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# Development of Prototype of Hydraulic Lift Using Wooden Sticks

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**ABSTRACT:** Hydraulic lift, a process by which some plants solve the problem of water deficit in the upper soil horizons, has been the subject of many recent studies by plant ecologists. These studies show that some shrubs and trees have the ability to move water from deep in the soil profile, where water potentials are high, to more shallow regions where water potentials are low and root transpirational demands are extreme. Evidence suggests that this phenomenon occurs mainly at night and is driven by the water potential gradient existing between the upper and lower soil horizons. As a result of this gradient, water enters the deeper tap roots, moves up the root system, and effluxes from the shallower roots into the soil. One benefit of hydraulic lift is clear—a greater supply of water in the upper soil horizons to support daytime transpiration. However, researchers propose that hydraulic lift also benefits the plant in other ways. These include increased rates of mineralization in the rhizosphere and the maintenance of fine roots that would normally desiccate during periods of drought. On a larger scale, the fact that many plants parasitize hydraulically-lifted water may have significant effects on species distributions within plant communities. Finally, with so many plants being “potential hydraulic lifters,” it is likely that hydraulic lift plays an important role in regional water balances and should be included in any model describing landscape hydrology.

**KEYWORDS:**

## I. INTRODUCTION

A hydraulic lift is a type of lifting device that utilizes hydraulic power to raise and lower objects or people vertically. It consists of a platform or carriage attached to a vertical support structure, along with a hydraulic system comprising a pump, fluid reservoir, control valves, and cylinders. When hydraulic fluid is pressurized by the pump, it creates force that is transmitted to the cylinders, causing them to extend or retract, thus raising or lowering the platform. Hydraulic lifts are commonly used in various industries, such as automotive repair shops, warehouses, construction sites, and even for elevating people in buildings. They offer advantages such as smooth operation, precise control, and the ability to lift heavy loads efficiently.

A hydraulic lift is a device for moving objects using force created by pressure on a liquid inside a cylinder that moves a piston upward. Incompressible oil is pumped into the cylinder, which forces the piston upward. When a valve opens to release the oil, the piston lowers by gravitational force. The principle for hydraulic lifts is based on Pascal's law for generating force or motion, which states that pressure change on an incompressible liquid in a confined space is passed equally throughout the liquid in all directions.

The concept of Pascal's law and its application to hydraulics can be seen in the example below, where a small amount of force is applied to an incompressible liquid on the left to create a large amount of force on the right. Hydraulic systems are used for precision control of large force applications, are economical, and make excellent use of energy resources.



Figure 1: Automobile Hydraulic lift



Figure 2: Prototype of Hydraulic lift

Hydraulic lifts are available in several types, each of which is optimized to meet specific load, safety, and mobility requirements. These include:

- Table lifts: Available in scissor or column-type designs, table lifts are ideal for lifting heavy loads across relatively short vertical distances.
- Personnel lifts: Personnel lifts are designed to safely raise personnel above ground level for maintenance, stocking, and other activities. Lightweight and portable, these lifts are suited for applications in which space is limited or weight is a concern.
- Forklifts: Forklifts are powerful devices that lift and transport heavy loads in warehouses, construction sites, and other industrial settings.
- Medical lifts: In the medical industry, medical lifts allow patients with limited mobility to be easily and safely moved by caregivers.
- Automotive lifts: Automotive lifts are designed to elevate vehicles to a comfortable working height for maintenance and repair tasks.

## II. LITERATURE REVIEW

The traditional hydraulic system consists of various useful components which allows it to perform the lifting functions precisely. These components are costly and if any part is faulty then the replacement of that part costs much, therefore the need for a low cost, simple mechanism, hydraulic system is required. As you can see in the below figure traditionally there are components like reservoir which contains the hydraulic fluid which is incompressible. The size of the reservoir depends on the size of the system and the amount of hydraulic fluid required by it and thus the cost of it also increases with this. Another main component is the fluid pump which pumps the fluid from the reservoir to the cylinder, it should be of high power to pump the incompressible fluid in the system and a manual plunger is used to control the direction of this pumped fluid, this plunger directs the fluid to the upper section of the cylinder or the lower section according to the demand. A relief valve is also added before the manual plunger so that when the load on the hydraulic ram is high, then the excess pressure on the pump is reduced by the relief valve by passing the fluid to the reservoir. Some components can be replaced by a simple rack and pinion mechanism and thus reducing the overall cost of the hydraulic lift.

