

# Design of Post Hole Digger Machine

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**Abstract**— Conventionally digging a deep holes or larger diameter holes requires more work and time. So in order to reduce this losses we are planning to design a post hole digger machine for Kamco Tera-trac 4W tractor. Post hole digger machine is used to reduce the man work and time for digging holes. These holes can be used for fixing electric post and different plantation such as rubber plant, coconut, sugar cane etc.

For rigid power and support, machine is attached to Kamco Tera-trac 4W tractor by means of PTO (power take off) shaft and three point linkage. PTO shaft of the tractor act as a basic power input and three point linkage provide a rigid support to the machine. Guarded shaft is used to transfer power from PTO shaft to the digger machine. Blades are provided at the end of the machine is used for digging holes. Various type of holes can be created by using different diameter and length of blades.

For designing Post hole digger machine, Creo parametric 1.0 software is used. Creo is 3D mechanical CAD software in which Drafting and assembly can be done easily.

**Keywords**— PTO, tractor, Guarded shaft, blades.

## I. INTRODUCTION

### OLD DIGGING TOOLS

The principle tool of the Neolithic farmers was the hoe, which had a stone head lashed to the handle, like the woodworker's adze of the time. Down to the middle age shovels for shifting earth or mixing mortar were made of solid wood, but spade for digging were shod with iron, usually costing about four times as much as the spade itself. The digging mattock is directly descendant of the roman soldier-carpenter's axe-adze, which also fathered the pickaxe. Digging forks and hand forks came later.

### KAMCO Tera-TRAC 4W tractor

Kerala Agro Machinery Corporation Limited (KAMCO), a state government enterprise marked its foray into manufacturing of tractors as a result TeraTRAC 4W formed and it sensing good demand, the corporation plans to market tractors in domestic as well as overseas markets. The company is rolling out the tractors which feature a 15-HP diesel engine, power steering, and four-wheel drive. Its engine is KOHLER LOMBARDINI KDW 702 engine and it's a watercooled four stroke engine. It has two cylinders to get a continuous

11.5kw operation and having a displacement of 686 cc. Its engine power is 11.5kw at 3200rpm and PTO power is 10kw at 3200 rpm. This tractor has 9L of fuel tank capacity and it possesses three point hitches for linkage purpose.



Kamco Tera-Trac 4W

Engine	KOHLER LOMBARDINI KDW 702
Type	Diesel engine, water-cooled, four stroke
Power	Continuous 11.5kw
No. of cylinders	2
Total displacement	686 cc
Engine gross power	11.5@3200rpm KW
Engine net power	11.5@3200rpm KW
PTO Power	10.0@3200
Fuel tank capacity	9 L
Hydraulic control system	Position Control Valve
Pump capacity	12L/min
Three point hitch	Category 1
Max. lift force at lift points	3000 N
24 in. behind	2400 N
Front tire	5.0*10" ,4 ply
Rear tire	6.5*16" ,6 ply
Weight	550kg
Overall Length	2236 mm
Overall width	875 mm
Overall height	1820 mm
Wheelbase	1228 mm
Minimum ground clearance	210 mm
Light Unit	12 volts, 40 Watts

Specification of KAMCO TeraTRAC 4W tractor

### Power take-off shaft (PTO):

A power take-off or PTO (fig.1.3) is one of the several methods for taking power from a power source, such as a running engine, and transmitting it to an application such as an attached implement or separate machines. Most commonly, it is a system comprising a splined output shaft on a tractor or truck, designed so that a PTO shaft, a kind of drive shaft, can be easily connected and disconnected, and a corresponding input shaft on the application end. The power take-off allows implements to draw energy from the engine. Semipermanently mounted power take-offs can also be found on industrial and marine engines. These applications typically use a drive shaft and bolted joint to transmit power to a secondary implement or accessory. In the case of a marine application, such shafts may be used to power fire pumps.[ Kim 2008].



