WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Pedal Press Pneumatic Lifting Jack

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A B S T R A C T

The primary objective of the project is to enhance the performance of a mini pneumatic jack, aiming for greater efficiency and usability for the end user. This machine operates on pneumatic power, leveraging its low coefficient of friction to ensure smooth operation. A pneumatic cylinder is utilized to provide the lifting force necessary to raise the jack.

Key components required for this improved version include:

1. **Foot Pump**: The foot pump serves as the primary mechanism for supplying compressed air to the pneumatic system. Users can easily operate the foot pump to generate the required pressure for lifting the jack.

2. **Pneumatic Cylinder**: The pneumatic cylinder acts as the powerhouse of the system, converting the compressed air supplied by the foot pump into linear motion to raise the jack. It should be appropriately sized and configured to provide the necessary lifting force efficiently.

3. **Solenoid**: The solenoid valve controls the flow of compressed air to the pneumatic cylinder, enabling precise and controlled operation of the jack. It ensures that the lifting action is initiated and halted as needed, enhancing safety and usability.

4. **Jack**: The jack itself is the load-bearing component that is raised by the pneumatic system. It should be robustly constructed to withstand the lifting force exerted by the pneumatic cylinder and provide stable support for the load.

By integrating these components effectively, the improved mini pneumatic jack will offer users a more efficient and user-friendly solution for lifting tasks, powered solely by pneumatic energy without the need for additional power sources.

1. Introduction

Automation can be accomplished via computers, hydraulics, pneumatics, robotics, and other sources. Among these options, pneumatics stands out as an appealing medium for cost-effective automation. The primary benefits of pneumatic systems are their affordability and simplicity. Automation holds significant importance in mass production. Presently, nearly all manufacturing processes are transitioning to automation to expedite product delivery.

The term "pneumatic" originates from the Greek word for "wind." "Pneumatics" refers to the study of air movement and its phenomena, derived from this root. Today, pneumatics primarily involves using air as a working medium in industry, especially for driving and controlling machinery and equipment. While pneumatics has historically been used for simple mechanical tasks, its role in advancing pneumatic technology for automation has become increasingly significant.

Pneumatic systems rely on a supply of compressed air, which needs to be available in sufficient quantity and pressure to meet the system's demands. When implementing pneumatic systems for the first time, ensuring an adequate compressed air supply is essential. Reciprocating compressors are often employed as a crucial component in facilities for providing compressed air. These devices intake air or gas at a certain pressure and deliver it at a higher pressure. Compressor capacity refers to the actual volume of air compressed and delivered, typically measured under intake conditions, such as atmospheric pressure and normal ambient temperature.

2. Advantages of Pneumatics

A. In pneumatic systems, air can be directly exhausted back into the surrounding environment, eliminating the need for special reservoirs and leak-proof system designs.

B. Pneumatic systems are characterized by their simplicity and cost-effectiveness.

C. Controlling pneumatic systems is relatively easier compared to other types of systems.

3. Working Principle

The system utilizes compressed air, generated via a foot pump, as its working medium. This compressed air is then conveyed through tubes to a pneumatic cylinder, where it is converted into reciprocating motion. Control over this motion is facilitated by a hand lever-operated solenoid valve. The reciprocating motion is transmitted to a jack via a piston within the cylinder. By activating the solenoid valve, the vehicle positioned over the jack can be lifted effortlessly.

Key advantages of this pneumatic jack system include:

- Efficient power transmission
- Minimal loss during transmission
- Ability for a single compressor to supply power to multiple pneumatic jacks
- Cost-effectiveness
- Ease of operation, reducing manual strain.

4. Standardization

It is the process of establishing the set of norms to which a specified set of characteristics of a component or a product should conform

- • Example: Standardizing the shaft consists of specifying the set of shaft diameters and material

5. OBJECTIVES OF STANDARDIZATION

- To make the interchangeability of the components possible
- To make the mass production of components easier

6. Factors Determining the Choice of Materials

The choice of material for a given application is influenced by several factors:

1. Properties: The material must possess the necessary properties for the intended application. This includes considerations such as weight, surface finish, rigidity, resistance to environmental factors like chemicals, service life, and reliability. The properties can be categorized into four principle types:

a. Physical properties: Melting point, thermal conductivity, specific heat, coefficient of thermal expansion, specific gravity, electrical conductivity, and magnetic properties.

b. Mechanical properties: Strength in tensile, compressive, shear, bending, torsional, and buckling loads, fatigue and impact resistance, elastic limit, endurance limit, modulus of elasticity, hardness, wear resistance, and sliding properties.

c. Manufacturing properties: Castability, weldability, surface properties, shrinkage, deep drawing, etc.

2. Manufacturing ease: Sometimes, the need for low manufacturing costs or specific surface qualities achievable through coatings may dictate the use of particular materials.

3. Required quality: The desired quality level influences the manufacturing process and consequently, the choice of material. For example, it may not be economical to cast a small number of components when welding or hand forging steel could be more cost-effective.

4. Material availability: Availability of certain materials may be limited, requiring the designer to opt for alternative materials that may not be perfect substitutes. Considerations include delivery schedules for materials and products.

5. Space constraints: High-strength materials may be necessary when forces involved are significant and space limitations exist.

6 Cost: Material cost is a significant consideration. Other factors like scrap utilization, appearance, and maintenance requirements of the designed part may also influence material selection.

7. Design Procedure

1. Definition of problem

2. Synthesis
3. Analysis of forces
4. Selection of material
5. Determination of mode of failure
6. Selection of factor of safety
7. Determination of dimensions
8. Modification of dimensions
9. Preparation of drawings
10. Preparation of design report

8. Design Considerations

- Strength
- Rigidity
- Reliability
- Safety
- Cost
- Weight
- Ergonomics
- Aesthetics
- Manufacturing considerations
- Assembly considerations
- Conformance to standards
- Friction and wear
- Life
- Vibrations
- Thermal considerations
- Lubrication
- Maintenance
- Flexibility
- Size and shape

9. Future Scope

• This innovation offers a solution for women elders and others stranded with a flat tire in remote locations, enabling them to change tires with ease.

• Time spent installing a manual jack and unloading the vehicle would be significantly reduced, saving valuable time in emergencies.

• The jack's capability to raise the car facilitates washing of the lower body, enhancing vehicle maintenance.

• Mechanics would benefit from on-road repairs facilitated by increased road clearance, allowing easier access to the vehicle's underside.

• By enhancing torque and power capacity, the jack can be adapted for use with Light Motor Vehicles (LMVs), expanding its utility beyond standard applications.

10. Conclusion

Upon project completion, we have determined that pneumatic jacks can effectively replace hydraulic jacks. The air needed to operate the jack is readily available in the environment, making it a convenient choice. Additionally, the project costs are relatively low compared to other jack alternatives. Due to the inbuilt nature of our jack, fatigue is minimized, further enhancing its durability. Mass production could further reduce costs. Overall, our pneumatic jack outperforms hydraulic jacks in lifting applications.

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