IARJSET
ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
ISO 3297:2007 Certified
Vol. 4, Issue 5, May 2017

# Design and Fabrication of Trenching Machine

**Sanket Khatpe[1], Amol Khedekar[2], Prithviraj Kale[3], Balkrishna Nandavadekar[4], Prashant Zodge[5]**

Department of Mechanical Engineering, NBN Sinhgad College of Engineering Pune[1,2,3,4]

Assistant Professor, Department of Mechanical Engineering, NBN Sinhgad College of Engineering Pune[5]

**Abstract:** A trencher (machine) is a device used for digging trenches, used for laying pipes & cables, for setting up drainage or in preparation for trench warfare strategy. Also irrigation is very necessary for cultivation of crops. Usually rivers are far from agri-lands, which creates difficulty to irrigate. To overcome this problem of irrigation, pipeline have been developed which connects river with agri-lands. In present days, it is been followed manually with heavy machines, which results in high economic costs and time. Trenchless methods are attractive solutions in areas where difficult ground conditions exist, high groundwater table, or urban settings with highly congested infrastructure render open trench excavation highly undesirable. Such settings may include pipeline routings under a river, heavily travelled roadways, or railroad line.

**Keywords:** Trencher, Cutter, Blade, Agriculture.

## 1. INTRODUCTION

Today trenching for pipelines in India or worldwide is continuous process, which asks for a huge man power as well as the money. In fact, trenching for pipelines in a farm or from water source to demand field requires approximately 30-40% of the total work expense. In order to minimize or reduce the trenching cost by 50% which we spend on man power, we should ad opt a portable trenching machine ,which machine requires only 50% or less than that of man power. A portable trencher machine in operation.

Landscapers and lawn care specialist may us a portable trencher to install landscape edging and irrigation lines. These machines are lightweight (around 200 pounds) and are easily maneuverable compared to other types of trenchers. The cutting implement may be a chain or a blade similar to a rotary lawn mower blade oriented so that it rotates in a vertical plane. A trencher may be combined with a drainage pipe or geo textile feeder unit and back filler, so drain or textile may be placed and the trench filled in one pass .Trenches range in width from 130mm to 550mm and can be dough to an average depth of 900mm*. Trenches can be dug to a depth of 800mm (depending on soil conditions) A heavy duty machine built to handle the extreme demands of the contractor Operator, it boasts more 'grunt' and a larger safe working load enabling it to power heavier industrial attachments, while still maintaining the ability to go through a standard door way. In order to increase soil fertility, farmers acquire the aid of fertilizers. This process is done by digging up manually a trench in the land to embed the fertilizer then refilling it. This procedure is time consuming. The hand labor required to accomplish this work increases the expenses of cultivation for the farmers. Reducing time and cost are two main objectives of our study. A much economical solution was introduced where farmers could resort to automation to fertilize the soil instead of manual labor.

## 2. SPECIFICATION OF ENGINE

| | |
|---|---|
| Type | 2 Stroke , Air Cooled |
| Cylinders | 1 |
| Max Power | 3.5 bhp 5000 rpm |
| Max Torque | 5Nm @3750 rpm |
| Bore | 46mm |
| Stroke | 42mm |
| Fuel Type | Petrol |
| Gear Box Type | Automatic |
| Transmission Type | Chain Drive |
| Displacement | 69.90cc |

## 3. MODEL

The trenching machine consists of a frame, 2 stroke engine, cutting blades, chain, wheels, bearing, sprocket and pinion .The cutting blade is connected to the engine by means of the chain and sprocket. The next cutting blade which is

IARJSET
ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
ISO 3297:2007 Certified
Vol. 4, Issue 5, May 2017

rotating with the axis perpendicular to the engine shaft is connected by means of a chain drive. The soil is removed by the blades which is attached to the chain drive. To apply vertical pressure on chain drive, a pneumatic cylinder is used so as to achieve the desired depth.

