30mm
- Pitch Diameter of Gear: 90mm
- Cone Distance = 47.43mm
- Face Width = 15mm
- Outer Cone Angle of Gear = 73.37°
- Outer Cone Angle of Pinion = 20.24°
- Root Cone Angle of Gear = 69.47
- Root Cone Angle of Pinion = 16.34
- Outside Diameter of Pinion = 32.84mm
- Outer Diameter of Gear = 90.95mm
- Required Material of Pinion: 35mm Dia * 40mm Mild Steel Rod
- Required Material for Gear: 95mm Dia * 40mm Mild Steel Rod

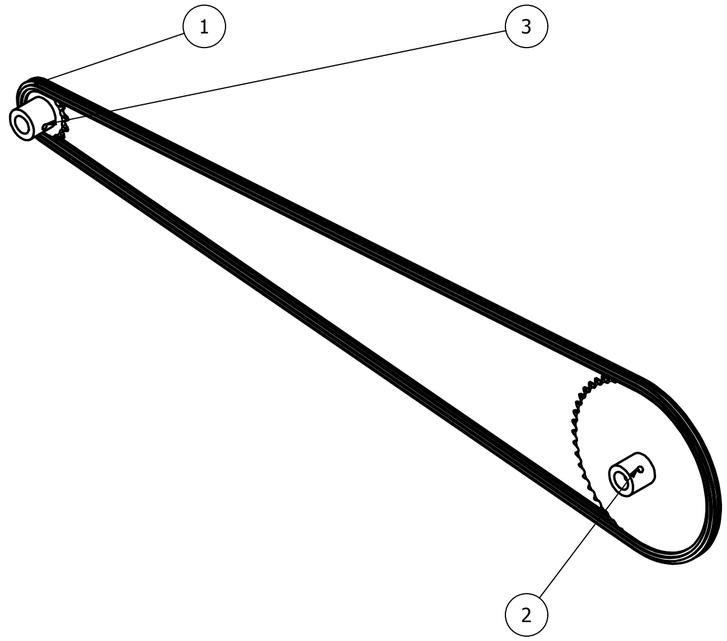


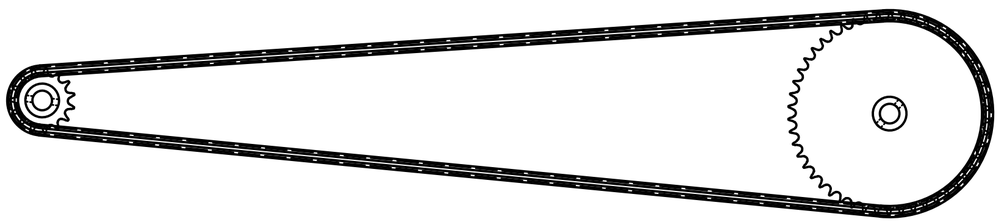






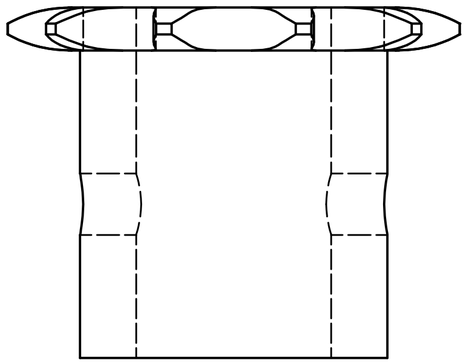
DRAWN Pankaj Kumar Verma	20-01-2015			
CHECKED				
QA		TITLE Bevel Gear Assembly		
MFG				
APPROVED		3rd ANGLE PROJECTION		
		SIZE C	DWG NO	REV
		SCALE	SHEET 1 OF 1	

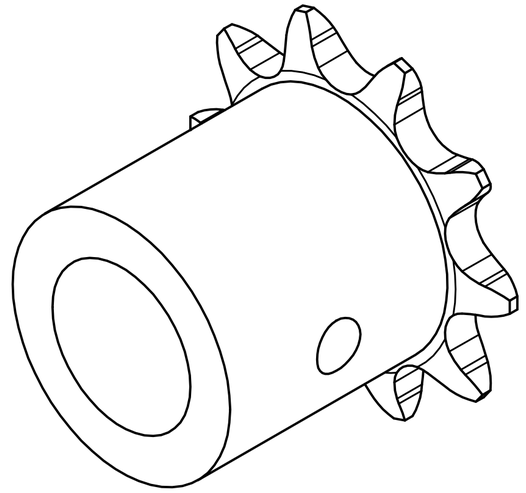


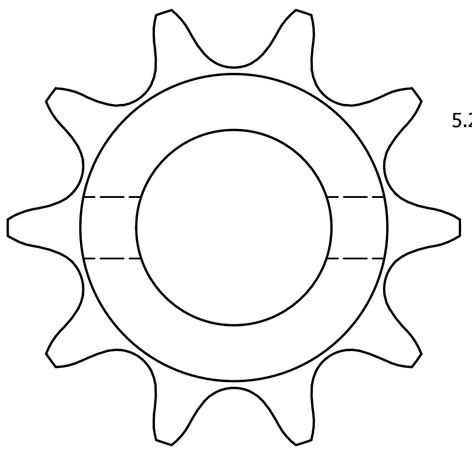


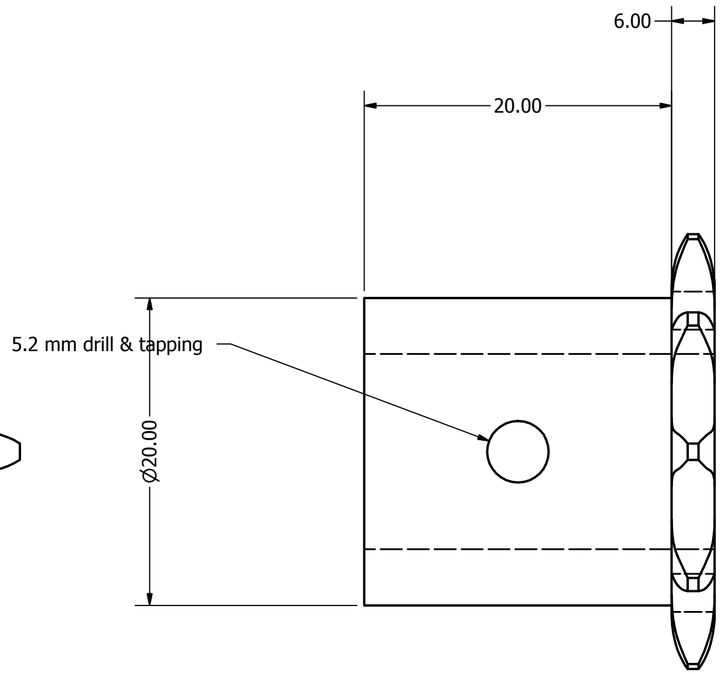
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Roller Chain	
2	1	Roller Chain Sprocket1	50 teeths
3	1	Roller Chain Sprocket2	15 teeths

DRAWN Pankaj Kumar Verma	20-01-2015	
CHECKED		TITLE Chain Drive
QA		
MFG		3rd ANGLE PROJECTION
APPROVED		SIZE C / DWG NO / REV
		SCALE / SHEET 1 OF 1









Quantity = 1
No. of teeths = 10
Module = 1.5
Roller Diameter = 8mm
PCD = 40.4mm
Outer Diameter = 48.4mm
Root Diameter = 32.4mm
Rod Diameter = 12.7mm
Depth of cut = 8mm
Index calculation = 40/10 = 4

