

DESIGN AND FABRICATION OF HYDRAULIC PLANT RELOCATING MACHINE

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ABSTRACT

The traditional method of plant conservation has become a common problem. This paper deals with the process of relocating the plant from one place to another. If a building or a structure has to be raised on a location where a plant is situated, a stereotypic method is followed (i.e.) uprooting the plant from that location. This system will prevent the plant life. Our aim is to obliterate the idea of destroying the plant life and preserving the ecosystem of the heavenly earth. Here, initially a hole is dug on the place where the plant has to be relocated with the help of the plant relocating machine. Then, the Hydraulic Plant Relocating Machine is moved to that particular plant and it is then levitated and moved to the place where it has to be replaced and then it is lowered. Thus, the plant is relocated to another location.

Keywords: *Hydraulic Plant Relocator Machine, Transplanting, Pascal Law*

INTRODUCTION

Tree planting is the process of transplanting tree seedlings, generally for forestry, land reclamation, or landscaping purposes. It differs from the transplantation of larger trees in arboriculture, and from the lower cost but slower and less reliable distribution of tree seeds. In silviculture the activity is known as reforestation, or afforestation, depending on whether the area being planted has or has not recently been forested. It involves planting seedlings over an area of land where the forest has been harvested or damaged by fire or disease or insects. Tree planting is carried out in many different parts of the world, and strategies may differ widely across nations and regions and among individual reforestation companies (Ugwu, 21012). Tree planting is grounded in forest science, and if performed properly can result in the successful regeneration of a deforested area. Reforestation is the commercial logging industry's answer to the large-scale destruction of old growth forests, but a planted forest rarely replicates the biodiversity and complexity of a natural forest. Because trees remove carbon dioxide from the air as they grow, tree planting can be used as a geo engineering technique to remove CO₂ from the atmosphere (Olatunde *et al.*, 2014).

In agriculture and gardening, transplanting or replanting is the technique of moving a plant from one location to another. Most often this takes the form of starting a plant from seed in optimal conditions, such as in a greenhouse or protected nursery bed, then replanting it in another, usually outdoor, growing location. Botanical transplants are used infrequently and carefully because they carry with them a significant risk of killing the plant. Different species and varieties react differently to transplanting; for some, it is not recommended. In all cases, avoiding transplant shock the stress or damage received in the process is the principal concern. Plants raised in protected conditions usually need a period of acclimatization, known as hardening off also known as frost hardiness. Also, root disturbance should be minimized (Ramdeva, 2012).

A tree spade is a specialized machine that mechanizes the transplanting of large plants whose hand-powered transplanting using traditional spades, wagons, and other equipment would be prohibitively laborious. These include large bushes and small or medium trees. By bringing mechanized power to what was formerly only a manual process, tree spades do for transplanting what tractors and combine harvesters do for agriculture, and what excavators and other heavy equipment do for construction. A typical machine consists of a number of blades that encircle the tree, digging into the ground and then lifting the entire tree, including its roots and soil, out of the ground. A shovel is a tool for digging, lifting, and moving bulk materials, such as soil, coal, gravel, snow, sand, or ore. Shovels are common

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tools that are used extensively in agriculture, construction, and gardening (Maharaja *et al.*, 2013). Most shovels are hand tools consisting of a broad blade fixed to a medium-length handle. Shovel blades are usually made of sheet steel or hard plastics and are very strong. Shovel handles are usually made of wood especially specific varieties such as ash or maple or glass-reinforced plastic (fibre glass) (Mahmud *et al.*, 2014).

MATERIALS AND METHODS

Methodology

The principle used in Hydraulic Plant Relocating Machine is Pascal's law which is the basis of hydraulic drive systems (Olatunde *et al.*, 2014). Pascal's law states that when there is an increase in pressure at any point in a confined fluid, there is an equal increase at every other point in the container. The setup can be divided into two halves i.e., Plant relocater setup and Trolley setup as shown in the figure 1.



