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Research Paper

MACHINE DESIGN AND ANALYSIS TO LAND LONG NARROW WAY CUTTING (DIGGING) FOR SIGNIFICANT OF BURY BY CABLE LINE, PIPE AND SEWAGE LINE

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The new machine designed to cutting (digging) the soil land for long narrow ways. The machine is used to cable wire bury by cutting the long narrow way, it is similar to pipe line bury way cutting, sewage way cutting, etc. The machine consists of major parts are follow as power transmission unit, cutting blades screwed with chain unit, depth adjustment unit, screw conveyor of container unit, frame and chassis unit, automatic feed unit, etc. Blades assembled with the chain unit is supporting with main shaft and guided shaft. The both shafts having sprockets are keyed with its. The sprockets is meshed with the inside of chain unit. Main shaft is transmission power receive from the engine shaft. The chain unit of rotation along by transmit from main shaft to guide shaft rotation. After cutting soil is sent through blade to collecting tank and it is consist of screw conveyor by unloading the cutting soil away from cut area. Depth of cut adjustment is along from the spindle screw rotation. The spindle forward movement is given by increase the depth of cut. Pivot joint of the chain unit is provide to radially depth of cut adjustment. Also during the soil cutting is provide the feeding taken from the machine movement. That is attain from two ways by one way is manually operating the machine movement and another one is automatic operating the machine movement. Automatic mode is access along by using the speed reduction gear box unit. In the unit is transmission power taken from the main shaft. The machine consists of rate of depth of cut, feed, speed, chain inclination, etc., is depending upon the soil properties of condition.

Keywords: Depth of cut, Feed rate, Soil, Narrow way, Blade, Cutting

INTRODUCTION

The machine design consideration for main reasons of the actual working difficulties comes to reduce. High depth of cut by two or more passes of the machine is provide to required depth of cut. Also the path of width

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is constantly maintain by to entire depth of cutting operation. The depth of cut is depending on the soil wet or dry condition and its properties of the soil condition. It has constant feed rate and depth of cut by regulate the soil cutting (digging) operation as our requirement.

Such as effectively energy utilization is possiblethan other heavy machinery. Manual work is lead to human fatigue and hurt, to spend more labour charge and deficiency of workers, slow of working performance, etc. So, the difficulties rectified along by means of the new machine designed. Engine placed by top of machine for act as dead weight. Thus the machine vibration also comes to reduced and increase the stable of machine during working condition.

MAJOR PARTS OF MACHINE

Chain with Blades Assemble Unit

In the chain unit consist of blades are screwed with the chain belt. It is made by stainless steel material for main reason of corrosive resistance, toughness wear resistance properties belong from the stainless material. So, blade consist of cutting point is designed to effectively cutting by means of similar for saw tooth of end cutting edges.

Screw Conveyor Assembled with Container

Screw conveyor is bearing supported with its container unit. It has been V-pulley keyed with screw conveyor shaft of one end. Such as power is transmitted from engine pulley to screw conveyor pulley through the V-belt drive. The container made by thin steel sheet material.