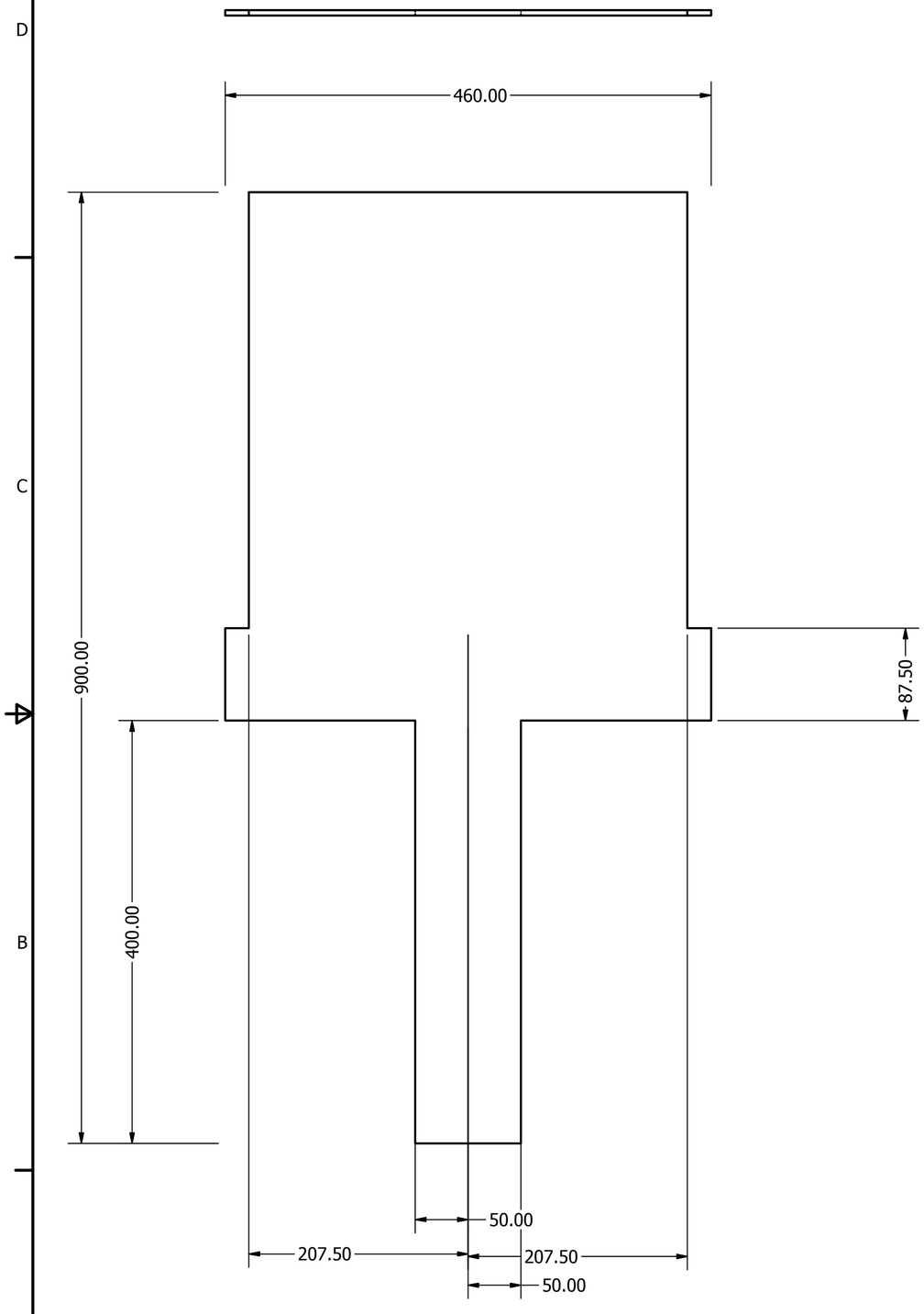
Material Required: 45mm Dia * 30mm Mild Steel Rod
Quantity: 1

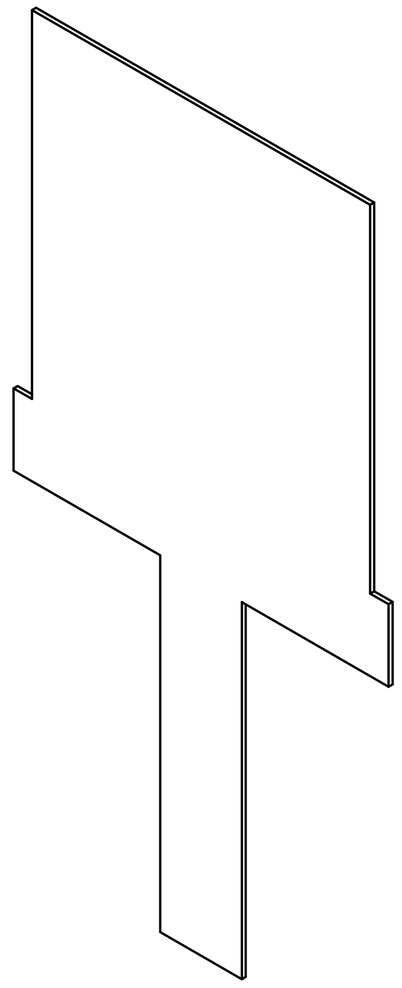
DRAWN Pankaj Kumar Verma	21-01-2015	TITLE Roller Chain Sprocket 1	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO / REV
		SCALE	SHEET 1 OF 1

3rd ANGLE PROJECTION

APPENDIX – 9

Isometric Drawing of Miscellaneous Parts

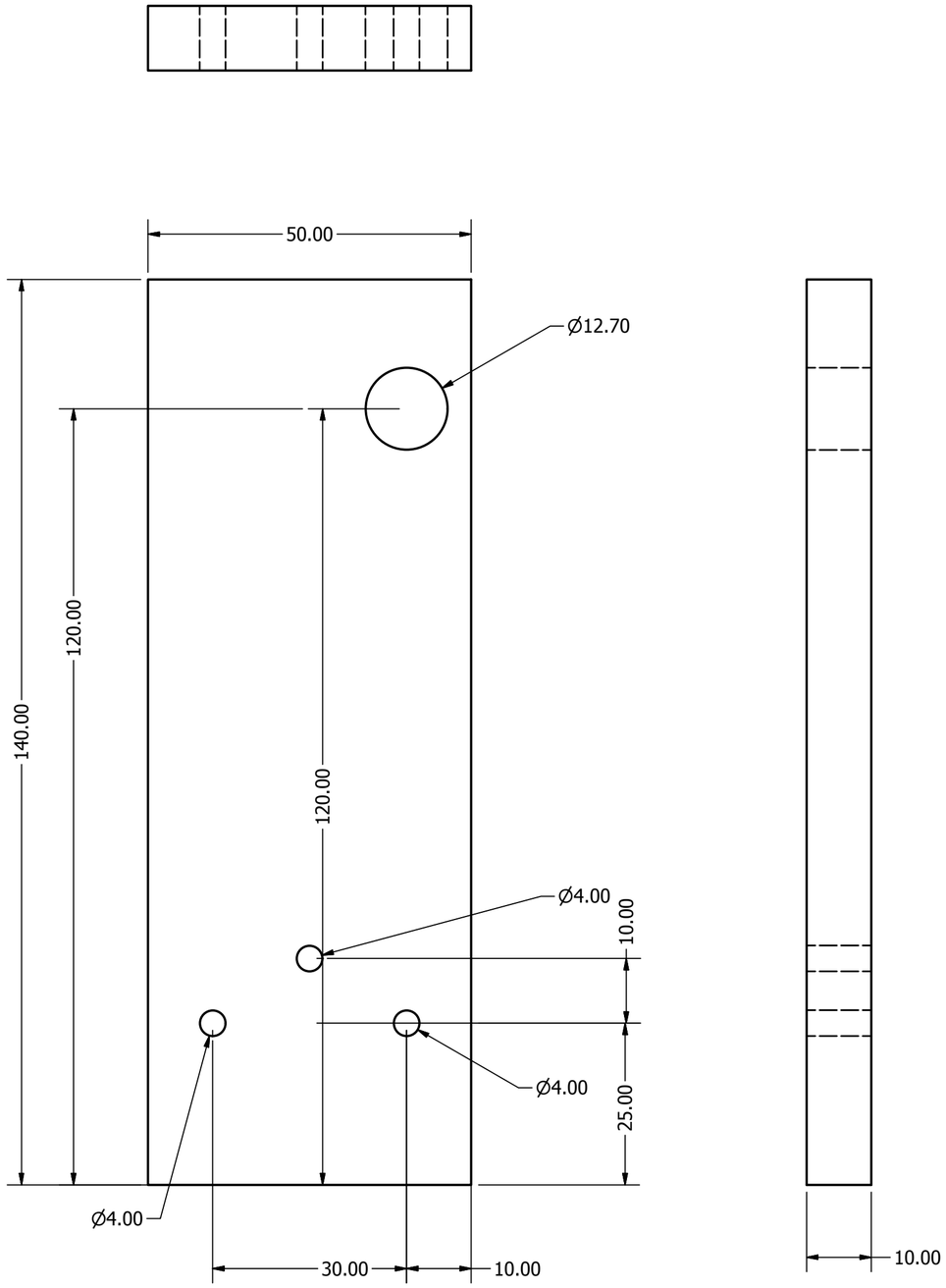


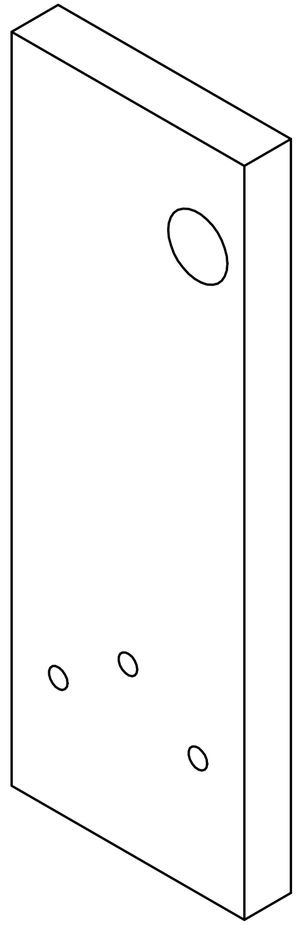


Material Required: 1000mm * 500mm * 5mm Mild Steel Sheet
Quantitty: 1

DRAWN Pankaj Kumar Verma	21-01-2015	TITLE Base Plate	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO / REV
		SCALE	SHEET 1 OF 1

