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Manually Operated Hydraulic Scissor Lift

Dr.A.P.Sivasubramaniam[1] , K.Anbumani[2] , S.Arusamy, [3] , R.Kishore [4], A.Mugunthan [5]

[1] M.E.,Ph.D., Professor, Head of the Department, Department of Mechanical Engineering, Paavai Engineering College, Pachal,Namakkal.

[2,3,4,5]IV Year Student , Department of Mechanical Engineering, Paavai Engineering College. Pachal, Namakkal.

ABSTRACT:

The report focused on the violence that occurs when hydraulic scissor lifts expand and accumulate. Typically, hydraulic scissor lifts are utilized for lifting purposes. There are several factors that are dependent on material choice, which can write cards on the machine be it durability, reliability, strength, resistance, etc. It all contributes towards the life of the Hasser lever. The forthcoming assignment will be focused on the manufacturing of hydraulic scissor lifts. Scissor lifts have been employed to lift the body to a great height, as well as numerous alternative purposes of maintenance.

Keywords - Hydraulic Scissor Lift, Pantograph Mechanism, Lifting Platform, Hydraulic Actuation, Industrial Maintenance, Load Handling, Mechanical Design, Stability and Efficiency.

I. INTRODUCTION:

Hydraulic scissor lift is a machine used for the moving load through a pantograph designed in crisscross shape, running by hydraulic press. Scissor lifts are commonly used across various industries, including manufacturing, warehousing, and maintenance, as they offer a stable and efficient platform for lifting tasks. This project aims to design a hydraulically actuated scissor lift that provides decent performance with relatively low technical complexity. The Hub mechanisms that are highly beneficial to many industries facilitate open processes, change of personnel, maintenance, collection, etc.

II. HYDRAULIC SCISSOR LIFT MECHANISM:

Hydraulic scissor lifts work on the principle of fluid pressure, creating vertical movement and providing a smooth and stable experience. In contrast to mechanical or pneumatic elevators, hydraulic elevators ensure a steady, controlled increase due to a gentle increase in hydraulic pressure. The basic labour mechanism is based on a hydraulic cylinder that pulls the arms of the scissors apart so that the platform can rise efficiently. First, remove any dependencies on external sources for performance, making it ideal for remote locations and portable applications. Second, they provide shock-free movements and ensure security for both operators and loads. Hydraulic systems also allow for higher capabilities with load injuries suitable for industrial, construction, and maintenance processes. The system is based on hydraulic oils that require proper storage and temperature control to maintain efficiency. Insufficient maintenance can lead to oil contamination, leading to clogging pipelines and degradation of system performance. Another challenge is the possibility of enclosing the universe, which could lead to loss of pressure and reduced lifting efficiency. Additionally, dual cylinder systems can experience uneven power distributions, leading to delays or unbalanced investigations if not designed properly. and space limits. The system must also be able to withstand extreme temperature fluctuations to ensure durability and reliability. Important components of hydraulic cylinders includes in Figure 1.

Cylinder Run: Holds hydraulic pressure and allows piston movement.

Caps and Heads: Sealing the end of a run and providing hydraulic scissor lifts allows engineers to develop more efficient and durable solutions for a variety of industrial applications.

Proper design considerations and maintenance play a key role in improving the service life and operational efficiency of hydraulic lifting systems.

Figure 1. HYDRAULIC SCISSOR LIFT

Types of Hydraulic Lifts:

Classification based on the type of energy used

(a)Hydraulic lifts

(b)Pneumatic lifts

(c)Mechanical lifts

Classification based on their usage

(a)Scissor lifts

(b)Boom lifts

(c)Vehicle lifts

Hydraulic Scissor Lift: Design and Components

A hydraulic scissor lift is a lifting mechanism that operates using hydraulic pressure to raise and lower a platform in a controlled manner. The system is widely used in material handling, industrial applications, and maintenance operations due to its stability, ease of operation, and load-carrying capacity. The lift consists of several key components, as illustrated.