Figure 1: Designed Machine Illustrate

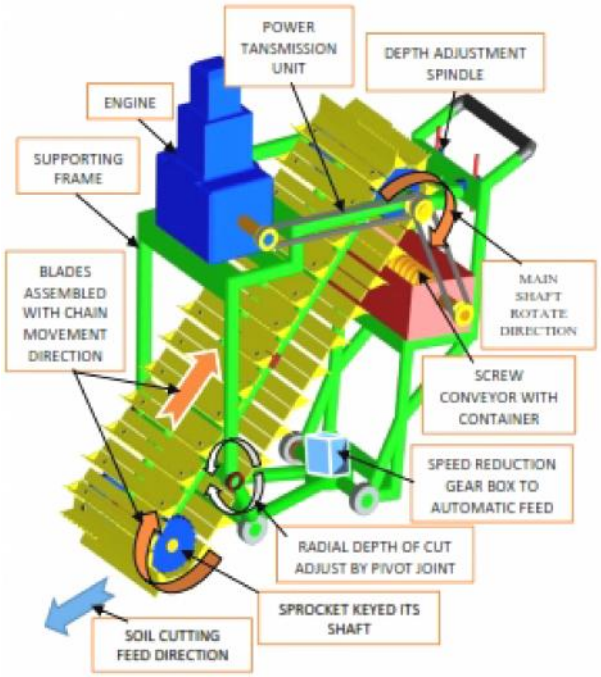
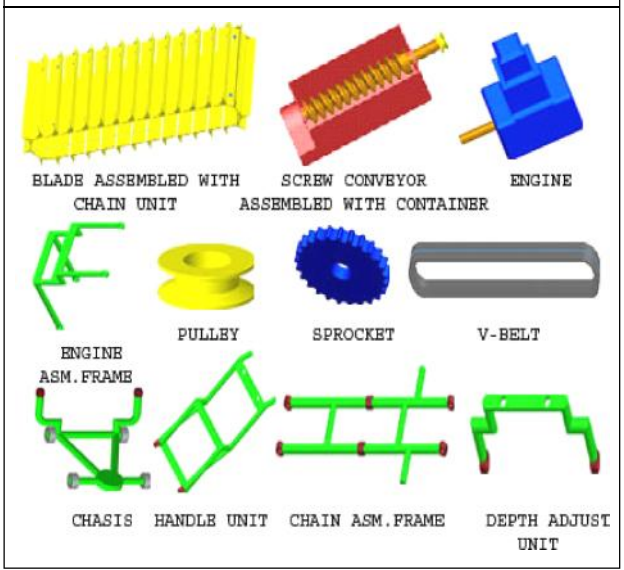


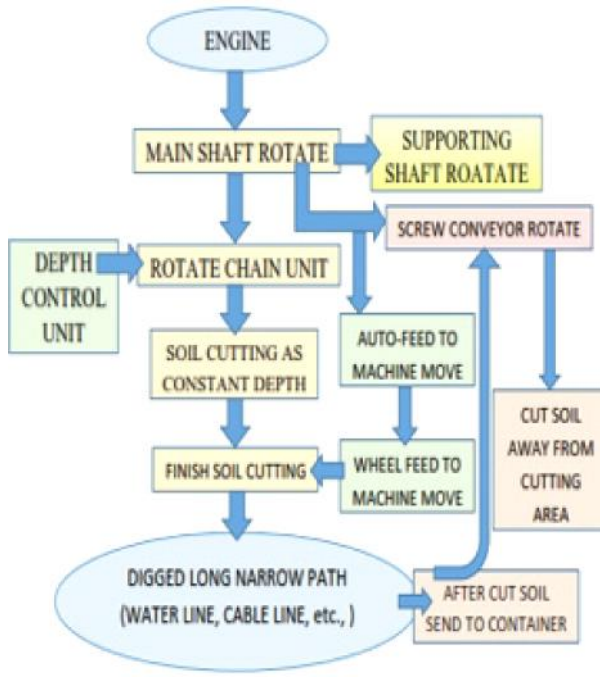
Figure 2: Major Parts of Machine



Power Transmission and Feeding Unit

V-belt drive is used to power transmission from one unit to other unit having pulley keyed with its shafts. Wheel feeding by means of speed reduction gear box unit attached to provide