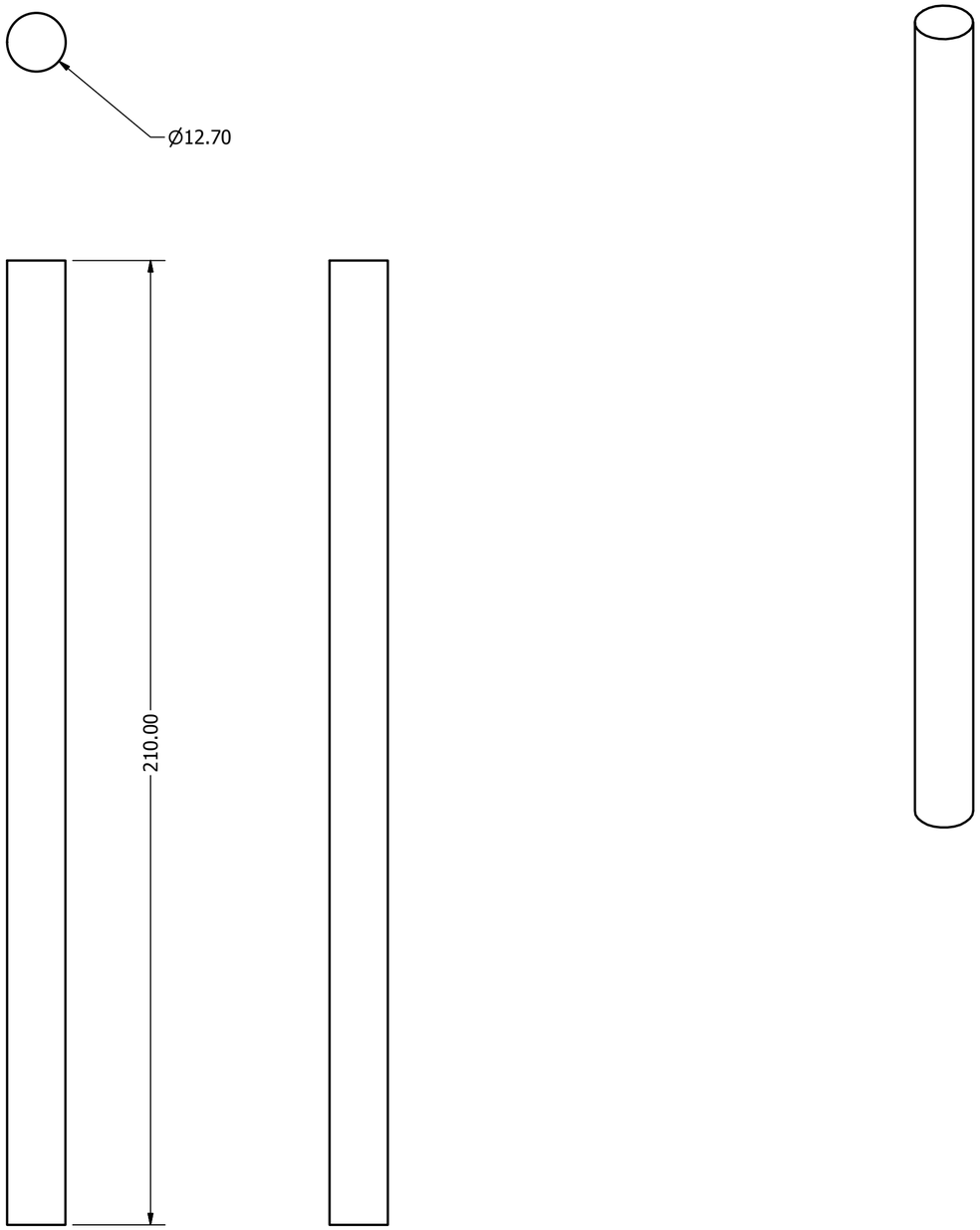
3rd ANGLE PROJECTION





Material Rquired: 50*10*140mm Mild Steel Flat
Quantity: 2

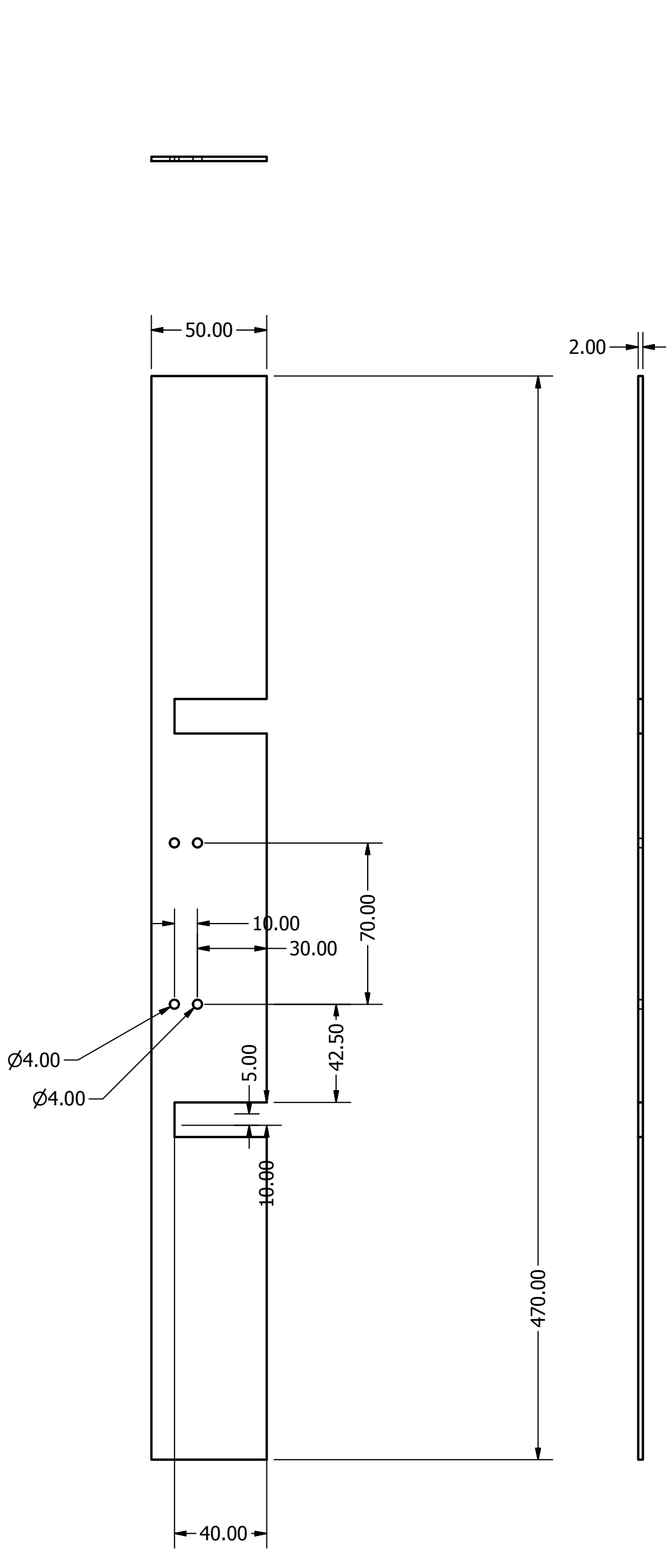
DRAWN Pankaj Kumar Verma	20-01-2015		
CHECKED		TITLE Bevel Gear Support	
QA			
MFG			
APPROVED		SIZE C	DWG NO Bevel_Gear_Support / REV
		SCALE	SHEET 1 OF 1

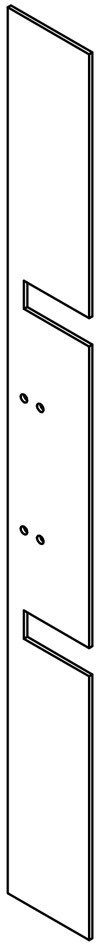


Material Required: 12.7mm * 210mm Mild Steel Rod
Quantity: 1

DRAWN Pankaj Kumar Verma	21-01-2015	TITLE Shaft 210 mm	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C / DWG NO / REV	
		SCALE / SHEET 1 OF 1	