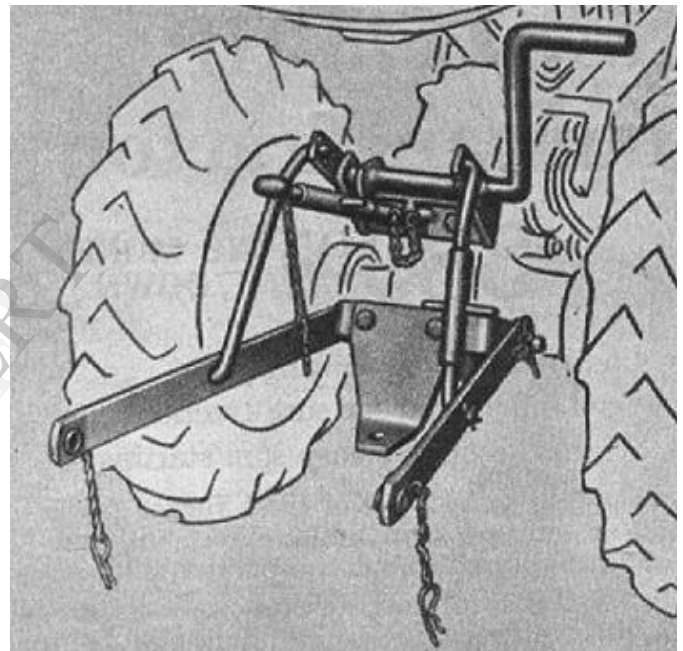
Power take-off shaft

PTO (Engine speed)	540,1000 rpm
Steering	Hydraulic
Transmission	4 Forward and Reverse 2
Brake	Oil immersed
Minimum turning radius (with brake)	2.56 m
Traveling speed	17.74 max km/h

Specification of PTO shaft

### Three point hitch

The three-point hitch most often refers to the way ploughs and other implements are attached to an agricultural tractor. The three points resemble either a triangle, or the letter A. Three point attachments are the simplest and the only statically determinate way of joining two bodies in engineering. A three point hitch attaches the implement to the tractor so that the orientation of the implement is fixed with respect to the tractor and the arm position of the hitch. The tractor carries some or all of the weight of the implement. The other main mechanism for attaching a load is through a drawbar, a single point, pivoting attachment where the implement or trailer is not in a fixed position with respect to the tractor. The three-point hitch is made up of several components working together. These include the tractor's hydraulic system, attaching points, the lifting arms, and stabilizers.



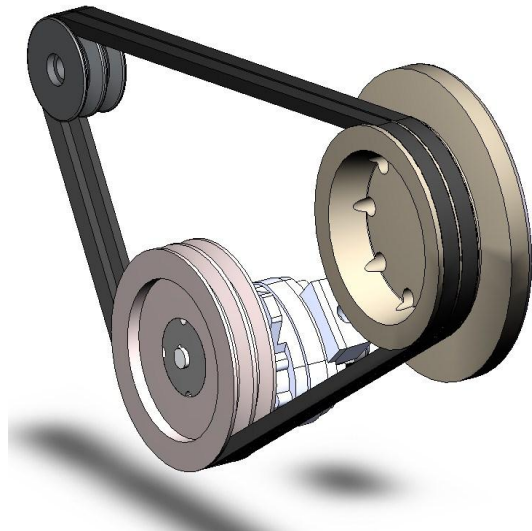
Three point hitch

Three-point hitches are composed of three movable arms. The two lower arms the hitch lifting arms are controlled by the hydraulic system, and provide lifting, lowering, and even tilting to the arms. The upper center arm called the top link is movable, but is usually not powered by the tractor's hydraulic system. Each arm has an attachment device to connect implements to the hitch. Each hitch has attachment holes for attaching implements, and the implement has posts that fit through the holes. The implement is secured by placing a pin on the ends of the posts.

### Belt and pulley system

A belt and pulley system is characterized by two or more pulleys in common to a belt. This allows for mechanical power, torque, and speed to be transmitted across axles. A belt drive is analogous to that of a chain drive, however a belt

sheave may be smooth so that the mechanical advantage is approximately given by the ratio of the pitch diameter of the sheaves only, not fixed exactly by the ratio of teeth as with gears and sprockets.



