Design and Development of Earth Auger

Akanksha Fule[1] Pratiksha Kachare[2] Ishaan Dharshivkar[3] Prof. D. I. Sangotra[4]
[1,2,3]BE Students [4]Professor
[1,2,3,4]Department of Mechanical Engineering
[1,2,3,4]Yeshwantrao Chavan College of Engineering, Nagpur, India

Abstract— At the time of the mechanization and returning farmland to forest in China , in order to plant trees as effectively as possible , earth auger as a kind of important mechanical equipment , its function will directly affect the quality and speed of afforestation in our country. Therefore, strengthening the exploration of the use and maintenance of earth auger is very important. This article summarizes the basic characteristics of earth auger, lists the main types and operation mechanism of earth auger, focuses on the usage method and maintenance strategy of earth auger, and looks forward to the future development trend of earth auger.

Keywords: Earth Auger; Use; Maintenance

I. Introduction

Because of the implementation of the policy of returning farmland to forest and greening policy in recent years and the rapid development of fruit tree planting at the same time, the use of various types of mechanical equipment for afforestation has become the first choice of modern people now, earth auger is this kind of new modern planting tools. This machine is driven by a gasoline engine and has many advantages such as, overall weight is relatively light, operation is more convenient, maintenance is fairly simple, fuel consumption is very low, noise is smaller, very easy to start and operating cost is relatively low. So, now the earth auger has been developed quickly and its range of application is becoming wider and wider.

II. Literature Review

- Auger blade (1952-02-08): The invention deals with a blade structure of the character defined, wherein the teeth of the blade are so constructed and positioned as to form a series of circumferential v-cuts. In the soil and to simultaneously and intermittently lift and break the raised I-portions of the soil intermediate the formed grooves, thus facilitating and expediting the drilling operation.
- Expanding boring head for earth auger (1968-05-28): This invention relates to a new and improved expanding boring head for earth this invention relates to a new and improved expanding boring head for earth auger. More particularly, the present invention comprises a tooth and tooth holder pivotally mounted on a boring head about an axis substantially parallel to the axis of rotation of the boring head but displaced outwardly relative thereto so constructed that the tooth moves between a retracted or inoperative position to a projected or operative position

III. Problem Definition

There has been a lot of developments in our current times, many of which have helped humanity evolve and be better than what we were as compared to previous generations, but considering all these advancements we still are not able to solve the issue global-warming, cheap labour and we are unable to provide assistance to our farmers in ways to reduce their expenditure by providing them a cheap and efficient tools for the production of food as well as support and help the Govt. By providing them with essential machinery which would reduce their time and increase their efficiency.

A. The Operation Mechanism of Earth Auger

Earth auger are generally composed of small gasoline engine, clutch, transfer-box and specially designed drilling tool, usually be suitable for punching in the mountainous region, frozen earth or ice layer, and is widely used in garden, trees planting, road construction and many other fields. Large or medium-sized earth auger usually rotates through pushing the shaft by the port of power-output shaft of tractor, and uses the universal drive shaft and gear box to drive the drill to rotate, so as to make the machine blade can cut the soil, and then the hydraulic efficiency elevation structure of tractor will raise or lower the drill, the chipped out soil or stone powder is put forward through the spiral blade, and is crushed to a decentralized state, which is thrown to the ground around the pit-mouth through the positive role of centrifugal force, so as to realize the whole process of the excavation work.

IV. Methodology

1) Application based concept
2) Design of Auger and Power Transmission
3) Autodesk 2D Model of designed Auger
4) Its Modification after failure analyzation
5) Detailed CAD Model
6) Actual Manufacturing of Auger

V. Materials and Methods

Material Used Frame – Mild Steel (Square Tube) Bevel gears – carbon steel Auger - Mild steel circular plates of 6 inch diameter Shaft Material A good material for the shaft must have sufficiently high strength, good machinability, low sensitivity to stress concentration and to withstand heat treatment operations of high wear resistance. Usually shafts are made of mild steel and carbon steel, the following grades of carbon steel being used C25, C30, C40, C45 and C50. Fig1: Drill bit named Auger used Application based Concept Design of auger and power transmission Autodesk 2D Model of designed Auger Its Modification after failure anaylization Detailed CAD Model Actual Manufacturing of Auger.

A. Design of Auger

The Shaft size is dictated by torque, but changes in horsepower and speed (RPM) affect torque as shown in the following equation of determining power;

$$P = \omega \times T$$

Where
T = Toque.
ω= speed (RPM).

T = $P\ \omega$ accordingly, an increase in horsepower would require more torque, as would a decrease in RPM.

For example, a 100-hp designed for 900-rpm would require twice as much torque as a 100-hp PTO designed for 1800-rpm. Each shaft must be sized for the torsional load it is expected to carry. In determining the shaft size, three approaches can be used:

- Determination of shaft diameter based on strength.
- Resistance to twisting method
- Transmission of torque approach.

B. Determination of shaft diameter based on strength.

When the shaft is subjected to both torsional and bending loads, the maximum torsional shear stress is given by:

τmax = 16 by πd 3 whole root of ($M2 + T$ 2)

(From Machine design by R.K. JAIN pg 647)

Where

M=bending moment

T=torque

C. Resistance to twisting method

The other way to calculate minimum shaft size is to set a limit on the amount of torsional deflection (twisting) that may occur. Resistance to torsional stress is directly proportional to shaft size: the larger the diameter, the greater the resistance to twisting. A rule of thumb with this method is that the shaft must be large enough that it will not deflect more than 1 degree in a length of 20 times its diameter.

To calculate the minimum shaft size to meet this specification, The Machinery's Handbook provides the following equation for determining minimum shaft size: 30

D= whole root of P by N × 4 (inches)

where:

P = horsepower

N = speed (RPM)

D. Transmission of torque approach.

This method involves determination of the shaft diameter by considering the following cases . Shaft with keyway.

D =whole root of 60×P by N (inches.)

E. Shaft without keyway.

D =whole root of 120×P by N (inches.)

Source: machinery's handbook.

F. The shaft to be keyed

hence the formula;

D = √60×P by N

is used where;

P = PTO horsepower ,

N = PTO speed in RPM.

VI. CONCLUSION

1) Based on the overall performance of the machine we can definitely say that the project will satisfy the need of small scale farmer, because they are not able to purchase costly agricultural equipment only for drilling purpose.
2) The machine required less man power and less time compared to traditional methods, so if we manufacture it on a large scale its cost gets significantly reduce and we hope this will satisfy the partial thrust of Indian agriculture.
3) Every farmer can obtain such mechanism just operating the tractor in auger drilling machine. 4. So in this way we solve the labour problem that is the need of today's farming.

BOOKS

[1] Design of Machine Element, Prof .V. B. Bhandari, Tata Mc-Graw-Hill Publishing Company Ltd.2007 Edition
[2] Strength of Machine Element, Prof. R. K. Rajput S. Chand Publication edition 2008.
[3] Fluid mechanics and hydraulic mechanism, R.K.BANSAL, Ninth edition