## III. COMPONENTS REQUIRED

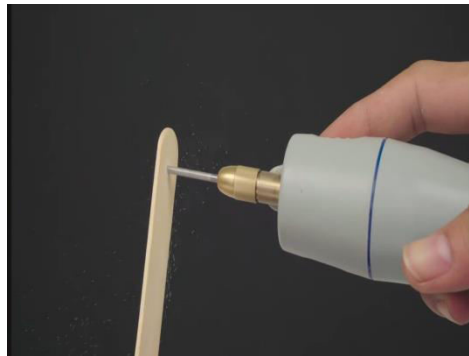


Figure 3: Drilling Operations

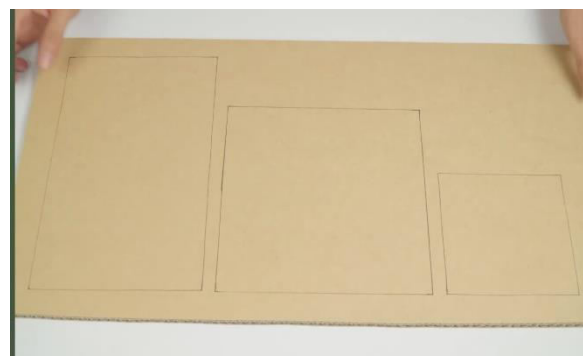


Figure 4: Base structure

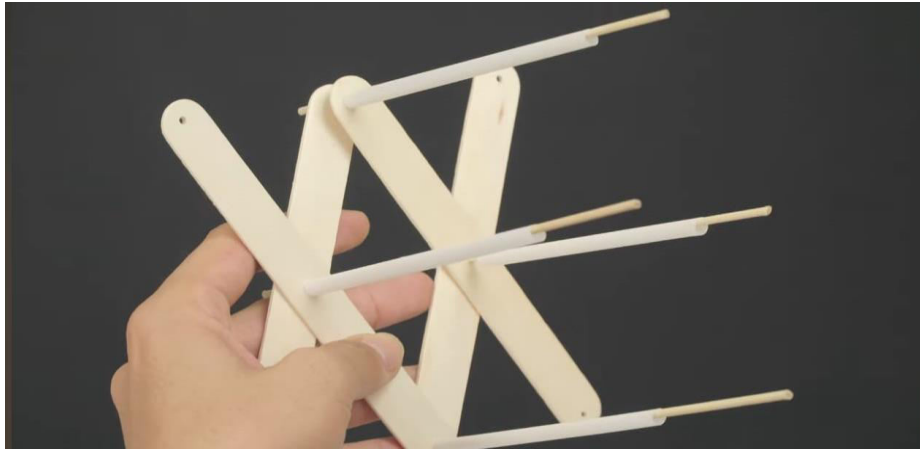


Figure 5: Actual structure

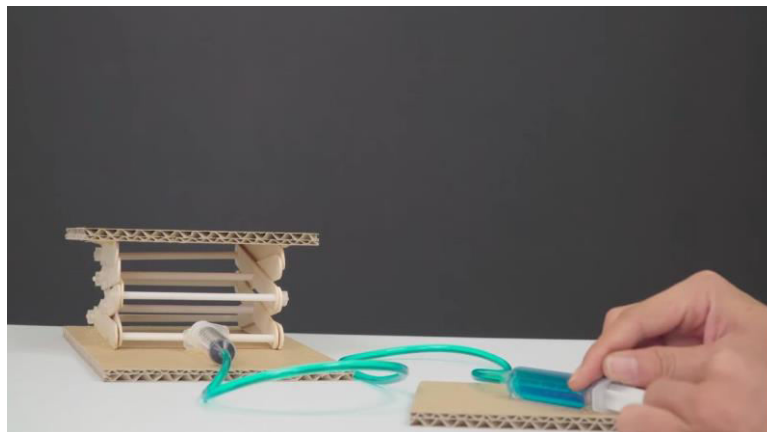


Figure 6: Before applying force

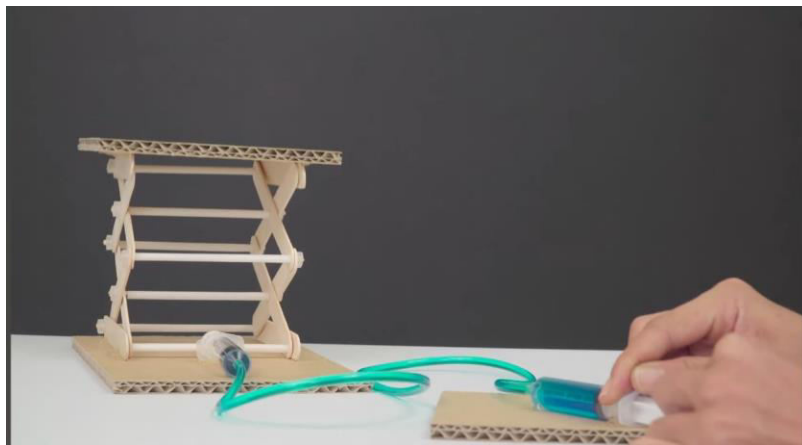


Figure 7: After applying force

#### IV. WORKING

The lift operates on the principle of hydraulic pressure. It consists of a hydraulic cylinder, hydraulic pump, control valves, hydraulic hoses, and a reservoir filled with hydraulic fluid.

When the lift is activated, whether manually or by an electric motor, the hydraulic pump starts operating. The pump pressurizes the hydraulic fluid in the reservoir, creating hydraulic pressure in the system. The pressurized hydraulic fluid is then directed through the hydraulic hoses to the hydraulic cylinder. The control valves regulate the flow of fluid, controlling the movement of the lift.

