

## To Study of Shaft Bearing in Digging Machine

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**Abstract** - Trees are defined as woody plants that have secondary branches supported clear of the ground on single main stem or trunk with clear apical dominance. Bearings are the most essential mechanical component used in all machines and mechanism. Hole drilling for Planting trees is a major activity that involves digging holes using either a drilling machine mechanism or hand tools. Extraction of oil involves a vigorous drilling exercise of extracting oil from depths of over 800 feet. The structures erected in drilled holes include electricity poles, flag posts, masts; buildings etc. Production, productivity, performance, reliability and many other aspects are mostly based on the bearing used in the machine. A machine will run successfully only when a correct bearing is applied in the machine along with its proper care and maintenance during working of the bearing.

- thus the requirements for bearing performance have continuously increased. NSK rolling bearings have not only kept pace: great ideas have ensured that they have always been one step ahead. It also faces a major wood shortage because plantation forests are not regenerating fast enough with an annual deforestation rate of 0.3 percent. extraction of oil involves a vigorous drilling exercise of extracting oil from depths of over 800 feet. Hole drilling for Planting trees is a major activity that involves digging holes using either a drilling machine mechanism or hand tools.

**Key Words:** Shaft, Bearing, Drilling, Digging Machine.

### 1. INTRODUCTION

For this purpose numerous vital criteria and important features need to be systematically considered and analysed. A minimum height specification at maturity varies from 3m to 6m ; a minimum of 10cm trunk diameter (30cm girth). These issues concern bearing life, static bearing capacity at maximum load, extreme load on part of the engine as well as the limiting speeds. There is growing scientific evidence that forests, and the carbon they emit, are undervalued.

In general, trees are necessary for our existence due to the following reasons:

- They are planted as cash crop tea, coffee, cottonwood, black locust and white ash
- Some are used as medicine
- They act as carbon sinks
- They control soil erosion
- They are used as fuel
- They act as windbreakers
- They are used for construction purposes

Kenya has less than two percent forest cover of the country's 58 million hectare with an estimated 186000-hectare forest cover loss since 19909(www.kenyaforests.org). However, capacities for high performance can only be fully utilised if the correct rolling bearing is fitted in the right place. Over the course of time gears have become increasingly powerful



Fig. 1.1 Tractor Driven Auger Type Drilling Units

Trees are defined as woody plants that have secondary branches supported clear of the ground on single main stem or trunk with clear apical dominance. Recent studies have determined that huge amounts of carbon are stored in peat and other organic matter soils, now estimated to account for about two thirds of the total undetected. The government is counting on farmers to increase Kenya's forest cover by up to 10 per cent —the level it was at independence. Indeed, native forests, tree plantations, grassland and other ecosystems in the world may take up more carbon dioxide than released by industrial activities. Drilling is the act of making a hole in a material using cutting equipment and can be done on the earth's surface. Even though tree planting is actually a great investment opportunity it has remained under appreciated in many parts of the country.

The history of developing and designing gears is the history of continuously improving performance. Hole drilling on the earth's surface is primarily done for several purposes, which include erection of structures, extraction of oil or planting trees. The structures erected in drilled holes include electricity poles, flag posts, masts; buildings etc. Compared with most other plants, trees are long lived, some of them getting to be several thousands years old and growing to up to 115m (375 ft) high., scenic beauty and medicinal value among other reasons.

## 2. RELATED WORK

Many traditional methods have been used which are so tedious and not efficient. Planting machines offer a means of planting woodland quickly using small team operators. This the critical factor when loading rocks, with use of EDEM different bucket designs could be evaluated by Studying the horizontal force in the simulations. Manually controlled machines can achieve a higher planting quality than semi-automatic planters because the operator can influence the positioning of the plant in the furrow. An optimized bucket design is important for increasing productivity and loading performance for underground loaders. Later year's development of simulation software and computers has made it possible to verify the design by simulating the loading process. In general a bucket with sharp and edgy shape gave lower forces. The edge thickness of the bucket lip was the individual design parameter that had the largest influence on the horizontal force; a thin edge generated lower force.

Due to their inefficiency, there has been need for a better way to plant trees. The simulation model was compared with practical tests. The attack angle (bottom angle) had low influence on the horizontal force . Whilst the quality of machine planting may be lower than standard manual planting, it is consistent and can achieve better results than operational manual planting. The purpose with this thesis has been to both develop and use a simulation model of the loading process for one of Atlas Copco's underground loaders. This has lead to mechanized ways of planting trees and hence the development of tree planting machine. EDEM uses the Discrete Element Method for simulating granular materials, which in this case was blasted rock. The tractive effort is the horizontal force the loader can generate. Agriculture cabbage planter have been adapted to plant trees cuttings (super-prefer) and purpose built machine (whitfield F-85) has been operating in northeast Scotland, on new planting schemes only. A factor such as particle flow, particle compression and loading setup adds complexity and uncertainty to the task. In the last past years, interest in mechanical planting machines has widened to other soil types. A simulation model was developed in the program EDEM. Design theories are today difficult to evaluate due to lack of verification methods. Nevertheless was a model that was able to detect force variations from small design changes developed. Tree planting machines are

not new, having been in use in both America and Europe for a number of years.

