International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 05 | May 2022 www.irjet.net p-ISSN: 2395-0072

"DESIGN AND FABRICATION OF PNEUMATIC GRIPPER"

Prof. Gaurav Nagdeve1[1], Ganesh Veer[2], Revannath Gadhave[3], Suraj Bhoge[4], Praful Thete[5], Pranay Ingole[6], Krishna Nimje[7]

2-7 Students B.E. Department of Mechanical Engineering,Rashtrasant Tukadoji Maharaj Nagpur University - [RTMNU], Nagpur, Maharashtra, India

1 Professor. Gaurav Nagdeve Department of Mechanical Engineering, Rashtrasant Tukadoji Maharaj Nagpur University - [RTMNU], Nagpur, Maharashtra, India

---

Abstract - *Material handling grippers are fitted to the end of an industrial arm robot. Grippers are used extensively in the pick and place industries. These are coupled as end effectors in an industrial work floor to realize and develop a task. The pneumatic gripper operates on the compressed air concept. A compressed air supply is linked to the gripper. The gripper opens when air pressure is provided to the piston, and it closes when air is released from the piston. The air pressure can be controlled with the help of the valve to control the force operating on the gripper. The goal is to create a pick-and-place gripper that is effective, easy, and cost-efficient.*

Key Words: Direction control valve (DCV), Compressor, Gripper, Modeling, Pneumatic System

1. INTRODUCTION

A pick-and-place robot is one that picks up an object and places it in a specific area. A gripper is used as an end effector by a pick and place robot. There are some ISO standards for gripper design and modelling. The major standard is ISO 14539:2000, which covers object handling with grasp-type grippers by manipulating industrial robots. Pneumatic grippers are mechanical grippers that are a cost-effective and dependable solution for a wide range of basic pick and place applications. A study was conducted to determine which type of gripper is most effective in pick and place applications, and the pneumatic gripper emerged as the winner.

Compressed air is used to transmit and control energy in the pneumatic system. It is frequently utilised in industrial automation and automotive applications that require quick reaction and low load. Air is employed as the medium because it is easy to compress and store. Air is abundant and would not harm the environment in the event of a leak.

In current technology, most pneumatic grippers use two or three fingers grippers, which are insufficient for picking a huge object. We modified the gripper structure from a two-finger or three-finger gripper to a four-finger gripper to boost the effective grabbing power.

1.1 INTRODUCTION TO PNEUMATICS :

Air is air that has a pressure that is substantially higher than that of the atmosphere. When compressed air is expanded to a lower pressure, it can be used to push a piston, like in a jackhammer; it can be used to move a shaft, like in a high-speed dental drill; or it can be expanded through a nozzle to produce a high-speed jet, like in a paint sprayer. Many pneumatic devices use compressed air as a source of energy to execute various tasks, such as riveting guns, air powered hammers, drills such as rock drills, and other pneumatic instruments. There are ways to employ compressed air in coal mining tools, lowering the risk of injury.

1.2 Scope

The goal of this project is to create a pneumatic gripper for industrial use. This project focuses on picking different characteristics that provide the gripper more usefulness and versatility. The gripper dimensions, material utilised to construct the gripper, and design of the gripper 1-8 may differ from one application to the next. To address these issues, we created a prototype four-finger pneumatic gripper for soda can automation.

1.3 OBJECTIVE

1) The pneumatic technology is being implemented.

2) Improved existing mechanisms

3) To employ a pneumatic system with easily available working fluid.

4) To create a system that is both efficient and cost-effective.

2. LITRETURE REVIEW

Khadeeruddin, et al. [1], They approach is to design of two jaw gripper, which is distinct from the traditional cam and follower gripper to control the movement of the jaws, as stated in the approach of handling of materials and mechanisms to pick and place found widely in factory automation and industrial manufacturing. The gripper

model's design, analysis, and construction are explained, along with a comparison to existing pneumatic grippers. Based on the application and several sets of variables, they computed the force and torque for the two jaw gripper. Because air hoses, valves, and other pneumatic equipment are simple to maintain, pneumatic grippers are relatively easy to use and maintain.

Swapnil Gurav et al. [2] deals with the design and manufacture of robot end effectors that must conduct a pick place operation for handling items in the industrial automachine and manufacturing industries. They created a gripper for the stamping and folding industries that needed to grasp sheet metal pieces. The kinematics and dexterity of the human hand are heavily emphasised in the design (humanoid). Ansys software is used to perform a kinematic study of the gripper to assist this beginner design. It is put through its paces with various loads and shapes.

Anna Maria Gil Fuster et al. [3] In order to reduce the cost of serial production, the gripper was developed and built using injection modelling. The prototype of the gripper was created using 3D printing. They conducted research on household items with unusual forms and weights. The SCARA robot served as inspiration for the final prototype of a four-finger gripper.