3rd ANGLE PROJECTION

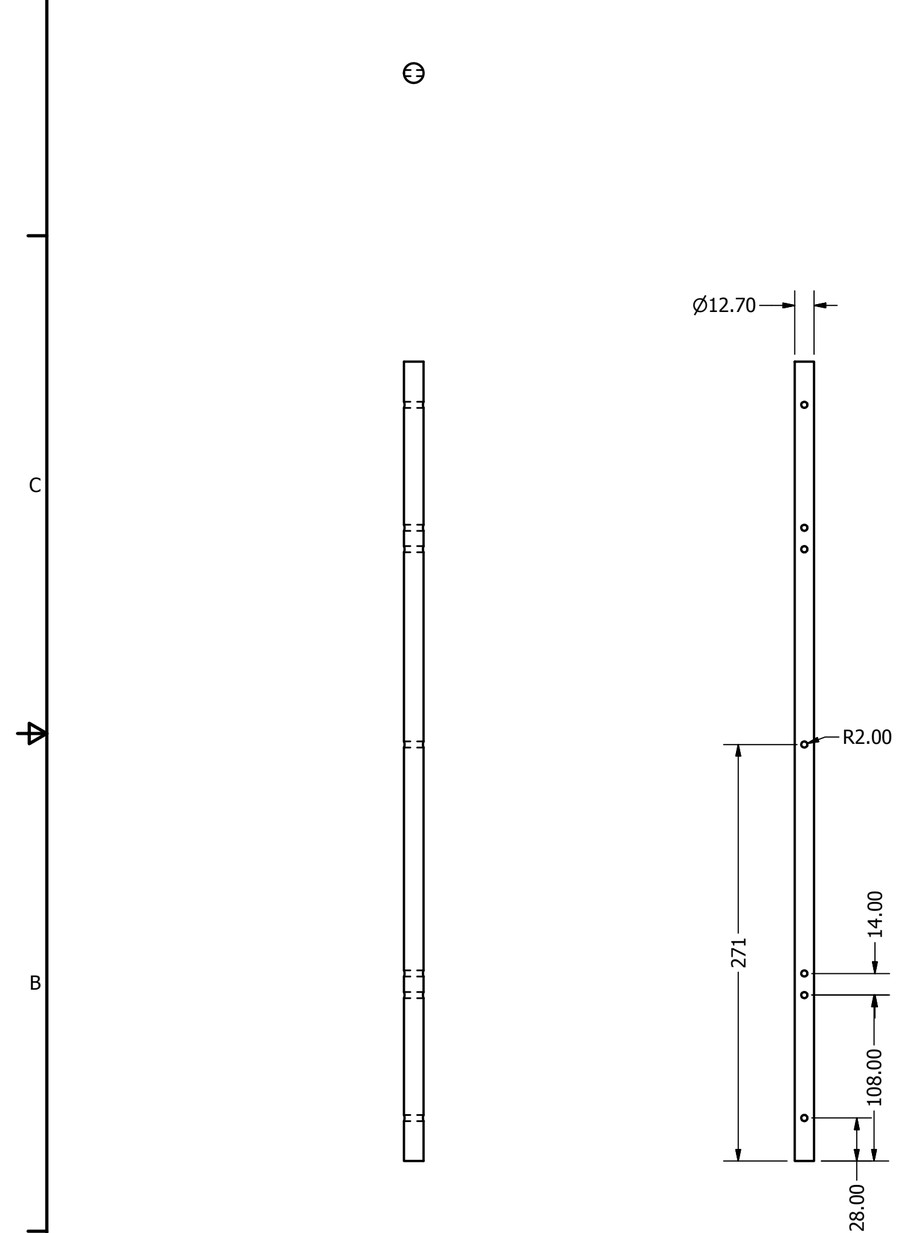




Material Required: 2mm * 50mm * 470mm Mild Steel Sheet
Quantity: 1

DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Plant Blocking Plate		
CHECKED				
QA				
MFG				
APPROVED				
		SIZE C	DWG NO Plant Blocking	REV
		SCALE	SHEET 1 OF 1	

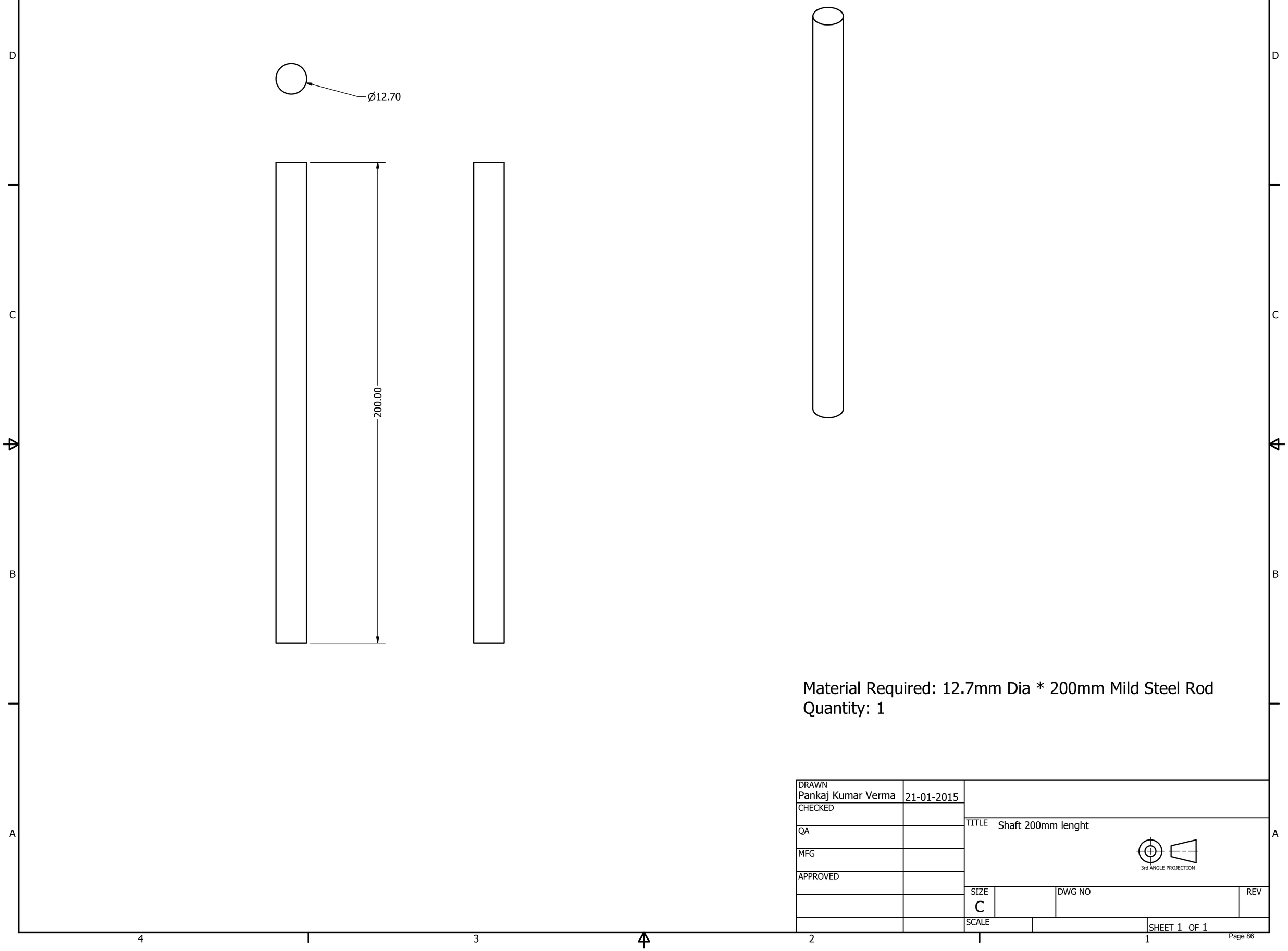
3rd ANGLE PROJECTION



Material Required: 12.7mm Dia * 420mm Mild Steel Rod
Quantity: 1

DRAWN Pankaj Kumar Verma	20-01-2015		
CHECKED		TITLE Rod Wheel	
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Rod_Wheel_420mm
		SCALE	SHEET 1 OF 1