### 2.1 Existing Methods:

#### 2.1.1 Auger Drilling.

Auger drilling is a drilling method that uses a large helical shaped screw to extract material from the ground. When used for drilling, the auger drill bit screws into the soil and material is automatically moved up the shaft of the rotation device. There are many types of augers available today. Large, powered augers are typically used in the farming, construction, and utility industries. These auger-drilling devices are used to drill holes for fence posts, utility poles, and large drainage pipes under highways. Some of these augers are large and cumbersome to operate. Figure 2.1 illustrates a giant auger for drilling holes for larger diameters.



Fig. 2.1 A Giant Auger

#### 2.1.2 Aeon Tree Planter

The AEON tree planter was invented by Norbert noecker in 1946. It was the first successful tree planting machine in the state of Michigan. The planting machine are now called aeon tree planter. Each machine is hand crafted by larry kaylor or kaylor welding services. The basic design of the aeon tree planter consists of : a coulter, trencher, and packing wheel. These very basic parts have remained unchanged since the planter was invented. However, there have been several improvements made to increase strength and convenience. One makes the frame out of steel bars five inches and half inches with a trencher welded securely to it. Each machine is equipped with a single seat for planting ease and comes with a tub to hold the trees being planted. Lift eye balances whole planter while being loaded for transit. In addition, each machine comes with two support legs to simplify storage and hook-up procedures. A 33.56 KW Tractor is strongly recommended or a tractor that is capable of lifting 2000kgs. Aeon tree planting machine is easy to operate, requires maintenance, and is durable. With so few



parts very little repair is ever needed. It is occasionally necessary to hard face weld or replaces the trencher point. This planter has been on the market for 25 years. It is used in many types of soil conditions and can handle most any large sized transplant. It has a planting trench of 0.3-0.356m, which minimizes root pruning of stock and insures better survival rate.



Fig. 2.2 AEON Tree planter

### 2.1.3 Hand auger equipment

The hand auger consists of extendable steel rods, rotated by a handle. A number of different steel augers (drill bits) can be attached at the bottom end of the drill rods. The augers are rotated into the ground until they are filled, and then lifted out of the hole to be emptied. A different auger can be used for each formation (soil) type. Hand augering can be done both by using a heavy tripod and winch (such as the vonder rig), or with lighter materials. It is suitable for unconsolidated formations: sand, silt and soft clay. Stiff clays, hard materials and gravels are difficult or impossible to drill through.



Fig. 2.3 Shows Different Bailers with Augers

By applying extension rods with a bayonet or a conical threaded connection, augering to greater depths is possible. With **hand** auger equipment a depth of 8-10 meter can realistically be achieved. The maximum boring depth strongly depends on factors such as soil profile and the characteristics of the material the auger has to pass through.

### 2.1.4 Tractor Driven -Post Drillers

These are also auger type but are rotary driven by the power take off of a tractor and hydraulic press is applied to push the rotating auger into the ground. The hydraulic

unit also provides the up and down motion that removes the loose soil after digging to reveal a clean hole.



Fig 2.4 Tractor Driven Post-Hole Driller

It is proposed to design a machine that can easily be used to drill holes for planting trees, electricity or telephone poles and other applicable areas. The machine to be designed can drill a hole of 600mm diameter and a maximum depth of one meter. The holes to be produced by the machine will be of uniform diameter throughout as opposed to the ones drilled by augers, which are usually conical. It is also possible to drill holes of different diameters like 200mm, 300mm and 400mm by just changing the size of the cutter plate. Important features of the proposed machine are: ease of transportation to drilling site, ease of assembly at the drilling site, being able to be attached and detached from the driving power easily.

## 3. METHODOLOGY

Before engagement of the cutter plate into the soil the cutter plate is closed as shown in the diagram below.

The proposed machine is driven by the tractor power take-off (PTO). The PTO shaft will be connected to the vertical shaft by a set of straight mitre bevel gears at 90°. The vertical shaft will be holding a cutter plate at the bottom on which a cutting tool is mounted.