Maheshwari et al. [4] built a pneumatic pick and place automation system for a groove grinding machine that was tailored to their issue statement. They analysed current systems and identified flaws, then created a pneumatic pick and place automation machine to solve those difficulties. They estimated the force that must be delivered to the metal and chose a pneumatic cylinder to control the operation in the groove grinding machine industry.

The pneumatic gripper used to manipulate cylindrical objects is discussed by.

Ciprian Rizescu [5] discusses the pneumatic gripper for manipulating cylindrical objects. The gripper is attached to an automatic machine that performs the moulding operation. The gripper is connected to a mechanical arm that is part of the automated machine. It is based on the planner slider crank mechanism, and the author created a mathematical model for the gripper coupled to the mechanical arm. It's used to simulate an assembly activity in 3D. The gripper is designed after analysing data such as force.

3. WORKING PRINCIPAL

At least two fingers on the parallel jaw gripper can be moved towards each other along one axis. The fingers can usually move independently of one another to avoid shifting the object, although they can only do simple tasks like open and close [4.1]. A longitudinal or side movement is therefore impossible. For maximum flexibility, a parallel jaw must be possible, as well as manual control to steer the gripper. The following concepts apply to this sort of parallel jaw gripper: - The grip of force closure: The force closure grip has the property of keeping the object in a stable state by balancing all forces and torques generated by the object.The total of all forces and torques must equal zero ($\Sigma F=0$; $\Sigma M=0$). There are two types of force closing grips: one with friction and one without friction. Because the force closing grip without friction is highly idealised and rarely used in everyday life, it is not discussed further. For holding a planar object, at least 2 contact points are required, and for gripping a three-dimensional object, at least 4 contact points are required. The second principle for holding items is the form closure grip. Because the gripper is a negative representation of the object (or a portion of it), the object's mobility within the gripper is limited in any direction, even when changing the gripper orientation.On well-defined contact surfaces, the force is adjusted. Tangential load, pressure load, and torque are not taken into account; instead, they are reduced to their respective forces. Either a particular geometry (i.e. a negative model of the object) or a large number of fingers are required by the gripper. When compressed air from the compressor is released through the pressure regulator, it rushes into the 5/2 way valve. The pressure measurements on the dial gauge can be used to maintain the desired pressure level. The system's maximum operating pressure is 10 bar, but we'll mostly be working at pressures far lower than that, preferably less than 5 bar.The compressed air enters the 5/2 way valve, which, when engaged manually or via a solenoid electric circuit, lets the compressed air to enter the inlet ports of the two 28 | P a g e double acting air cylinders (max supply pressure of 10 bar) that are positioned immediately opposite each other. A 5/2 way valve could be used instead of a 5/3 way valve, which is an advanced valve that controls the piston rods' stroke length by regulating the quantity of compressed air flow. The bore diameter and stroke of the cylinder are both 50 mm.When air enters the cylinder, it pulls the piston forward, causing the piston rods to travel outwards, increasing the distance between the gripper surfaces. As a result of this action, the grippers open, allowing the object to be released. When compressed air flow is reversed, air flows out of the cylinder, through the valve, and into the compressor via the regulator. This explains the piston rod's return stroke, which aids in grasping the load when the distance between the gripper surfaces shrinks. The pressure is maintained according to the needed gripping force. The breadth of the object to be gripped is measured by the distance between the grippers.Both gripper arms move in a drilled guide path produced with the help of two iron rods that prevents movement along any other axis.

4. COMPONENTS USED

Air Receiver : Receivers maintain consistent air pressure in a pneumatic system, independent of how much or how little is used. This allows for the balance of consumption peaks that cannot be compensated for by the compressor

Fig No.1 Air Receiver

Compressed Air Filter : The pressurised air is fed through a baffle plate in the filter bowl and travels through the filter from left to right. The battle plate causes the air to rotate, and the heavier dust particles and water droplets are spun against the inner wall of the filter bowl by centrifugal force.

Fig. No. 2 Compressed Air Filter

Compressed Air Regulator : The compressed air produced by the compressor will change over time. Regardless of pressure fluctuations in the main loop, centrally situated regulators installed in the compressed air network provide a consistent supply pressure (secondary pressure). (Initial pressure).

Fig. No. 3 Compressed Air Regulator

Compressed Air Lubricator : As a general rule, compressed air should be dry, that is, free of grease. It may be essential to grease some components. Compressed air lubrication should therefore always be limited to the plant areas that require it. Mist lubricators are used to feed specifically selected oils into compressed air for this purpose. Oils injected into the air by the compressor are incompatible with the lubrication of control system components.

Fig. No. 4 Compressed Air Lubricator

Pneumatic Actuators : An actuator is a device that converts energy from the supply into productive work. The system controls the output signal, and the actuator responds to the control signals through the final control element. To indicate the status of the control system or actuator, other types of output devices are used.

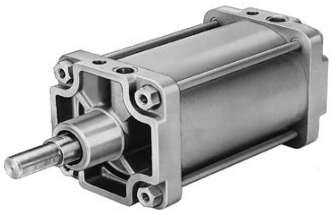

Fig. No. 5 Pneumatic Actuators

Pneumatic Values : Signal components, control components, and a functioning part make up pneumatic control systems. Valves are signal and control components that alter the working element's operating sequence.