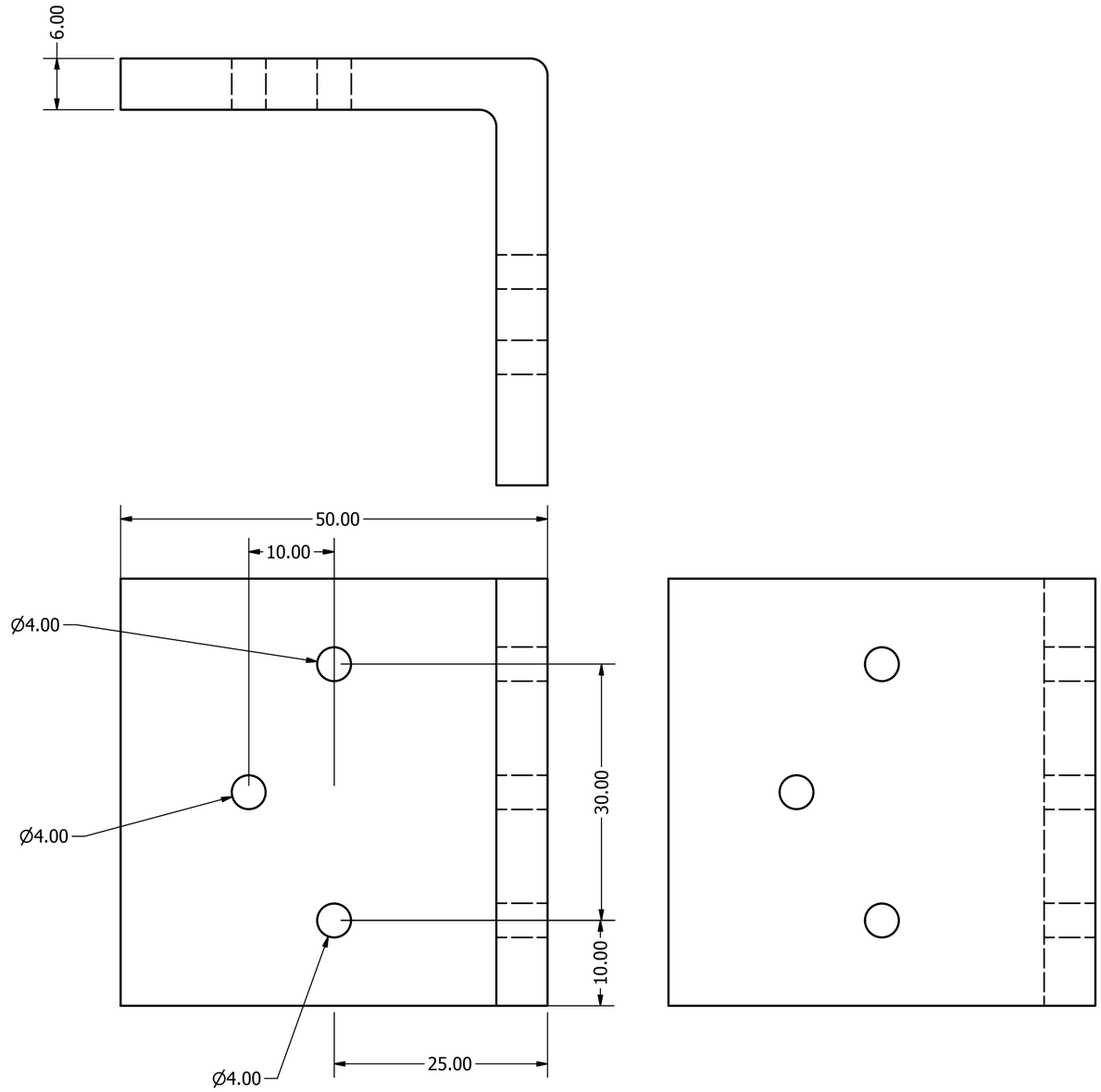
3rd ANGLE PROJECTION

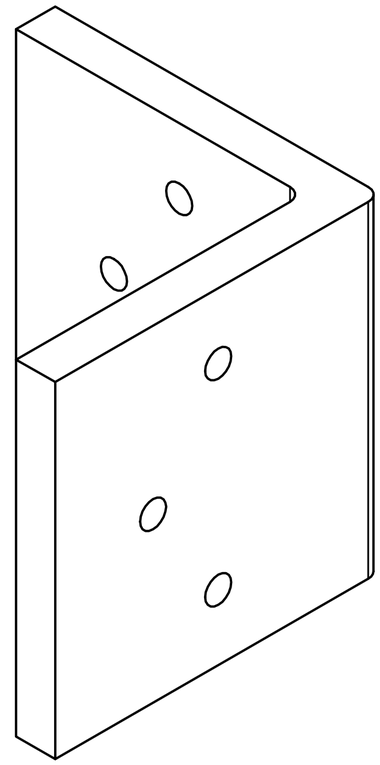


Material Required: 12.7mm Dia * 200mm Mild Steel Rod
Quantity: 1

DRAWN Pankaj Kumar Verma	21-01-2015		
CHECKED		TITLE Shaft 200mm lenght	
QA			
MFG			
APPROVED			
		SIZE C	DWG NO / REV
		SCALE	SHEET 1 OF 1

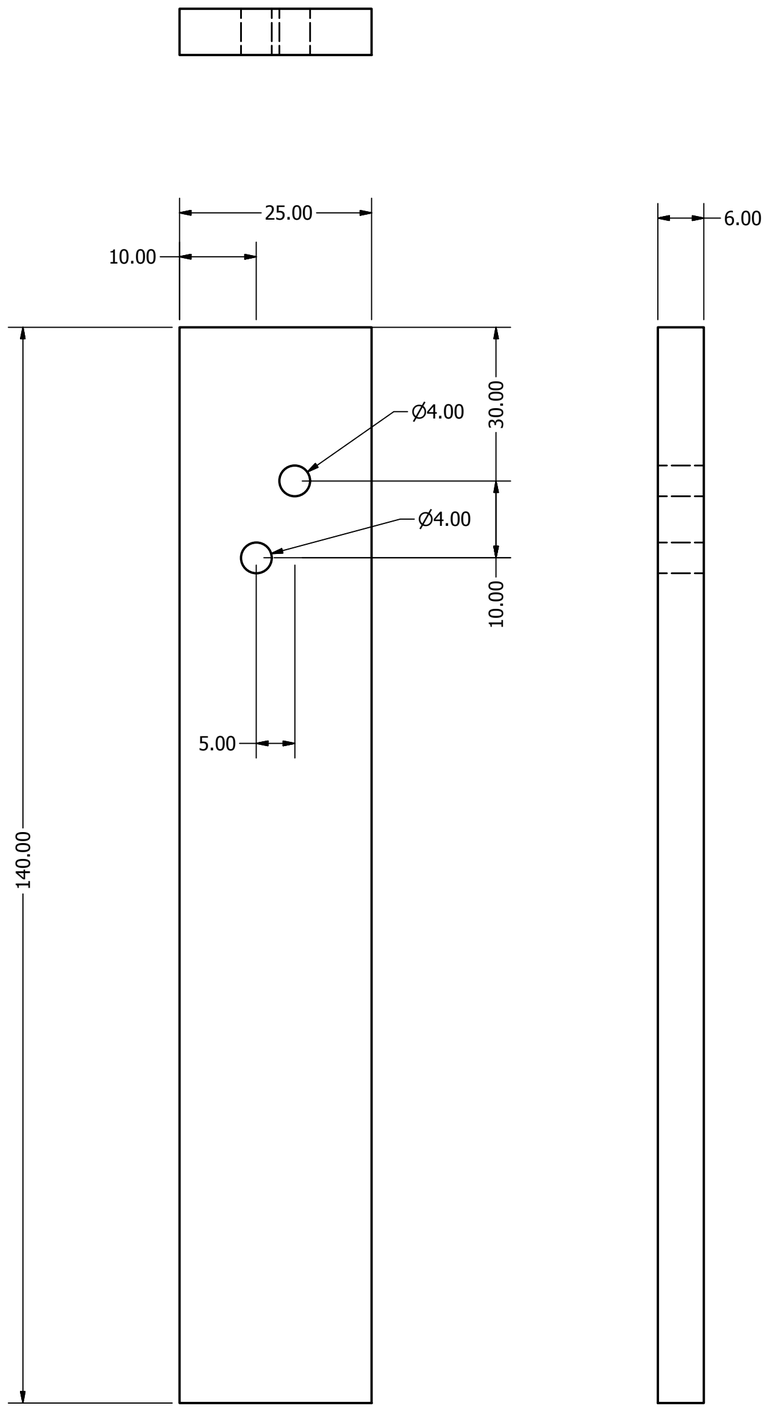
3rd ANGLE PROJECTION

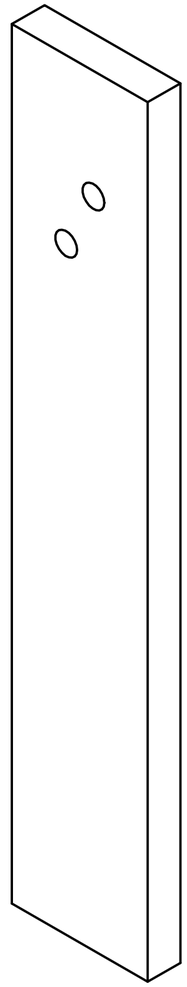




Material Required: 50mm * 50mm * 6 mm Mild Steel Angle
Quantity: 10

DRAWN Pankaj Kumar Verma	21-01-2015	TITLE: Support Angle Standard		
CHECKED		3rd ANGLE PROJECTION		
QA				
MFG		SIZE C	DWG NO	REV
APPROVED		SCALE	SHEET 1 OF 1	

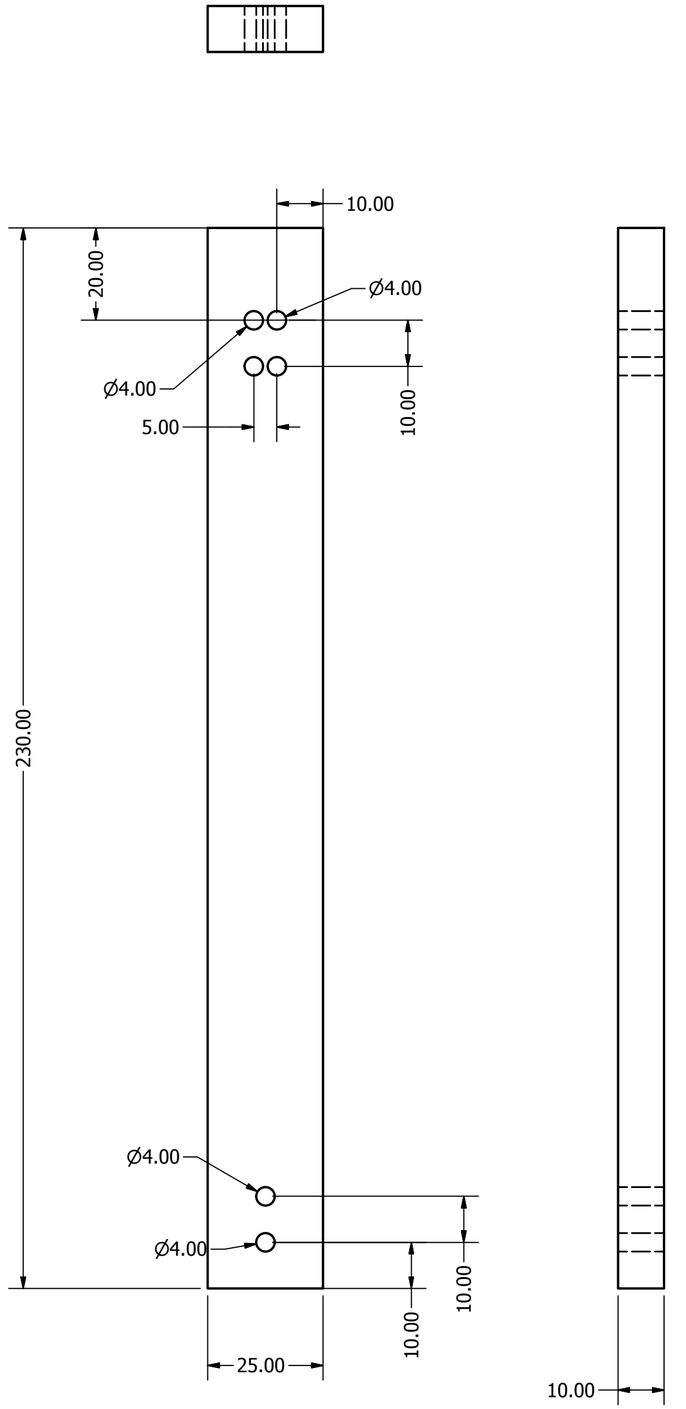


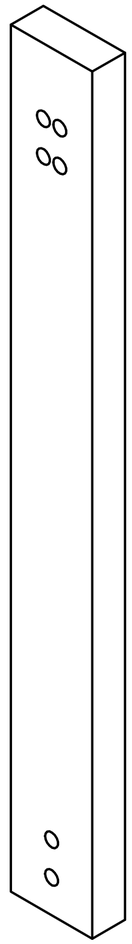


Material Required: 140mm *25mm * 6mm Mild Steel Flat
Quantity: 1

DRAWN Pankaj Kumar Verma	21-01-2015	TITLE Tray Power Transmission Bar	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO / REV
		SCALE	SHEET 1 OF 1