Belt and pulley system

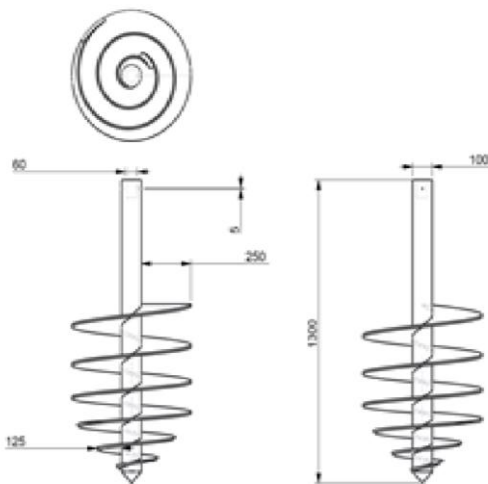
**Design parameter**

**General Working**

Post hole digger machine is used for digging round hole especially inserting electric post. Digging a hole by using pickaxe or any other digging tool consumes a lot of man power and time. In post hole digger machine, digging blades are attached to the end of the machine. By using these blades we can simply make hole without any manpower and less time. These blades are mounted on a main shaft and shaft is directly connected with power take off shaft of the tractor or may not be with guarded shaft coupling to get the input power.

**Blades**

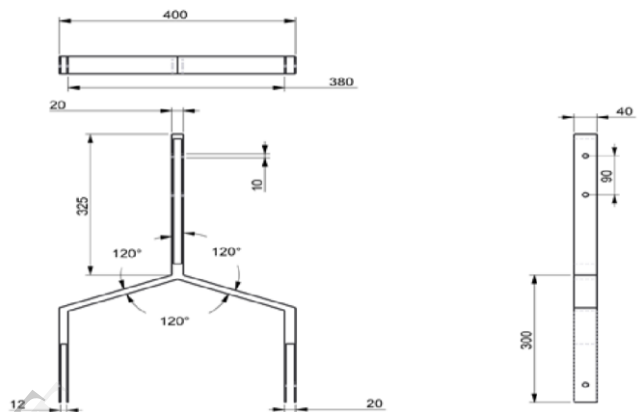
The most important parts of the post hole digger machine are its blades. The diameter and the depth of the hole can be varied by putting different blades. Mainly the blades have a swirl structure which has an advantage for making holes easily. The blades are



mainly made of steel and cast iron. The front end of the blades is made sharpened.

- Blade length : 1300mm
- Shaft outer diameter: 100mm
- Shaft inner diameter: 60mm
- Pin hole diameter : 5mm
- Blade diameter : 0 to 250mm

**Three point hitch**

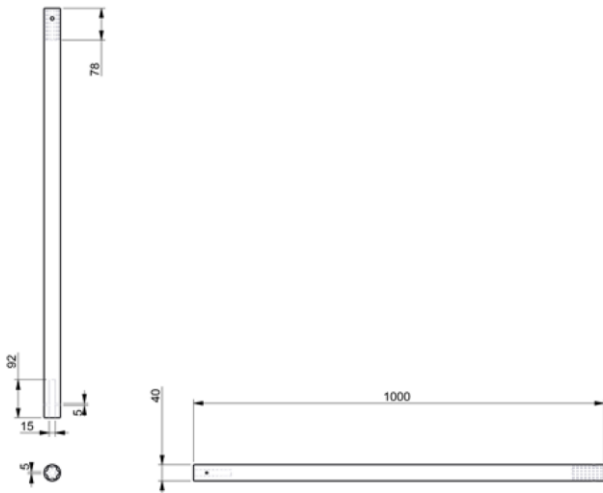


The three-point hitch most often refers to the way ploughs and other implements are attached to an agricultural tractor. The three points resemble either a triangle, or the letter A. Three point attachments are the simplest and the only statically determinate way of joining two bodies in engineering. A three point hitch attaches the implement to the tractor so that the orientation of the implement is fixed with respect to the tractor and the arm position of the hitch. The tractor carries some or all of the weight of the implement. The other main mechanism for attaching a load is through a drawbar, a single point, pivoting attachment where the implement or trailer is not in a fixed position with respect to the tractor.

