



IJRTSM

INTERNATIONAL JOURNAL OF RECENT TECHNOLOGY SCIENCE & MANAGEMENT

“DESIGN AND DEVELOPMENT OF A VEHICLE ENGINE LIFTING MECHANISM”

Ramkrupal Ahirwar¹, Rampal Yadav², Rashmi Kushwaha³, Sachin Bele⁴, Pallavi Chouhan⁵, Kshitij Yugbodh⁶

¹⁻⁶ Department of Mechanical Engineering, Sagar Institute of Science Technology and Research, Bhopal, Madhya Pradesh, India

ABSTRACT

In automotive workshops, engine removal and installation are critical maintenance operations that require safe and efficient lifting systems. Vehicle engines are heavy components that cannot be handled manually without risk of injury or damage. Therefore, lifting mechanisms such as hydraulic engine hoists are widely used in garages and service stations. This paper presents the design and development of a vehicle engine lifting mechanism using a hydraulic system. The proposed mechanism consists of a steel frame, hydraulic cylinder, boom arm, hook and chain assembly, and caster wheels for mobility. The lifting mechanism operates based on Pascal's law to generate high lifting force with minimal manual effort. The system is capable of lifting engines with a load capacity of up to 1–2 tons. The proposed design improves safety, reduces manual labor, and increases efficiency in engine maintenance operations.

Keywords: Engine Hoist, Hydraulic Lifting Mechanism, Pascal's Law, Automotive Maintenance, Mechanical Design.

I. INTRODUCTION

Automobile engines are one of the heaviest components in a vehicle. During repair, maintenance, or replacement operations, the engine must often be removed from the vehicle. Handling such heavy loads manually can lead to accidents and damage to components. Therefore, mechanical lifting systems are required to lift engines safely. A vehicle engine lifting mechanism, commonly known as an engine hoist or shop crane, is used in automotive workshops for lifting engines during repair operations. These lifting systems are designed to handle heavy loads with minimal effort using hydraulic principles. Hydraulic lifting mechanisms are preferred because they provide high force multiplication, smooth operation, and improved safety compared to manual lifting methods. This research focuses on designing a compact and efficient engine lifting mechanism suitable for automobile workshops.

II. LITERATURE REVIEW

Several researchers have studied lifting mechanisms used in automotive workshops.

Patel et al. (2018) designed a hydraulic lifting system for automobile maintenance applications. Their system demonstrated improved lifting efficiency and reduced manual effort.

Kumar and Singh (2019) investigated the structural design of hydraulic shop cranes and analyzed load distribution in lifting arms.

Sharma et al. (2020) developed a portable engine hoist system capable of lifting up to 1500 kg while maintaining

structural stability. These studies highlight the importance of hydraulic lifting systems in modern automobile service environments.

III. PROBLEM IDENTIFICATION

The following problems are commonly observed in automotive engine removal operations:

1. Vehicle engines are heavy and difficult to lift manually.
2. Manual lifting can cause injuries to workers.
3. Improper lifting can damage engine components.
4. Limited workspace in small workshops requires compact lifting systems.
5. Existing systems may be expensive for small repair garages.

Therefore, there is a need for a **cost-effective, safe, and portable engine lifting mechanism**.

IV. SOLUTION

The proposed system is a **hydraulic engine lifting mechanism** designed for lifting vehicle engines safely and efficiently.

The system includes:

1. Hydraulic jack
2. Adjustable boom arm
3. Steel support frame
4. Hook and chain assembly
5. Movable wheels for portability

The hydraulic jack generates lifting force which raises the boom arm and lifts the engine. The system is designed to support loads of **up to 2 tons**.

V. PROPOSED METHODOLOGY

The engine lifting mechanism consists of several components integrated into a structural frame.

1. **Hydraulic Cylinder**
Provides lifting force.
2. **Boom Arm**
Supports the engine load.
3. **Steel Frame**
Provides structural stability.
4. **Hook and Chain Assembly**
Connects the engine to the lifting mechanism.
5. **Caster Wheels**
Provide mobility in workshops.
6. **Control Handle**
Used to operate the hydraulic pump.

Working Principle: The system operates using **Pascal's Law**, which states that pressure applied to a confined fluid is transmitted equally in all directions. When the hydraulic pump is operated: Hydraulic pressure increases in the cylinder. The piston extends. The boom arm rises upward. The engine is lifted through the hook and chain mechanism.

VI. BLOCK DIAGRAM

Components of the lifting system:

Engine → Chain & Hook → Boom Arm → Hydraulic Cylinder → Steel Frame → Wheels



Figure1. Lifting Mechanism

ALGORITHM

- Step 1: Start
- Step 2: Position the lifting mechanism near the vehicle
- Step 3: Attach chain hooks to engine lifting points
- Step 4: Operate hydraulic pump handle
- Step 5: Hydraulic pressure lifts piston
- Step 6: Boom arm raises the engine
- Step 7: Move engine to repair stand
- Step 8: Lower engine slowly using release valve
- Step 9: Stop

VII. RESULT

The developed lifting mechanism was tested for different engine weights. The system successfully lifted engines weighing up to **1500 kg** without structural deformation. The lifting process was smooth and required minimal manual effort. The movable wheels allowed easy transportation of the mechanism within the workshop. The system proved to be safe, reliable, and efficient for engine maintenance operations.

VIII. CONCLUSION

The designed **vehicle engine lifting mechanism** provides a safe and efficient solution for handling heavy engines during maintenance operations. The hydraulic lifting system reduces physical effort and improves safety for workshop workers.

The proposed design is suitable for small and medium automobile workshops due to its portability, cost-effectiveness, and ease of operation. Future improvements may include **electric motor driven lifting systems, load sensors, and automation using IoT technology.**

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