3rd ANGLE PROJECTION

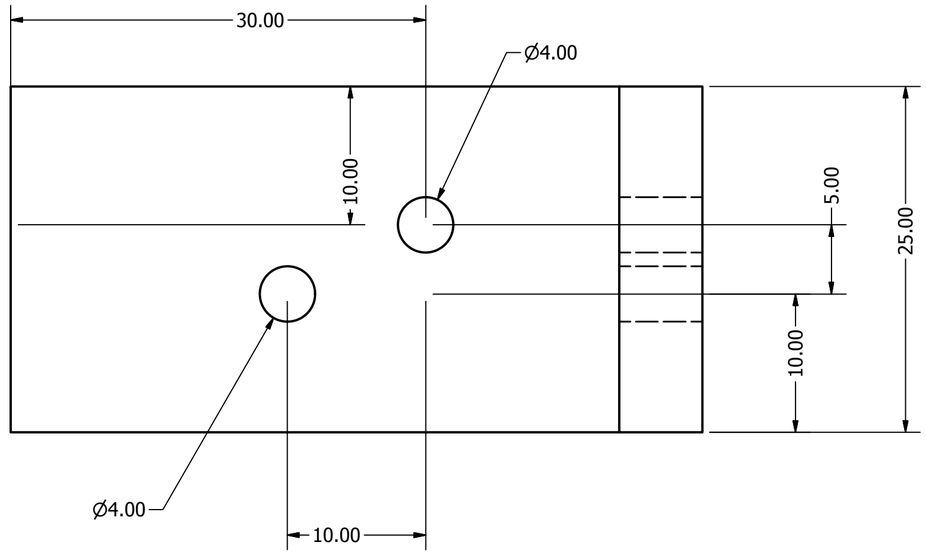


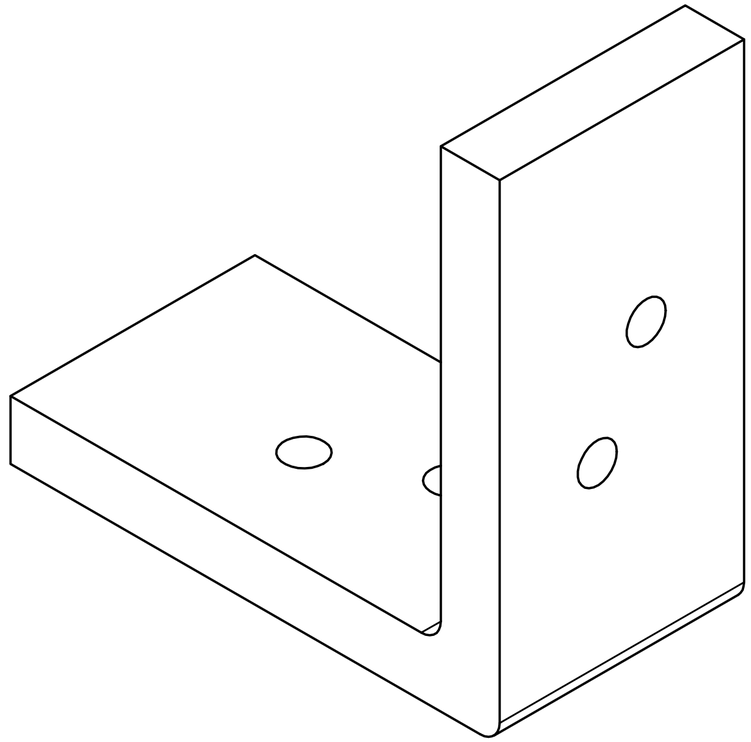


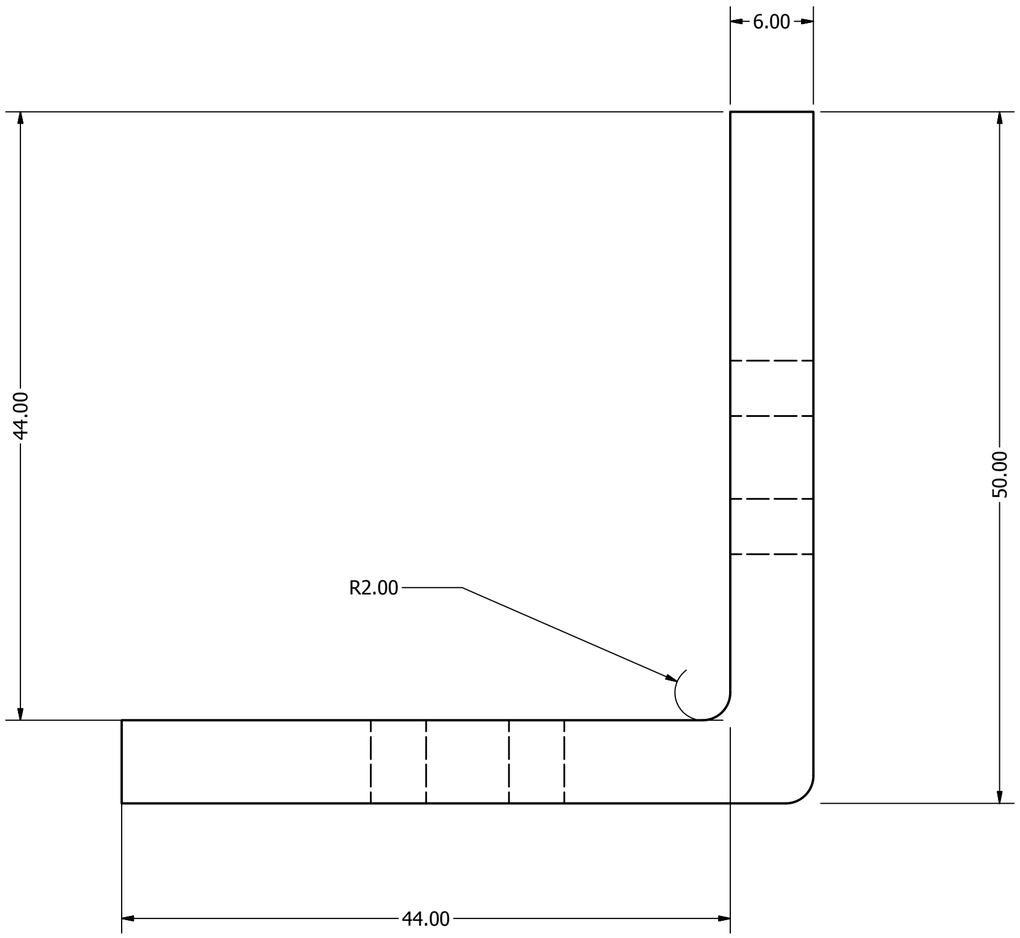
Material Required: 25mm * 230mm * 10 mm Mild Steel Flat
Quantity: 2

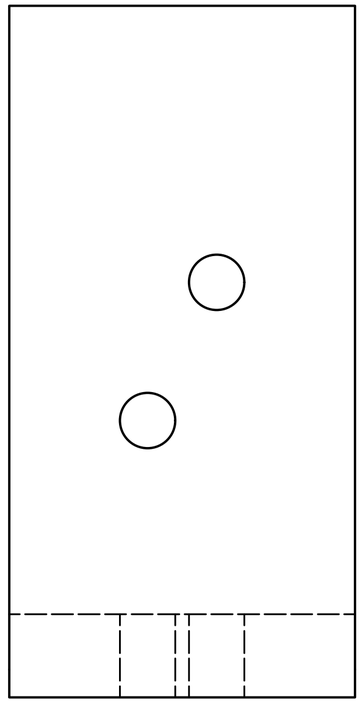
DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Tray Support	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Tray_Support
		SCALE	SHEET 1 OF 1