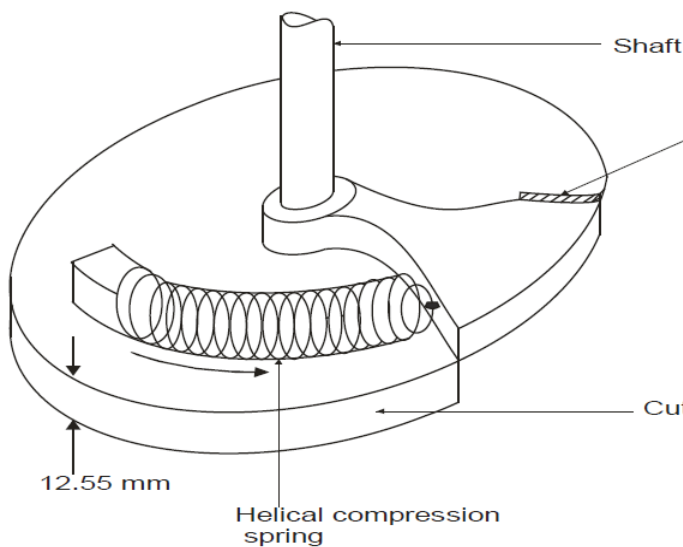


Fig 3.1 Working of Shaft Bearing in Digger Machine (Closed Assembly)

When the cutter plate is fully open, soil-cutting operation commences. Soil cutting operation in this case is similar to turning in metal cutting where a layer of metal (chip) is removed. In soil cutting, a layer of soil is removed or scrapped and it flows through the tool face to the top of the cutter plate. After drilling to a sufficient depth, rotation of the cutter plate is stopped, hence the helical compression spring pushes back the plate carrying the cutting tool since there are no soil cutting forces thus closing the cutter plate. The column of soil resting on the cutter plate can now be lifted up to the surface and dropped. The operation is repeated until the required depth of the hole is reached.

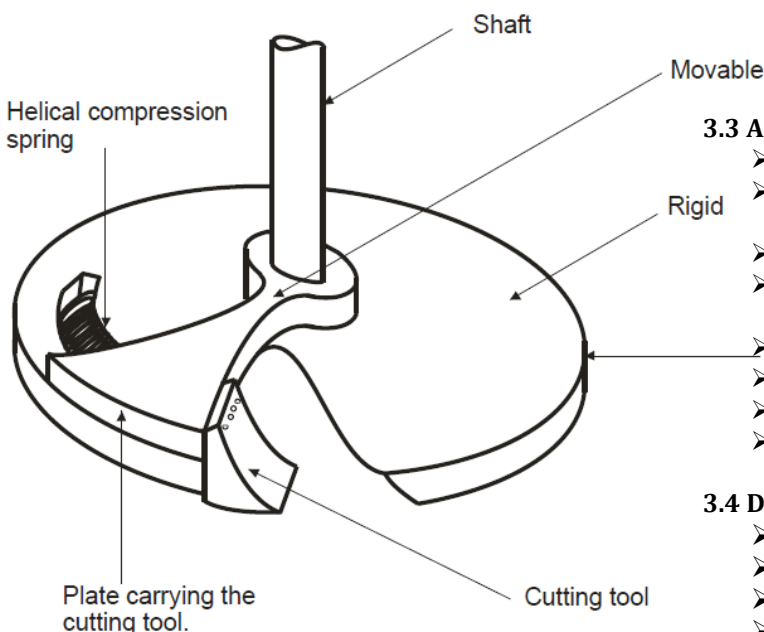


Fig 3.2 Working of Shaft Bearing in Digger Machine (Open Assembly)

### 3.1 Shaft Bearing

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; 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:

- (i) Determination of shaft diameter based on strength.
- (ii) Resistance to twisting method
- (iii) Transmission of torque approach.

### 3.2 Characteristics of Rolling Bearings

Compared with plain bearings, rolling bearings have the following major advantages:

- Their starting torque and friction is low and the difference between the starting torque and running torque is small.
- With the advancement of worldwide standardization, rolling bearings are internationally available and interchangeable.
- Maintenance, replacement, and inspection is easy because the structure surrounding rolling bearings is simple.
- Many rolling bearings are capable of taking both radial and axial loads simultaneously or independently.
- Rolling bearings can be used under a wide range of temperatures.
- Rolling Bearings can be preloaded to produce a negative clearance and achieve greater rigidity Support by means of fixed and floating bearings

### 3.3 Advantages:

- It takes less radial space
- It becomes quieter in operation particularly after a suitable running period
- It has unlimited life
- It has less sensitive to injury from contamination and foreign particles
- It is best suited for overloading
- It is easy to manufacture
- It has low cost
- It remains from rust and corrosion

### 3.4 Disadvantages:

- It requires more attention
- It requires higher starting torque
- More lubricant is needed for lubrication
- Loss of lubricant is more
- More power is needed for driving
- More axial space is required.

#### 4. CONCLUSION

The structures erected in drilled holes include electricity poles, flag posts, masts; buildings etc. A machine will run successfully only when a correct bearing is applied in the machine along with its proper care and maintenance during working of the bearing. Thus from the study it is concluded that bearings are the most essential mechanical component used in all machines and mechanism. Extraction of oil involves a vigorous drilling exercise of extracting oil from depths of over thousands feet. Production, productivity, performance, reliability and many other aspects are mostly based on the bearing used in the machine.

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