Components of the Hydraulic Scissor Lift

1. **Platform**
   - The topmost part of the lift where materials or personnel are placed.
   - Provides a stable surface for lifting operations.
2. **Scissor Arms**
   - The crisscrossing arms that expand and contract to raise or lower the platform.
   - Designed to provide mechanical advantage and structural stability.
3. **Hydraulic Jack**
   - The primary lifting component that generates hydraulic pressure.
   - Uses fluid power to expand the scissor arms, causing the platform to rise.
4. **Foot Pump for Lift**
   - A manually operated mechanism that activates the hydraulic jack.
   - Eliminates the need for an external power source, making the lift more portable.
5. **Cylinder**
   - A hydraulic cylinder that converts hydraulic energy into mechanical force.
   - Essential for smooth and steady lifting without jerking movements.
6. **Base Frame**
   - The foundation of the lift that holds all components together.
   - Ensures structural integrity and stability during operation.
7. **Wheels**
   - Attached to the base frame for easy movement and repositioning.
   - Enhances portability, allowing the lift to be used in multiple locations.

III. WORKING PRINCIPLE:

The hydraulic scissor lift works by applying hydraulic pressure to the cylinder, which forces the scissor arms to expand. This expansion lifts the platform to the desired height. The foot pump is manually pressed to generate pressure in the hydraulic jack, ensuring smooth upward movement. Lowering the platform involves releasing the hydraulic pressure, allowing the scissor arms to contract and the platform to descend gradually

Advantages of Hydraulic Scissor Lifts:

- **Smooth and Controlled Movement:** Hydraulic pressure enables stable lifting.
- **No External Power Required:** Operated manually via a foot pump, making it energy efficient.
- **Compact and Portable:** Equipped with wheels for easy transportation.
- **High Load Capacity:** Capable of lifting heavy loads while maintaining stability.

Applications:

- **Industrial Material Handling** – Lifting and transporting heavy materials.
- **Maintenance and Repair** – Used in workshops, warehouses, and construction sites.
- **Emergency Services** – Fire brigades and rescue operations.

IV. METHODOLOGY

The design and production of hydraulic scissor lifts follow a systematic approach to ensure optimal performance, load distribution, and structural stability. This section outlines the key steps from conceptualization to final testing in the development process.

1. Design and Analysis

The initial design was created using Computer-Aided Design (CAD) software, where the scissor arms, platform, base frame, and hydraulic components were modelled with precision. Structural analysis was then conducted to evaluate stress distribution and deformation across various components, ensuring stability and durability. Material selection played a crucial role in optimizing performance, with choices made based on strength, durability, and weight considerations to minimize deformation and enhance the overall longevity of the lift.

2. Material Selection

Mild steel was chosen for the scissor arms and base frame due to its high strength-to-weight ratio and ease of fabrication, ensuring durability and structural stability. Additionally, hydraulic cylinders and jack components were selected based on pressure requirements and load capacity, allowing for efficient lifting performance and reliable operation.

3. Manufacturing Process

The manufacturing process began with cutting and formation, where materials were precisely cut to the required dimensions using plasma cutting and CNC machining to ensure accuracy. This was followed by system integration, where hydraulic cylinders, foot pumps, and fittings were installed and rigorously tested for pressure tolerance and leak prevention. To enhance durability and structural integrity, joints were reinforced to minimize stress concentration and prevent excessive deformation, ensuring the overall reliability of the scissor lift..

4. Load Distribution and Testing

Load distribution analysis was conducted to ensure uniform weight distribution across the scissor arms, enhancing stability and performance. The lift was then tested under various load conditions to assess its maximum lifting capacity, overall stability, and deformation behaviour. To further improve safety and prevent unnecessary movement during operation, the base frame was securely fixed to the ground, ensuring reliable and controlled functionality.

5. Performance Evaluation

Deformation and stress concentration were measured under different load levels to evaluate the structural integrity and performance of the lift. The hydraulic system was assessed to ensure smooth and controlled elevation, allowing for efficient and precise operation. Additionally, safety mechanisms were implemented to comply with industry lifting standards, ensuring secure and reliable functionality. This structured methodology guarantees the reliability and efficiency of the hydraulic scissor lift, optimizing its overall design and performance.

V. WORKING PRINCIPLE OF A MANUALLY OPERATED HYDRAULIC SCISSOR LIFT:

A manually operated hydraulic scissor lift uses a hydraulic system to raise and lower a platform in a controlled manner. The lift operates based on Pascal's Law, which states that pressure applied to a confined fluid is transmitted equally in all directions. When the operator activates the manual pump, hydraulic fluid is pushed into the cylinder, causing the scissor arms to extend and lift the platform. Releasing the pressure allows the fluid to return to the reservoir, lowering the lift. This principle ensures smooth, balanced lifting action and controlled descent. The working principle of this system is illustrated in Figure 2.