Figure 3: Over-All Functions of Machine



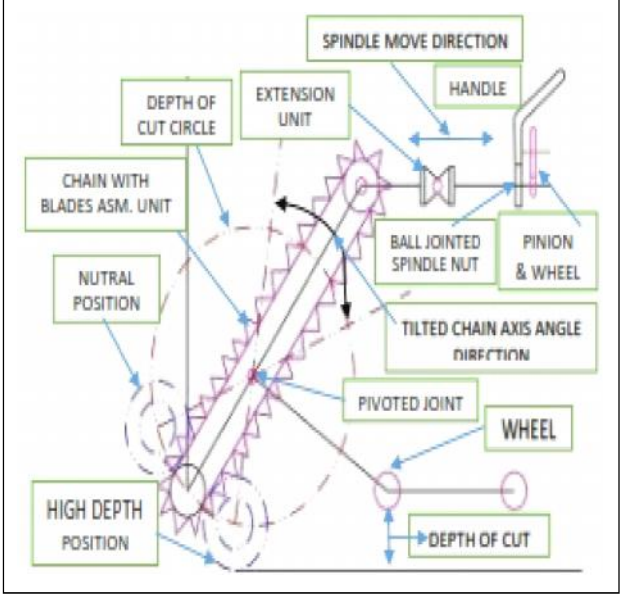
automatic movement of the machine. The unit is convert the driving shaft speed comes to reduce the level of feeding wheel. The feed rate adjustment is according to our requirement. The feed control along by achieve the speed of engine and gear reduction unit through adjust the feed rate.

WORKING METHODOLOGY

Depth of Cut Adjustment Mechanism

Main function of the unit is radially turn along the depth of cut circle of depth adjustment is provide to various of depth range. But, the depth adjustments are lie between range on radially turn from pivot joint upto top most of blade cutting point boundary. The chain assembled with the sprocket wheel and it is mounted on the rotating shaft. The both end of two shaft supported along the radial adjustment of chain frame.

Figure 4: Depth of Cut Mechanism



CALCULATION

Depth of Cut

Spindle thread pitch = 15 mm (from graphical experimental)

1 revolution of gear wheel = 8 times of pinion rotation

1 revolution of wheel = 8 × 15 = 120 mm displacement of spindle

1 mm displacement of spindle = 1/120 times of gear wheel rotation

320 mm (from graphical experimental) displacement of spindle = 15° inclination angle from chain axis to normal axis

15° inclination angle from chain axis to normal axis = 320 × (1/120) times of gear wheel rotation.

15° inclination angle from chain axis to normal axis = 3 times of gear wheel rotation

3 times of gear wheel rotation = 80 mm depth of cut (from graphical experimental)

Feed of Length

1 complete revolution of wheel = 5 second

Feed of machine (N) = 1/5 = 0.2 rps.

1 revolution of wheel = 1 perimeter of the wheel

$\Pi \times D = \Pi \times 100 = 314$ mm linear displacement of machine

SPEED = $\Pi \times D \times N = \Pi \times 100 \times 0.2$

62.8 mm/sec × (60/1000) = 3.76 m/min

ANALYSIS

Depth of Cut Circle Analysis of Tabulation

Here, the table value is the depth of cut circle radius increase with consequent of soil depth of cut increased. Such as the depth of cut circle decrease along by the depth of cut of soil is automatically decreased.

Table 1: Depth of Cut Circle Radius = 225 mm

S. No.	No's of Wheel Revolution	Inclination Angle	Depth of Cut (mm)
1.	Nil	35°	Neutral position (ideal)
2.	3	50°	80
3.	3 + 3 = 6	65°	80 + 50 = 130

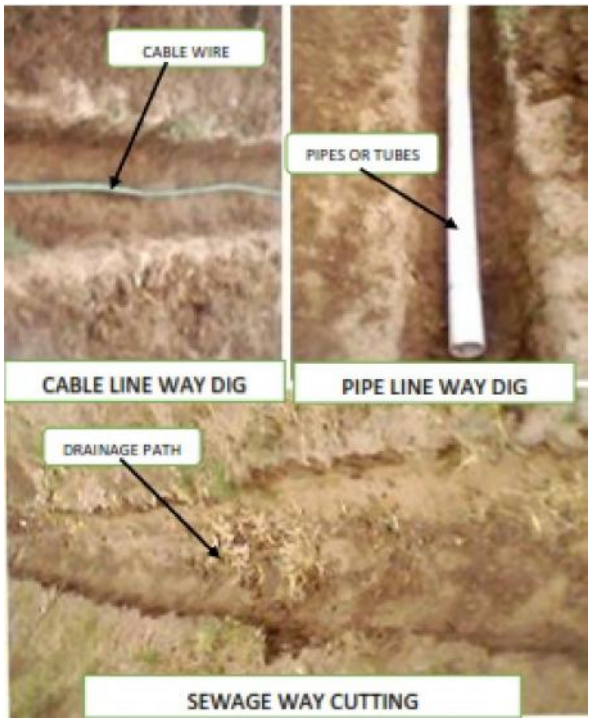
Table 2: Depth of Cut Circle Radius = 400 mm

