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DESIGN A ND FABRICATION OF SCISSOR MECHANISM FORLIFTING

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Abstract - The design and fabrication of a mechanism for lifting using a pneumatic cylinder is a common approach in industrial and commercial settings. This type of mechanism is used to lift heavy loads and move them from one location to another. The pneumatic cylinder is a type of actuator that converts compressed air into linear motion. The design of the mechanism includes a lifting platform, a support frame, and a pneumatic cylinder. The lifting platform is designed to support the load, while the support frame is used to hold the pneumaticcylinder in place.The fabrication process involves several steps, including designing the mechanism, selecting the appropriate materials, and assembling the components. The materials used for the mechanism must be strong and durable enough to handle the weight of the load being lifted. The assembly process includes mounting the pneumatic cylinder onto the support frame and connecting it to the lifting platform.The pneumatic cylinder works by using compressed air to create a force that moves the piston within the cylinder. This linear motion is transferred to the lifting platform through a linkage system, which raises the platform and the load on it. The mechanism can be controlled using various methods, such as a manual valve or an automatic control system.In conclusion, the design and fabrication of a mechanism for lifting using a pneumatic cylinder is a widely used approach in industrial and commercial settings. The process involves careful selection of materials, proper design, and precise assembly to ensure the mechanism is safe, reliable, and efficient in lifting heavy loads.

Keywords — Scissor Mechanism, Pneumatic cylinder, Load Lifting.

1. INTRODUCTION

Scissor lifts, as depicted in figure 1, are a type of mechanism that allows for vertical displacement of some load, through the use of linked, folding supports, in a crisscross “X” pattern, referred to as a pantograph (or, simply, a scissor mechanism). Scissor liftsare widely used in industrial applications, and also form a staple design element in competitive robotics. Each arm of the crossesis called a ‘scissor arm’ or ‘scissor member’. The upward motion is produced by the application of force, by some actuator (usuallyhydraulic, pneumatic, or mechanical), to the outside of the one set of supports, elongating the crossing pattern, and propelling theload vertically. However, the positioning of the actuator, in terms of the point of application of the force on the pantograph, can affect the force required of the actuator for a given load. Prudent placement of the actuator can greatly reduce the force required and the stress levels in the adjacent scissor arms. So far, all literature on the force analysis of scissor lifts relies on an actuator- position dependent approach, where a different force expression is derived for every new actuator position. This has clear drawbacks, such that when a new actuator position is to be implemented, a new expression must be derived from first principles. This research aims to derive a generalized force equation, which may be implemented for any actuator position, with the adjustment of a few position variables. The method outlined by Spackman, 1989, of deriving a

force equation as a function of the derivative of scissor height with respect to actuator length is used here as a starting point. For the purposes of this paper, we will be deriving and using an equation for the output force of the actuator as a function of the rate of change of height with respect to actuator length. This was demonstrated as a more potent method of force calculation by Spackman in 1989 (Spackman H., 1989).

2. LITERATURE SURVEY

• Tian Hongyu & Zhang Ziyi, Design and simulation Based on Pro/E for a Hydraulic Lift Platform in Scissors type, InternationalWorkshop on Automobile, Power and Energy, 2011

• A.Mehmood, S. Laghrouche & M.El Bagdouri, Modellig identification and simulation of pneumatic actuator for VGT system,Laboratoire S.E.T., Universities de Technologies de Belfort-Montpelier, Belfort, France.

• Sebastian Butefish, Volker Seidmann & Stephanus Buttegnbach, Novel micro-pneumatic actuator for MEMS, Institute forMicrotechnology, Technical University of Braunschweig, Alte Salzdahlumer Str. 203, 38124 Braunschweig, Germany, 2002

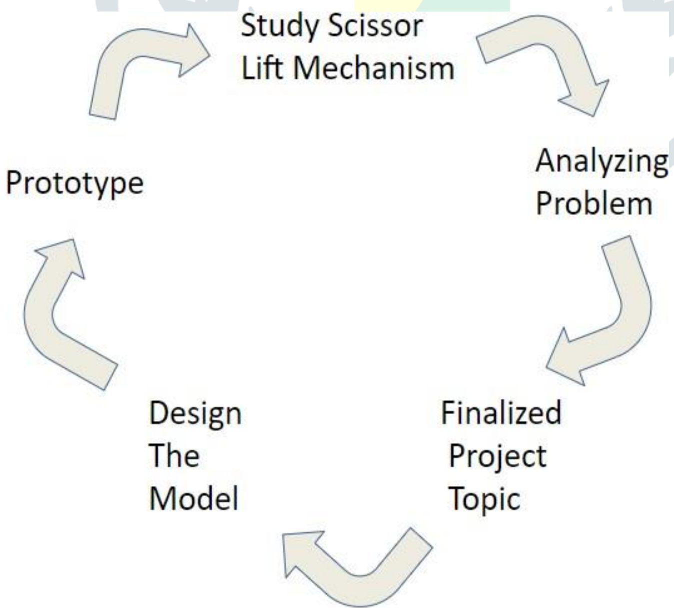
3. OBJECTIVE

Specifically, the project aims to:

1. Design a scissor mechanism that can achieve the required lifting height and capacity using a pneumatic cylinder as the actuationsource.
2. Select and size the pneumatic cylinder and other components to ensure reliable and efficient operation of the mechanism.
3. Fabricate the scissor mechanism using high-quality materials and precise manufacturing techniques to ensure the requiredstrength and durability.
4. Develop a reliable and efficient air supply system to power the pneumatic cylinder.
5. Test the scissor mechanism to verify its lifting capacity, stability, and safety, and make any necessary adjustments ormodifications.
6. Provide proper documentation, including design specifications, fabrication procedures, and testing results.

Overall, the objective of this project is to produce a functional and reliable scissor mechanism for lifting using a pneumaticcylinder that meets the required lifting capacity, height, and safety standards

4. METHODOLOGY



5. DESIGN AND ANALYSIS

When designing a scissor mechanism for lifting using a pneumatic cylinder, there are several important factors to consider. Here are some steps to follow:

1. Determine the load capacity: The scissor mechanism should be able to support the weight of the load being lifted. Calculate the weight of the load and make sure that the scissor mechanism can support it.

2. Choose the pneumatic cylinder: The pneumatic cylinder should be chosen based on the load capacity and the required lifting height. The cylinder should have enough force to lift the load and extend to the required height.

3. Design the scissor mechanism: The scissor mechanism should be designed to have enough strength and stability to lift the load. The mechanism should be made of strong and durable materials, such as steel or aluminum. The number of scissor links should be chosen based on the required lifting height and load capacity.

4. Calculate the required air pressure: The air pressure required to lift the load should be calculated based on the load weight and the size of the pneumatic cylinder. The air pressure can be adjusted using a pressure regulator.

5. Install safety features: Safety features such as limit switches and overload protection should be installed to prevent accidents and damage to the equipment.

6. Test the mechanism: The scissor mechanism should be tested to ensure that it can lift the load safely and smoothly. The lifting and lowering speeds should be controlled using flow control valves.

By following these steps, you can design a safe and reliable scissor mechanism for lifting using a pneumatic system.

6. WORKING PRINCIPLE

The scissor lift mechanism is made up of a set of linked bars or arms that pivot around fixed points to create a scissor-like motion. When the mechanism is activated, the arms extend and compress, causing the platform or load to move vertically. The basic scissor lift mechanism consists of two sets of linked arms, with each set comprising of two arms. The top and bottom arms of each set are connected by a joint in the middle, and the two sets are linked together at their midpoint. The platform or load is usually mounted on the top arms.

The pneumatic cylinder is typically mounted at the base of the mechanism, with the piston rod connected to the bottom arm of the scissor mechanism. When compressed air is introduced into the cylinder, the piston rod extends, causing the bottom arm to pivot and start the lifting process.

As the bottom arm moves, it causes the other arms to pivot as well, creating a scissor-like motion. As a result, the distance between the top and bottom arms increases, lifting the platform or load mounted on the top arms. The amount of force exerted by the cylinder determines the weight capacity of the scissor lift mechanism.

The scissor lift mechanism can be customized to meet specific requirements. For example, additional sets of linked arms can be added to increase the lifting height. The length and width of the arms can also be adjusted to suit different load sizes.

The pneumatic cylinder is a popular choice for powering scissor lift mechanisms as it is relatively easy to control, has a high power-to-weight ratio, and requires minimal maintenance. Additionally, it can provide a smooth and quiet operation. However, other types of actuators such as hydraulic cylinders or electric motors can also be used to power scissor lift mechanisms depending on the specific application requirements.

7. CONCLUSION

In conclusion, the scissor lifting mechanism using a pneumatic cylinder is a reliable and cost-effective solution for lifting applications in various industries. This lifting mechanism has several advantages, including simplicity, ease of operation, and low maintenance requirements. It is suitable for lifting lighter loads to a moderate height, making it an ideal choice for applications where a hydraulic or electric system may be over-engineered.

However, it is important to consider the limitations of a scissor lifting mechanism using a pneumatic cylinder, including the limited lifting capacity and height, air supply requirements, and maintenance needs. To overcome these limitations, proper equipment, such as an air compressor and storage tank, multi-stage lifting, and noise-reducing technology can be used.

In the future, advancements in pneumatic technology, integration with automation systems, customization, and environmentally-friendly design can further enhance the performance of scissor lifting mechanisms using pneumatic cylinders, providing more efficient and effective lifting solutions.

Overall, the scissor lifting mechanism using a pneumatic cylinder is a viable and practical lifting solution for various industries and applications, providing an affordable and easy-to-use lifting mechanism with a wide range of future scope for development and improvement.

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