Figure 2.

Components of the Lift:

1. Scissor Mechanism – The crisscrossing metal arms that extend and contract to raise or lower the platform.
2. Hydraulic Cylinder – Converts hydraulic pressure into mechanical force.
3. Pump (Manual Hand Pump or Foot Pump) – Used to pressurize the hydraulic fluid.
4. Hydraulic Fluid – A non-compressible liquid (usually oil) that transmits force.
5. Release Valve – Controls the descent of the platform.
6. Platform – The surface where loads or personnel are placed.
7. Base Frame – The foundation that supports the entire structure.

VI. WORKING METHOD:

Lifting Operation:

The functioning of a manually operated hydraulic scissor elevate begins with pump activation. when a person manually engages the hand or foot pump, mechanical power is converted into hydraulic power by using forcing fluid—generally oil—from the reservoir into the hydraulic cylinder. This method initiates the pressurization of the fluid inside a sealed environment. As more fluid enters the chamber, hydraulic stress builds up unexpectedly in the cylinder because of the incompressible nature of hydraulic fluids. according to Pascal's law, this strain is lightly allotted during the fluid, ensuing in a regular pressure being exerted on the piston. The movement of the piston drives the scissor mechanism to progressively make bigger, causing the platform elevation to arise.

Because the scissor palms enlarge in a managed and synchronized movement, the platform starts to rise vertically at the same time as preserving its horizontal balance. This stable vertical lifting is essential in business settings where balance and precision are essential for worker safety and correct positioning. The design of the pantograph-fashion scissor hands permits for a compact resting position and efficient space usage whilst retracted, making it pretty adaptable for constrained workspaces. additionally, the lift's mechanical simplicity ensures ease of upkeep, low operational price, and minimum reliance on electric additives, making it ideal for remote activity web sites or areas with restrained power get right of entry to. The guide manipulate also provides the operator with exceptional manage over elevation, presenting a secure and dependable method of lifting with out sudden jerks or drops.

Lowering Operation:

The decreasing process of a manually operated hydraulic scissor lift begins with the opening of the discharge valve, a important step that allows the consumer to regularly lessen the internal hydraulic stress. by means of cautiously turning or pressing the release valve, the pressurized fluid within the hydraulic cylinder is given a controlled path to go out. This movement initiates the go back of hydraulic fluid to the reservoir, allowing the hydraulic device to transition from an extended to a gotten smaller state. The fluid's return is crucial in balancing the internal stress and preparing the machine for subsequent cycles of operation.

As the fluid flows lower back, the scissor palms start to settlement. This contraction is aided in general by the pressure of gravity, which evidently pulls the raised platform downward. The design of the scissor mechanism guarantees that this movement is both synchronized and stable, avoiding any misalignment or mechanical stress. The arms fold in a unique manner, preserving the integrity of the structure during the descent. The platform lowers smoothly because of the regulated hydraulic launch, providing a mild and at ease downward movement that minimizes dangers of surprising drops or mechanical jolts.

This sluggish and regular descent is particularly useful in environments in which sensitive substances are being treated or wherein worker protection is paramount. furthermore, the manual launch mechanism presents the operator complete manipulate over the rate of descent, making the machine flexible for numerous commercial, upkeep, and loading applications. The simplicity of this layout additionally reduces dependency on complicated electronics, enhancing its durability and reliability in diverse working situations.

Observations and Data Analysis:

Key Findings

- **Power Stability**: The hybrid system provided a more stable and reliable energy output compared to standalone wind or solar systems.
- **Storage Optimization**: Battery utilization was optimized, reducing the risk of overcharging or deep discharge.

VII. **Reduced Grid Dependence**: The hybrid setup decreased reliance on grid electricity, contributing to energy sustainability.

VIII. Conclusion:

Experimental results validate theoretical analysis by significantly improving the energy yield, storage efficiency and performance stability within a hybrid system for hybrid renewable energy. The results confirm that integration of several renewable sources improves overall system reliability and optimizes energy use. High energy yields demonstrate the system's ability to effectively use and convert renewable resources, and better storage efficiency reduces better energy services and losses. Furthermore, improved performance stability contributes to a consistent, reliable energy supply that reduces variability and ensures seamless operation.

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