S. No.	No's of Wheel Revolution	Inclination Angle	Depth of Cut (mm)
1.	Nil	35°	Neutral position (ideal)
2.	3	50°	125
3.	3 + 3 = 6	65°	125 + 87.5 = 212.5

RESULTS AND DISCUSSION

General Application of Fields

Figure 5: Applications



Graphical Result Analysis

In the Figure 6 is cost vs length of cutting way parameter is to be plotted by means of the new designed machine and manual performance is compared. The graph is provided result is

Figure 6: Cost vs Cutting Length

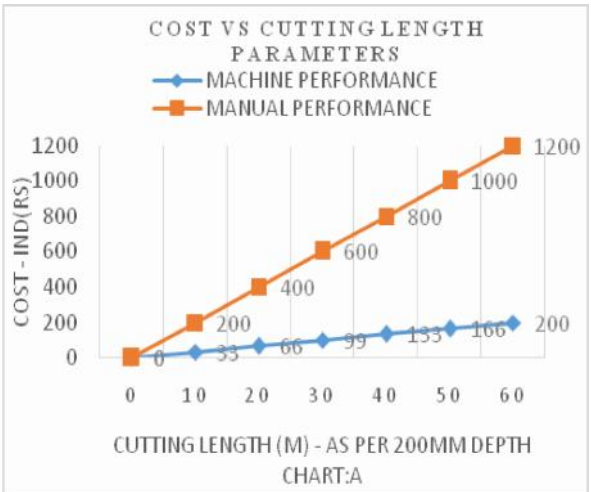
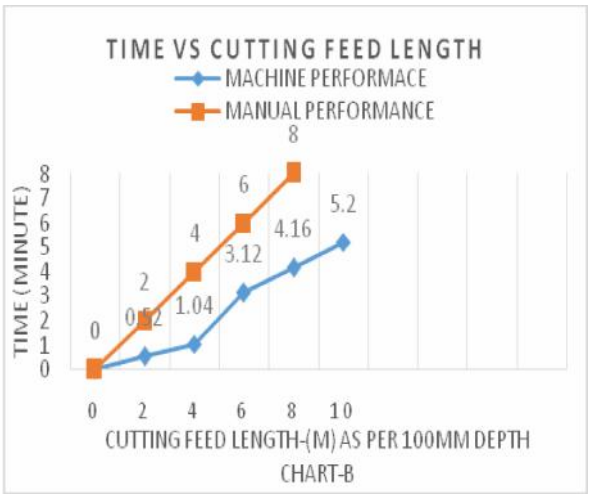


Figure 7: Time vs Cutting Feed Length



the manual performance is 6-times of expenditure cost compare than the new designed machine as per meter.

The Figure 7 is plotted parameters time and feed length of cutting way of the new designed machine and manual performance. Thus the graph is provided result of machine cutting length 3.8 times higher than the manual performance as per minute values.

CONCLUSION

Nowadays, long narrow ways cutting is essential in the soil land by water line, cable line, etc., bury. So the task to having problems are following reasons of labour demand, high expenditure cost to do the work, heavy or special machinery requirement, slow speed of work performance, etc. In the problem rectified by introducing the long narrow way cutting (digging) machine design. Also, it is easy to performance during the work, simple maintenance is enough, less space occupation, fuel consumption very low compare than other heavy machinery, etc., such as effectively and efficiently performance is possible. Also, automatic feeding movement of the machine attachment is possible. The machine utilizable fields are civil work, pipe line cutting, cable line digging, sewage ling, etc., thus the above all reasons for consider to design the long narrow way cutting (digging) machine.

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