The hydraulic cylinder is the primary component responsible for lifting the platform or load. It consists of a piston and a cylinder filled with hydraulic fluid. When pressurized fluid enters the cylinder, it exerts force on the piston, causing it to move upward. The upward movement of the piston in the hydraulic cylinder is translated into vertical motion of the lift platform. The platform is attached to the piston or a lifting mechanism connected to the piston, allowing it to move upward.[1]

The lift platform supports the load or object being lifted. It is typically designed to accommodate various shapes and sizes of loads, ensuring stability and safety during lifting operations. The lift can be controlled using manual levers, buttons, or switches, or through automated systems depending on the design. The control system regulates the flow of hydraulic fluid and manages the movement of the lift platform.

#### V. CONSTRUCTION

1. Design: Plan the design of the hydraulic lift, considering load capacity, lift height, and available materials. Design components that can be constructed using cardboard and injection molding.
2. Materials: Gather materials such as cardboard sheets, injection molding materials (e.g., thermoplastics), hydraulic cylinder, hydraulic pump, hydraulic hoses, control valves, reservoir, hydraulic fluid, and any additional components needed for the lift mechanism.
3. Cardboard Structure: Use cardboard sheets to construct the frame and platform of the hydraulic lift. Cut and assemble the cardboard into the desired shape and size, ensuring it's sturdy enough to support the load.
4. Injection Molding: Design and create small components, brackets, or connectors using injection molding techniques. Mold these components from thermoplastic materials to add strength and durability to the cardboard structure.
5. Hydraulic Components: Install the hydraulic cylinder, pump, reservoir, and control valves onto the cardboard frame. Connect them with hydraulic hoses, ensuring proper sealing and connections.
6. Assembly: Attach the platform to the hydraulic cylinder using the injection-molded brackets or connectors. Ensure the platform moves freely up and down without any obstructions.
7. Testing: Test the hydraulic lift to ensure it operates smoothly and can lift the intended load. Check for any leaks, malfunctions, or structural weaknesses.
8. Safety Features: Install safety features such as guardrails or barriers to prevent accidents. Ensure all components are securely fastened and can withstand the load.

#### VI. USES

Hydraulic lifts are used in a variety of different applications. They can be found in automotive, shipping, construction, waste removal, mining, and retail industries as they're an effective means of raising and lowering people, goods, and equipment. A vast number of today's vehicles have some form of hydraulic lifting equipment built in – a typical example is loading doors on lorries.

The reason hydraulic lifting equipment is preferred over other forms of lifting equipment is that it's extremely reliable and also in most cases easy to maintain. All hydraulic lifts use hydraulic pressure as the motive force whether they use air compressors or not because the air compressor pressurized the hydraulic oil and fluids allowing it to lift a load. Air compressors and hydraulics work together then to provide a safe and reliable means of lifting. Without one or the other lifting equipment would not work.

Hydraulic lifts are used in an extensive assortment of automotive, shipping and waste removal applications. They are an effective means of raising and lowering people, equipment, cargo and machines, and find regular use in automobile repair. A vast number of trucks utilize hydraulic lifts to facilitate the transport of heavy freight, and hydraulic lifts provide an excellent solution to certain nursing and disability concerns

Advantages And Disadvantages

□ Advantages:-

- These lifts can easily lift heavy objects and machinery in companies and in warehouses.
- Hydraulic lifts also help to reduce the amount of time for unloading and loading.
- In case you are looking to buy a hydraulic lift for the five-story building, the types of lifts would be outstanding & it is cost effective.
- Hydraulic lifts can also be used for any of the nearby floors, In case of an emergency.
- These lifts are highly durable and very easy to use and maintain.
- These lifts produce very less noise.

□ Disadvantages:-

- Slow speed-the main disadvantage of hydraulic lift is that it cannot travel at more than 150 feet in a minute..
- Require control room - the hydraulic fluid oil varies with temperature, so an efficient machine-room control system.
- Produce high-heat- This type lifts are the high-heat producing system.
- Performance problem- at the time of operation the machine oil may leak into the ground and cause pollution in groundwater.

## VII. CONCLUSION

The mini hydraulic lift project has been a significant success, achieving its primary objectives of designing, building, and testing a functional hydraulic lift system. Through rigorous planning, careful component selection, and meticulous assembly, we were able to create a compact yet robust lift mechanism capable of lifting moderate loads efficiently.

Throughout the project, we encountered challenges such as fluid leakage, pressure inconsistencies, and structural stability issues. However, through collaborative problem-solving and iterative refinement, we were able to overcome these obstacles and optimize the lift's performance.

The final prototype demonstrated satisfactory lifting capacity, smooth operation, and reliability. It met or exceeded our initial expectations in terms of functionality and safety. Additionally, the project provided valuable insights into hydraulic systems, mechanical design principles, and project management.

The mini hydraulic lift designed and tested in this report meets the specified requirements for load capacity, vertical travel, and safety features. It offers a compact and reliable solution for lifting applications in small-scale operations and workshops.

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