Figure 1: Photographic View of Hydraulic Plant Relocator

The plant relocater has a rectangular beam for support. This acts as the skeleton of plant relocater. The rectangular beams are welded and made into a shape of rectangle. A vertical and horizontal of such rectangle is then fixed (welded). This forms into an 'L' shape frame. To this support another rectangular beam is inclined at an angle. Totally three such cylinder supports are made. Two such beams are placed at the far end of the L section. The remaining one beam is fixed at the point where the horizontal and vertical intersect. And to these inclined beams cylinders are fixed. A piston is made to reciprocate inside the cylinder with the help of a piston rod. The piston rod moves to and fro because of hydraulic fluid injected into the cylinder via hose pipe from a hydraulic power pack (which sits in the trolley) (Mahmud *et al.*, 2014). To the piston rod a bush is fitted to which a shovel or a spade is fixed. The three cylinders

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are glued to the beam in such a way that the shovel forms a hollow cone when the three piston rod in the cylinder extends. This forms the Plant relocater setup. The trolley setup, has it meant is used for moving the plant relocater to the desired location. This includes a rectangular beam as used in the plant relocater setup. These beams are made as a base to which a sheet of 3mm thickness is welded. This plate holds the power pack which weighs around 110kgs. To the bottom of the plate, a pair of wheels is hitched. A housing bearing case is nailed to the bottom. To the bearing case, another set of wheels are fixed (i.e.) this acts as a steering mechanism.

The plant relocater setup and the trolley are brought close together. A 'C' channel is placed between them. A roller, extended from the plant relocater setup is made to roll on this C channel which ensures as a support. A hydraulic cylinder is prescribed vertically on a plate (base of the trolley section). Piston rod from this cylinder is fastened to the plant relocater setup in such a manner that when this piston extends, plant relocater moves up. The specification of the plant relocater is given in the table 1.

Table 1: Specification of Hydraulic Plant Relocater

Sl. No	Name of the Part	Quantity
1.	60*40 Mild Steel Tube	68kg
2.	Plated Rod	4
3.	Honed Tube	4
4.	Mild Steel Plate	26kg
5.	Nylon Wheel	4
6.	Caster Wheel	2
7.	Rotary Direction Controlvalve	2
8.	Bearing	8
9.	Piston Seal	3
10.	Bushes	6
11.	Nylon Lock Nut	4
12.	O-Ring	3
13.	Gland Seal	3
14.	Align Bolt	12
15.	Hydraulic Power Pack	1(RENTED)
16.	Hydraulic Fluid	30lit

Working

Initially a place for shifting the plant is decided. The plant relocater is moved to that location. The spade or shovel is made to pierce into the ground. The spade forms a conical shape. This cuts down the portion of a mud to which the plant has to be anchored. The main hydraulic cylinder located at the base of the trolley lifts the relocater beam, this in turn lifts the conical spade without deforming its shape as shown in the figure 2. Thus, the portion of the mud is removed from the desired place.

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Figure 2: Photographic View of Actuation of Shovel

Now the relocater machine moves towards the plant which has to be uprooted. This operation follows the same as the above process. The only difference in that is a plant is occupied along with the mud. The spade or shovel is made to pierce into the ground.

The spade forms a conical shape. This cuts down the portion of a mud along with the plant. The main hydraulic cylinder located at the base of the trolley lifts the relocater beam, this in turn lifts the conical spade without deforming its shape. Thus, the portion of the mud along with the plant is uprooted without disturbing the roots of a plant.

The next process is moving the plant to the desired place. Here, the plant is transported to the location (It is movable (i.e.) since a trolley is attached to the plant relocater). The plant relocater holding the plant is moved to spot and it is then lowered into the ground. The main cylinder retracts back and thus the beam is lowered. Thereby the shovel is brought to the ground. The spades are deformed back (i.e.) the 3 cylinders undergo retraction so that the plant is descended.

Conclusion

Thus, the Hydraulic Plant Relocator is very much useful in uprooting the plant within a short duration of time and consumes less man power. This Hydraulic Plant Relocator machine could help to maintain the surroundings green without cutting off plants and trees.

In future instead of going in for a conventional method we can go in for a plant relocating machine because it reduces man power and plant can be relocated in short period of time. The spade setup can also be attached to proclaim or a heavy vehicle to relocate big trees in a short span of time. The spade diameter can also be increased depending upon the plant or tree which is to be relocated.

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