Fig. No. 6 Pneumatic Values

Flow Control Valves : Flow control valves (Throttle valves) influence the volumetric of compressed air, in both directions.

Fig. No. 7 Flow Control Valves

Houise And Tubing : A way must be given for conducting clean, dry, and lubricated compressed air to tools and equipment beyond the compressed air distribution system, which is made up of rigid main pipelines, feeder lines, and associated fittings and accessories. This is accomplished using air hose tubing.

Fig. No. 8 Houise And Tubing

6. CIRCUIT

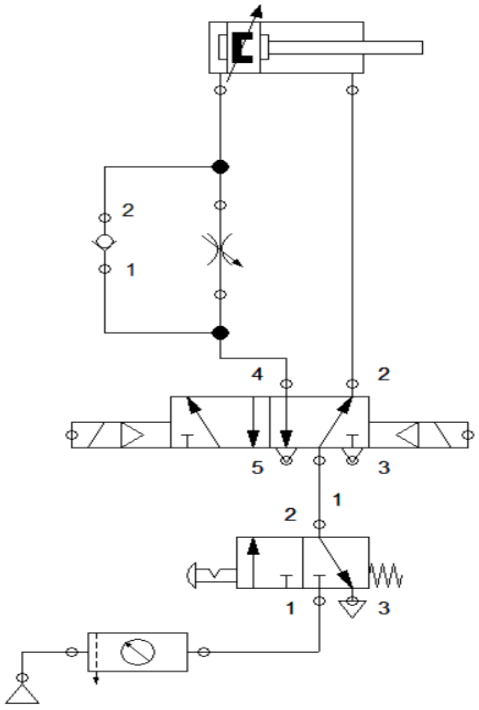

Fig No.9 **:** Electro-Pneumatic circuit for proposed model

The pneumatic circuit for the automatic actuation of a pneumatic gripper in robotic arm applications is shown in Figure 6.1. The following components are included in the circuit: The pneumatic source (#7), 3/2 DCV (#2), 5/2 DCV (#3), Throttle valve (#4), Check valve (#5), FRL (#6), and the pneumatic double acting cylinder (#1). The gripper (#Gripper) is attached to the end of the piston.

The 3/2 DCV is controlled by a hand lever or a push button to allow air to travel through the circuit for safety reasons. The robotic arm features an accelerometer sensor (#A) that detects rotation and a proximity sensor (#B) in the gripper's centre that detects things. The sensor's signals are used to control the cylinder through the 5/2 DCV.

To capture the things, the cylinder must first be stretched. The signal is provided to the 5/2 DCV to energise the Solenoid when the arm rotates 180 degrees.

The cylinder is expanded and the gripper is opened once it is energised. The presence of an article must then be detected and seized. The signal is transferred to the Solenoid B to be energised once the object has been identified by the Proximity sensor, which is located in the gripper's centre. The cylinder is retracted after it has been energised, allowing the gripper's jaw to shut and the object to be gripped. We may now move it to the desired location.

6 . FINAL PRODUCT

Fig. No. 10 PNEUMATIC GRIPPER

8. CONCLUSIONS

From the foregoing result, it is determined that the employment of a pneumatic gripper for industrial and mechanical operations is the most convenient.

Above is a future model of pneumatic machine on which drilling, cutting, and other operations are performed using a pneumatic system, which overcomes all of the problems associated with traditional operations.

This pneumatic multi operation Machine will be exhibited in order to increase production and job quality

It also includes a full description of the machine mechanism and its several primary components. Various pneumatic devices are used to turn the manual controlled machine into an automatic machine, as explained in the paper.

The results show that there is a higher reduction in operational time. As a result, the output will be higher, and human interference will be less.

REFERENCES

[1] Prof. Gadhia Utsav, Shah Harsh, Patel Viral, Patel Kushang, and Amin Harsh, "Design and development of universal drilling machine: a review study," "International Journal for Technological Research in Engineering," April 2016, pp.27-42.

[2] Tudor Deaconescu and Doinaarliman (NEGREA), "Study on the Pneumatic Actuation of Gripping Systems," "Advances in Production, Automation, and Transportation Systems," "ROMANIA," Hydraulic and Pneumatic, 2015, pp.88-110.

[3] Gujjarlapudikrishnavamsi, Gadinarayana, "Design and Analysis of Pneumatic Gripper with Two Jaw Actuavation," ISSN 2319-8885,4[1], January-2015, PP.20-23.

[4] K. Krantikumar, K.V.S.S. Saikiran, and Jakkoju Sathish, "Study on the Pneumatic Actuation of Gripping Systems," ISSN NO: 2348-4845, March-2016, pp.501-509.

[5] Miguel Angel Castillo, "Advanced Pneumatic Gripper, Countersink, and Riveting Experience," "SAE international report," pp.210-325.