- Total length : 625mm
- Angle between each linkage: 120°
- Diameter of the linkage : 40mm

**Connecting rod**

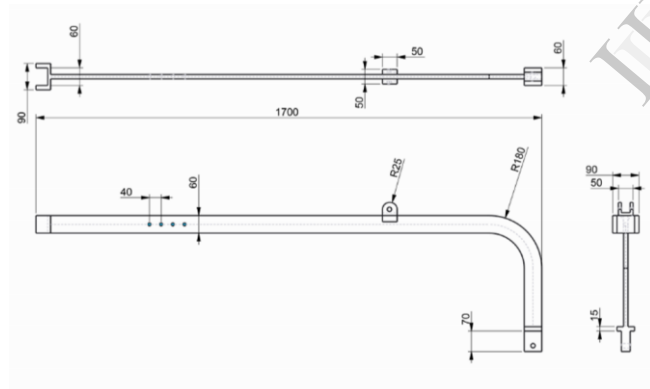
Connecting rod is a connecting element, which is connected between the guarded shaft and the bevel gear. This connecting rod is mainly made of cast iron. One end of the connecting rod has a spline shape structure and the other end has a hollow cylindrical shape. The bevel gear is connected to the hollow cylindrical end by using a pin.



Total length of the rod : 1000mm  
 Diameter of the shaft : 40mm  
 Spline length : 78mm  
 Hollow cylindrical length : 92mm  
 Diameter of the hollow cylinder: 15mm  
 Diameter of the pin : 5mm

**Frame**

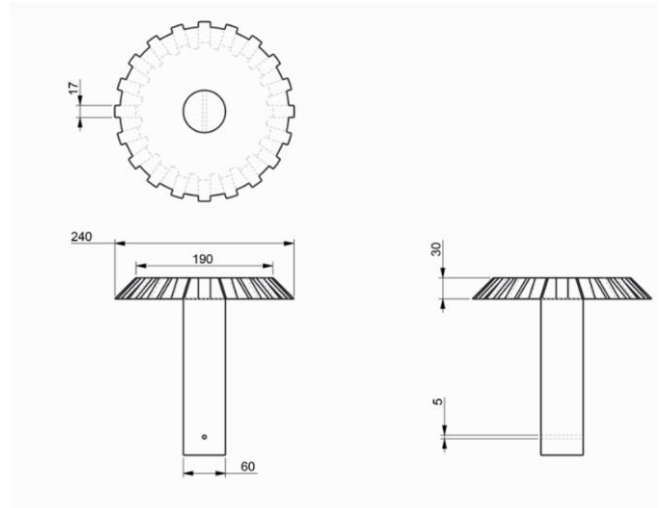
It is a solid body, which holds entire machine. It is made up of cast iron. It has an L- shape structure and a pneumatic piston is used for controlling the motion of the apparatus.



Total length of the frame: 1700mm  
 Radius of the frame: 180mm  
 Radius of the frame: 60mm

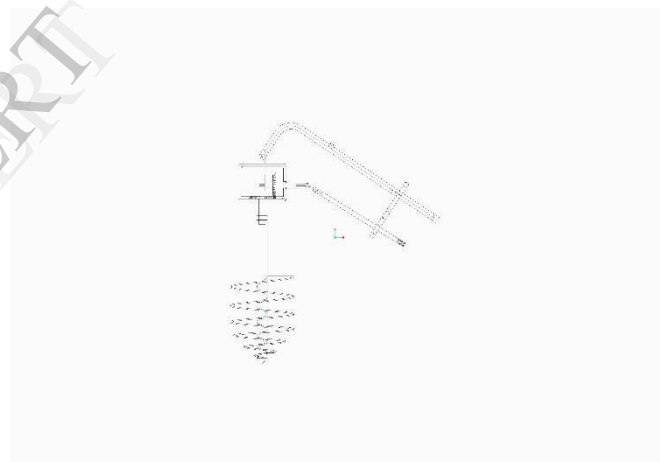
**Bevel gear**

Bevel gears are gears where the axes of the two shafts intersect and the tooth-bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart, but can be designed to work at other angles as well. The pitch surface of bevel gears is a cone.



Larger diameter of the bevel gear : 240mm  
 Smaller diameter of the bevel gear: 190mm  
 Diameter of the shaft : 60mm  
 Thickness of the gear : 17mm

**Overall view**



**CONCLUSION**

This project provide a view of design a Post hole digger machine with respect to the specification features of Kamco Tera- trac 4w tractor. Power input is taken from the power take off shaft (PTO) of this tractor. Three point linkage provide rigid support and reduce the vibration.it can also use for the mobility of digger machine. Power from the PTO shaft is transferred to the digger machine by using guarded shaft. Speed can be increased by changing the gear ratio. Blades are provided at the end of the machine which is used for digging holes. The various types of holes can be created by using different diameter and length of blades. Creo parametric 1.0 for designing the post hole digger machine.

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