3rd ANGLE PROJECTION





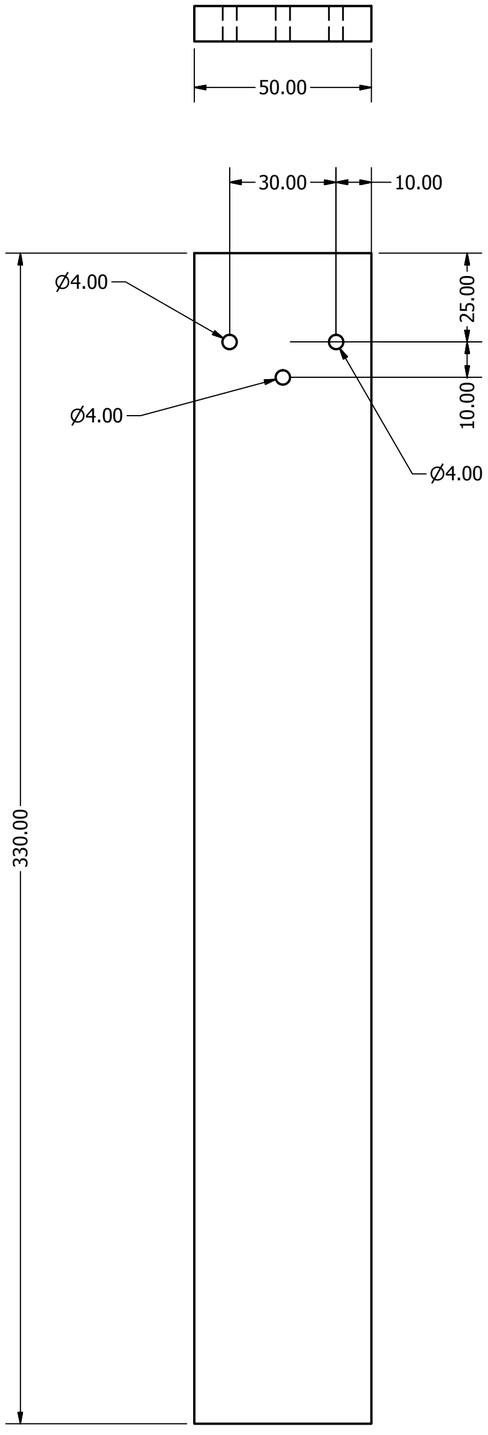


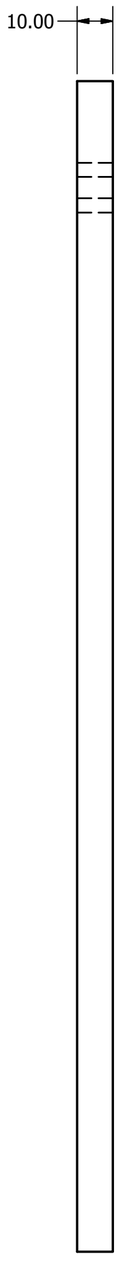


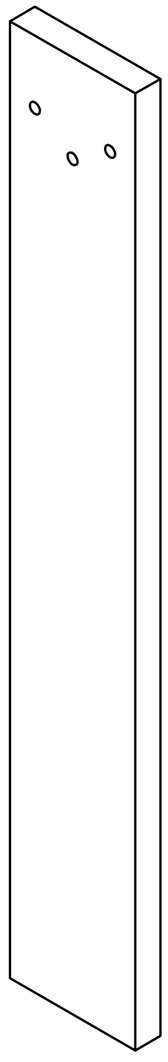
Material Required: 50mm * 50mm * 6mm Mild Steel Angle
Quantity: 3

DRAWN Pankaj Kumar Verma	20-01-2015	TITLE: Tray Supporting Wall Angle
CHECKED		
QA		
MFG		
APPROVED		
		SIZE: C; DWG NO: Tray_Support_Angle; REV:
		SCALE: ; SHEET 1 OF 1

3rd ANGLE PROJECTION



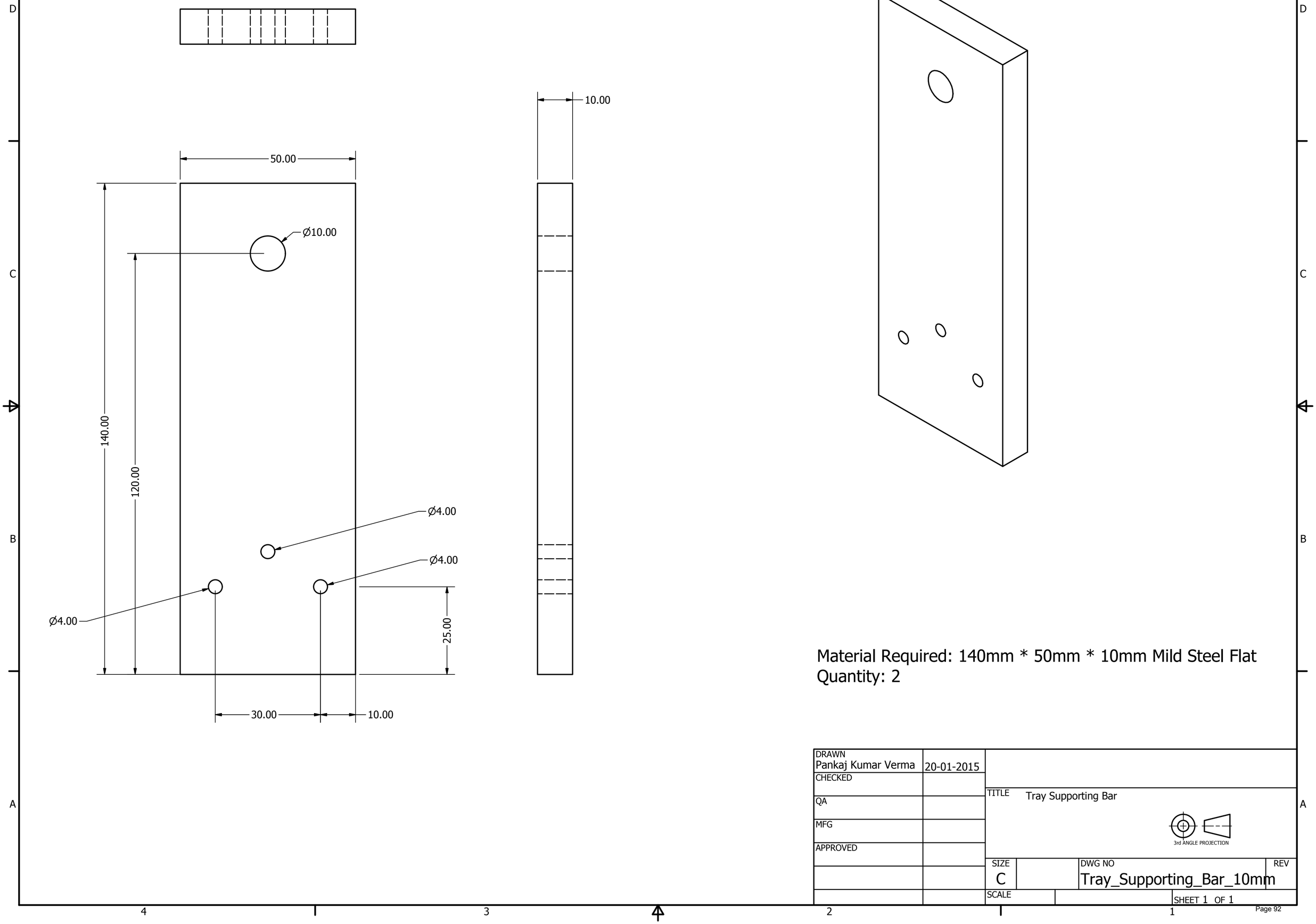




Material Required: 330mm * 50mm * 10mm Mild Steel Flat
Quantity: 2

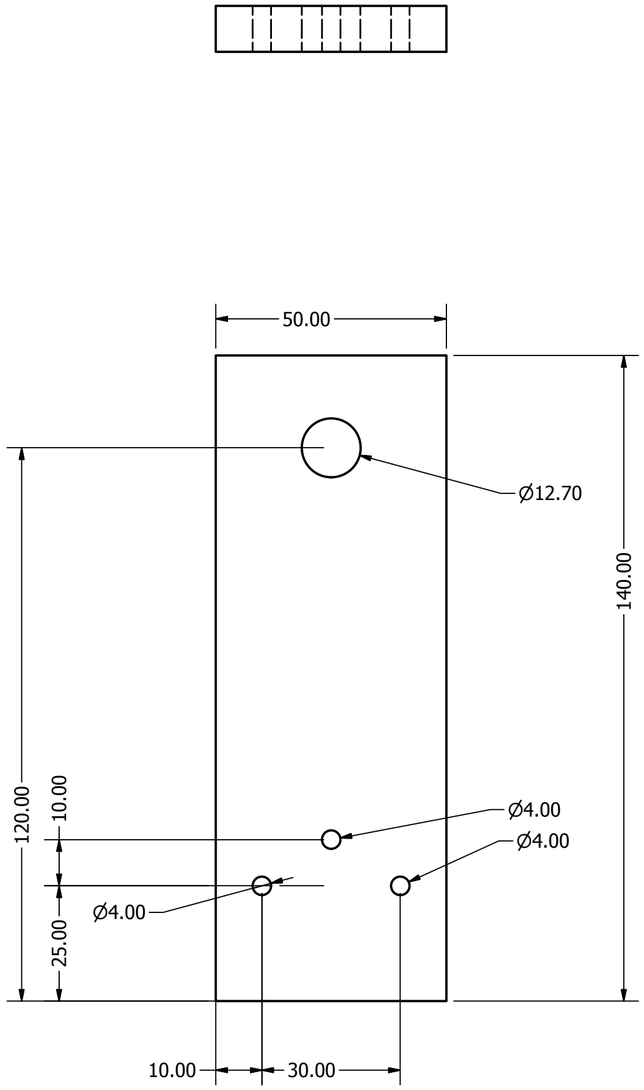
DRAWN Pankaj Kumar Verma	20-01-2015	TITLE Tray Supporting Bar	
CHECKED			
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Tray_Supporting_Bar
		SCALE	SHEET 1 OF 1