Fig 1.Trenching machine

## 4. DESIGN AND SELECTION OF PARTS

**Force required to remove soil**

P = ( ϒgd + C + q)dw
P = Force cutting
ϒ = Soil density
g = acceleration due to quality
c = collision seed or soil
q = surcharge pressure or soil
w = foot width = 20mm
d = cutting depth = 450mm
ϒ = max = 2.20g/cm$^3$ = 2200 kg/m$^3$
c = 105 Kpa = 1.05*10$^5$ N/m$^2$
q = 900 kN/m$^3$ = 0.900 N/m$^3$
F =[ ( 2200 * 9.8 *0.450 ) + 1.05*10$^5$ + 0.900 ) ]*( 0.450 * .020 )
F = 10323.261 N

**Design for frame**

Material used – mild steel, square pipe
Area=1*1 inch=25.4*25.4 = 645.16 mm$^2$
Length of link=24 inch=24*25.4=609.6 mm
Weight of engine t=15 kg= 15*9.81 =147.15 N

**Design of chain and sprocket**

Pitch Circle diameter of sprocket =91.92 mm
Number of teeth on sprocket = 16
Number of teeth on sprocket wheel = 16
Roller diameter, d1=11.91mm
Width, b1=12.57mm Pitch = 19.05mm
Load on shaft =31100 N

**Design for shaft**

Material for shaft is C30 Maximum diameter as 12mm for the shaft.

**Design of Bearings**

Bearing type:- SKF 6001 bearing.
Inner diameter =12mm
Outer diameter, D=28mm
Width, B=8mm

**Double acting pneumatic cylinder** of 30 mm bore diameter and 150 mm stroke length is used

IARJSET
ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
ISO 3297:2007 Certified
Vol. 4, Issue 5, May 2017

## 5. WORKING

Fig 2. Block Diagram Of Trenching Machine

The trenching machine consists of a frame, 2 stroke engine, cutting blades, chain, dummy wheels ,bearing, sprocket and pinion .The cutting blade is connected to the engine by means of the chain drive and sprocket The next cutting blade which is rotating with the axis perpendicular to the engine shaft is connected by means of chain drive .The soil is removed by the blade which are mounted on the chain drive which is Connected to main engine shaft. which is connected to the engine. When the engine is started, the main shaft rotates and we get a power output of 5000 RPM, 3.5bHP . This power is transmitted to the main shaft which is fitted on the frame.

## 6. CONCLUSION

We have taken up this project as real challenge, as we were not experience in the agri-machine field. We started our work on this project facing new challenges. After the completion of the project work we tested it in the agri-land and we are pleased to note that it does meet the requirements for what it is meant. This machine is developed to reduce the time and effort required for production up to the great extent &also this machine manufacturing cost is less as compared to other. The maneuverability of the device is quite good and the handling is quite simple. For commercial purpose, one can improve the efficiency of the device effectively by better modification and by using the standard materials.

## ACKNOWLEDGMENT

This paper is the outcome of hard work with the help and cooperation from many sources. We would like to show our gratitude to the college management and also we are immensely grateful to all the faculties of the department of mechanical engineering, NBN Sinhgad College of Engineering.

## REFERENCES

[1] THE PIPELINE TRENCHER trenching%20machine/pipeline%20trenching%20machine.pdf
[2] Irizarry, J., D.M. Abraham, R.D. Wirahadikusumah, and C. Arboleda. 2002. Analysis of Safety Issues in Trenching Operations. 10th Annual Symposium on Construction Innovation and Global Competitiveness, September 9-13, 2002. sConstruction
[3] Lee, S., and D.W. Halpin. 2003. Predictive tool for estimating accident risk. Journal of Construction Engineering and Management, American Society of Civil Engineers (ASCE). 129(4):431-36. Lew, J., D.M. Abraham, R.D. Wirahadikusumah, J. Irizarry, and C.A. Arboleda. 2002. Excavation and trenching safety: Existing standards and challenges. Proceedings of Triennial Conference CIH WO99 Implementation of Safety and Health on Construction Sites, May 7-10, 2002, Hong Kong.
[4] Jiya .Y.J, Zhu .X.H, Institute of Mechanical Engineering, Southwest Petroleum University, Chengdu, Sichuan 610500, PR China,"3D mechanical modeling of soil orthogonal cutting under a single reamer cutter based on Drucker– Prager criterion",International Journal of Innovative Research in Science, Engineering and Technology
[5] Srinivasan. K, Viswanath R. P , College of Engineering Guindy, Chennai, Tamil Nadu, India "Design and Optimisation of Blades for Rotavators" , International Journal of Innovative Research in Science, Engineering and Technology
[6] Md. AqibNaque ,Akhtar Ali Rizvi ,Amogh v. Tijare , P. C. E. Nagpur, Maharashtra, India"Development and Fabrication of SoilTiller and Weeder", International journal for innovation in engineering and technology