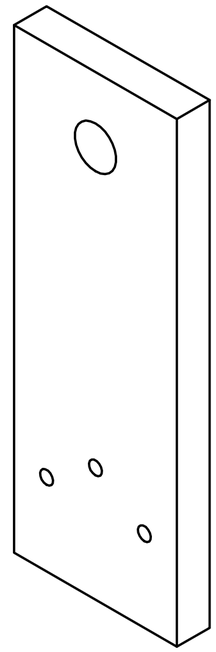
3rd ANGLE PROJECTION



Material Required: 140mm * 50mm * 10mm Mild Steel Flat
Quantity: 2

DRAWN Pankaj Kumar Verma	20-01-2015	
CHECKED		
QA		TITLE Tray Supporting Bar
MFG		3rd ANGLE PROJECTION
APPROVED		SIZE C | DWG NO Tray_Supporting_Bar_10mm | REV
		SCALE | SHEET 1 OF 1





Material Required: 140mm * 50mm * 10mm Mild Steel Flat
Quantity: 4

DRAWN Pankaj Kumar Verma	20-01-2015		
CHECKED		TITLE Wheel Support	
QA			
MFG			
APPROVED			
		SIZE C	DWG NO Wheel_Support
		SCALE	SHEET 1 OF 1

3rd ANGLE PROJECTION

APPENDIX – 10

COST ANALYSIS

COST ANALYSIS

1. Material (Mild Steel: Flat, Sheet, Angle)

Part Number	QTY	Material	Mass	Total Mass
Picking Arm 1	2	Mild Steel	0.062 kg	0.124
Picking Arm 2	2	Mild Steel	0.161 kg	0.322
Picking Arm 3	2	Mild Steel	0.305 kg	0.61
Translation Mechanism Circular Plate	1	Steel, Mild	0.880 kg	0.88
Translation Mechanism Groove Rod	1	Steel, Mild	0.140 kg	0.14
Sprocket 2	1	Steel, Mild	0.036 kg	0.036
Picking Mechanism Support Angle 1	6	Mild Steel	0.032 kg	0.192
Picking Mechanism Supporting Wall	2	Mild Steel	0.939 kg	1.878
Pulling Mechanism Angle	2	Steel, Mild	0.331 kg	0.662
Tray Lower Part	2	Steel, Mild	0.587 kg	1.174
Tray Side Wall	4	Steel, Mild	0.111 kg	0.444
Tray Angle	8	Steel, Mild	0.026 kg	0.208
Tray Supporting Angular Plate 1	1	Steel, Mild	0.129 kg	0.129
Tray Supporting Angular Plate 2	1	Steel, Mild	0.202 kg	0.202
Wheel Plate	2	Steel, Mild	2.760 kg	5.52
Wheel Angle	32	Steel, Mild	0.090 kg	2.88
Pulling Rod	1		3.905 kg	3.905
Base Plate	1	Steel, Mild	9.869 kg	9.869
Bevel Gear Support	2	Steel, Mild	0.537 kg	1.072
Plant Blocking Plate	1	Steel, Mild	0.349 kg	0.349
Support Angle Standard	10	Steel, Mild	0.218 kg	2.18
Tray Power Transmission Support Bar	1	Steel, Mild	1.292 kg	1.296
Tray Support	2	Steel, Mild	0.445 kg	0.89
Tray Support Angle	3	Steel, Mild	0.108 kg	0.324
Tray Supporting Bar	2	Steel, Mild	0.508 kg	1.016
Tray Supporting Bar 10mm	2	Steel, Mild	0.164 kg	0.328
Wheel Support	4	Steel, Mild	0.537 kg	2.28
Bevel Gear 1	**1**	Steel, Mild	0.082 kg	0.082
Bevel Gear 2	1	Steel, Mild	0.276 kg	0.276
Sprocket 1	1	Steel, Mild	0.307 kg	0.307
Total	**101**			**39.575**

Total Mass = 39.575 kg
Rate = Rs. 65 /kg
Cost = Rs. 2572

2. Material (Mild Steel: Rod)

Part Number	QTY	Material	Mass	Total Mass
Picking Arm Shaft 1.0	4	Mild Steel	0.224 kg	0.896
Picking Mechanism Shaft 2	1	Mild Steel	0.147 kg	0.147
Picking Mechanism Shaft 1	1	Mild Steel	0.023 kg	0.023
Picking Mechanism Coupler	2	Mild Steel	0.043 kg	0.086
Wheel Coupler	2	Steel, Mild	0.250 kg	0.5
Translation Mechanism Coupler 1	1	Steel, Mild	0.114 kg	0.114
Translation Mechanism Coupler 2	1	Steel, Mild	0.108 kg	0.108
Translation Mechanism Rod 10mm 1	1	Steel, Mild	0.030 kg	0.03
Translation mechanism Rod 10mm 2	2	Steel, Mild	0.123 kg	0.246
Pulling Mechanism Shaft	1	Steel, Mild	0.196 kg	0.196
Pulling shaft 2	1	Steel, Mild	0.052 kg	0.052
Spur Gear 1	1	Steel, Mild	0.054 kg	0.054
Spur Gear 2	1	Steel, Mild	0.940 kg	0.94
Shaft 210 mm	1	Steel, Mild	0.254 Kg	0.254
Wheel Rod	1	Steel, Mild	0.508 kg	0.508
Shaft 200mm	1	Steel, Mild	0.236 kg	0.236
Bevel Gear 1	**1**	Steel, Mild	0.082 kg	0.082
Bevel Gear 2	1	Steel, Mild	0.276 kg	0.276
Sprocket 1	1	Steel, Mild	0.307 kg	0.307
Sprocket 2	1	Steel, Mild	0.036 kg	0.036
Total	**26**			**5.091**

Total Mass = 5.091 kg
Rate = Rs. 80 / kg
Cost = Rs. 407

3. Machining Cost

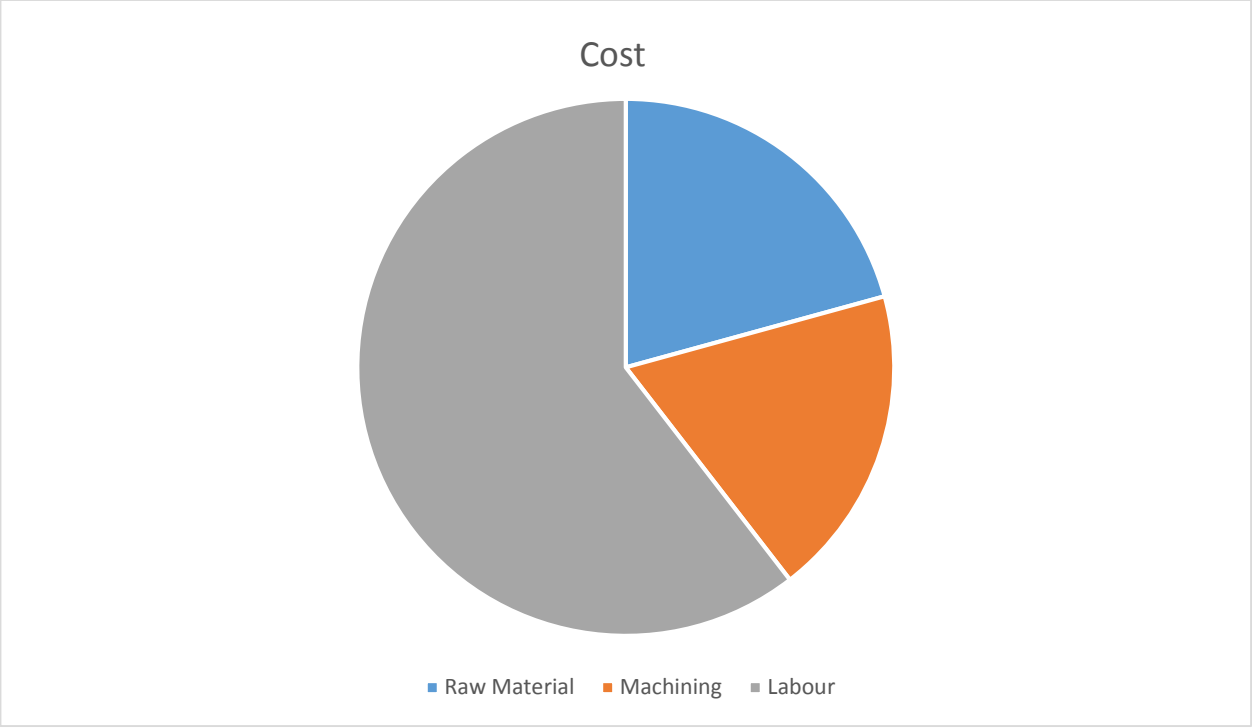
Machine	Rate	Time (hr)	Cost (Rs.)
Lathe	Rs. 150 / hr	6	900
Milling	Rs. 250 / hr	4	1000
Drilling	Rs. 75 / hr	10	750
Cutting	Rs. 50 / hr	1	50
CNC	Rs. 1200 / hr	0	0
Total			**2700**

4. Labour

Type of Labour	Rate	Time (hr)	Cost (Rs.)
Skilled	Rs. 400 / Day	60	3000
Unskilled	Rs. 350 / Day	130	5688
Total		**190**	**8688**

Table for total cost:

Type	Cost
Raw Material	2979
Machining	2700
Labour	8688
Total	**14367**



Weakness of the device

1. The planting unit is not much robust.
2. The angle at which the tray is inclined is very high.

Suggested Improvements

1. A more robust planting unit can be fabricated, with help of iteration of the different types of heads of the Planting Arm 3.
2. Multiple machines can be used by connecting the in a line to a tractor. This will increase the no. of rows of transplantation and decrease the labour cost.