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FABRICATION OF PNEUMATIC ARM HAMMER MACHINE

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DECLARATION OF CANDIDATES

We here by declare that, the work presented in this project is the outcome of the project work, perform by us under the supervision of **Md.Minhaz Uddin** Lecturer, Department of Mechanical Engineering, Sonargaon University. We also declare that the project titled "**FABRICATION OF PNEUMATIC ARM HAMMER MACHINE"** is submitted to the Department of Mechanical Engineering of Sonargaon University of Bangladesh in Partial Fulfillment of the Degree of the Bachelor of Science in Mechanical Engineering.

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ABSTRACT

This project aims at fabricating an automated hammering machine that can perform hammering operations without the involvement of any human operator. This project selected because no such machines are available in these industries. The introduction of an automated hammering machine in the industries will help the industries in prospering and it will make the operation safe and easy. Moreover the project will have a greater impact on the metal industries. The machine will be capable of performing fast and hammering operations. The pneumatic arm hammer consists of a cylinders, a shaft works with lead screw mechanism capable of converting motion of piston to rotational motion of arm with help of using compressed air. The designed processes are carried out based on integrated information of kinematics dynamics and structural analysis of the desired robot configuration as whole. The highly dynamic pneumatic arm model can be easily set at intermediate positions by regulating the pressure using the flow control valve. As the pneumatic arm is constructed with light materials, so that it will be much easier for a person to handle it with proper manner. The handling of materials and mechanisms to pick and place of objects from lower plane to higher plane and are widely found in factories and industrial manufacturing.

Contents

Chapter: 1
INTRODUCTION

1.1 Introduction

Hammering is the most common operation in fabrication as well as civil work. And 90% of hammering is to be done on nails on walls, furniture and other work which cannot be put in a hammering machine. It has to be done manually by hammering each nail a certain number of times. This involves a lot of effort was considered to be a task with no other alternatives.

Well this would change as we hereby design a pneumatic based hammering as well as nail puller arm attachment. The system is made to be an arm attachment to ensure flexibility of use so that it can be used on walls, furniture small spaces as well as in metal fabrication. The system has a number of applications and will automate all these hammering tasks with highly increased speed and efficiency. The system makes use of a pneumatic actuator powered by a compressed air supply, the cylinder is attached with a hammering head to ensure hammering surface. The hammering head is also integrated with a nail puller to allow for easy nail pulling on the go. The pneumatic system is driven by an automatic circuitry to ensure continuous hammering without any effort. The pneumatic cylinder is driven back and forth continuously to ensure high power on target hammering for instant and accurate hammering. This would save a lot of time in fabrication as well as civil work operations. The hammering system is attached to the arm with a dual support for comfort. The hammering system is also attached to the arm attachment through spring dampers to ensure least possible jerk on the arm. Thus the system provides a modern day arm attachment hammering system to ease and speed up hammering work using pneumatic system.

1.2 Objectives

- To design & construction of Automatic Arm Hammer.
- Air Pressure Control using input and output of solenoid valve by Transformer Capacitor , Relay ,Sensor ,diode and Switch
- Working of pneumatic hammer with air pressure.

Chapter: 2

LITERATURE REVIEW

2.1 Introduction

Pneumatics refers to the science of using compressed air to transmit energy and force. A basic example of utilizing pressurized air for the desired function is something as simple as blowing air into a balloon and then letting it zoom around the room. Pneumatic tools are essential components behind things such as drilling, hammering machines, machinery that transports heavy objects, and even jet engines! The word pneumatics may sound modern and complex, but the technology has been used by humans for thousands of years. In fact, it began when primitive hunters first created blow-guns to hunt down their prey. These contraptions delivered pressure of around 1 to 3 psi. It wasn't until 3000 B.C that small compressors were developed to assist in starting fires. Around 10 to 70 A.D, a Greek mathematician simply known as the Hero of Alexandria created what would be the first pneumatic tools. Despite their rudimentary design, these tools would lay the foundation upon which future pneumatic systems would be developed. Fast forward to the 1600s, a German physicist known as Otto von Guericke would invent the first vacuum pump that made use of pressurized air. The 1800s would later be known as the era in which pneumatic evolved into its own industry with businesses and inventors alike recognizing its great potential. No longer did people tinker around with pneumatic systems out of curiosity but rather to produce tools that served a practical purpose. Innovation began with the introduction of pneumatic tubes in Victorian England that used pipelines to transport telegrams from one station to another. During the late 1800s, an American merchant known as John Wanamaker developed tube systems that helped transport money and mail items. The most elaborate use of these tubes was introduced in 1867 by a man called Alfred Beach. He created a subway line that transported passengers through a pipe. Unfortunately, his project was not granted commercial access and closed down after a while. The year 1890 saw the invention of the pneumatic hammer by Charles Brady King. This tool became vital for fastening steel structures in railway sleepers and shipyards.

2.2:Pneumatics Today

Now a days, pneumatic tools provide an accurate and quick pressure supply for a number of applications including packaging, automation control, and heavy load movement. Pneumatic systems continue to evolve to provide better-pressurized solutions. provides businesses across multiple industries with pneumatic tools that assist in heavy load handling and movement. These tools require minimal training to operate and assist in reducing energy costs.

Chapter: 3
METHODOLOGY

3.1 Introduction

This project aims to make a project to Pneumatic arm hammer. In this project are used various instrument such as Compressor , Pneumatic cylinder, Solenoid valve , various type Nipple, Air Filter, Pipe, Transformer, Proximity sensor, Diode-4007,1000MFD Capacitor, 8 pin relay With Base, 2pin Plug, Switch , twain core wire . These are discussed below.

3.2.1 Air Compressor

An air compressor is a pneumatic device that converts power (using an electric motor, diesel or gasoline engine, etc.) into potential energy stored in pressurized air (i.e., compressed air). By one of several methods, an air compressor forces more and more air into a storage tank, increasing the pressure. When the tank's pressure reaches its engineered upper limit, the air compressor shuts off. The compressed air, then, is held in the tank until called into use.[1] The kinetic energy provided by the compressed air can be used for a variety of applications such as pneumatic tool as it is released air and the tank depressurizes. When tank pressure reaches its lower limit, the air compressor turns on again and re-pressurizes the tank. An air compressor must be differentiated from a pump because it works for any gas/air, while pumps work on a liquid.

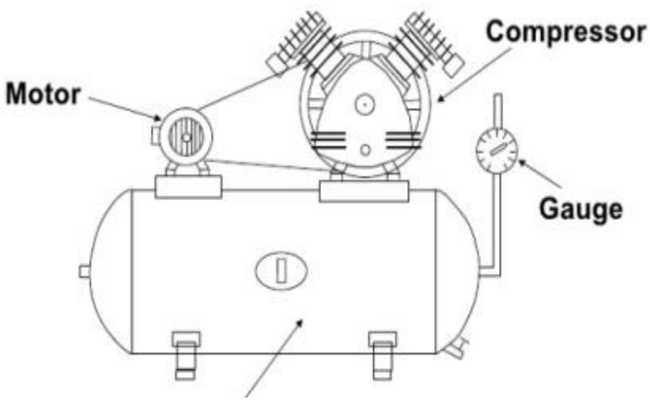


Figure 3.2.1: Block diagram of Air Compressor.

3.2.2 Pneumatic Air Cylinder

Pneumatic cylinders are mechanical devices that produce force by using energy from pressurized air. These devices consist of a piston, piston rod, and cylinder. The pressure inside the cylinder rises as air enters on one side of the cylinder. The rise in internal pressure causes the piston to move in a specific direction. The piston rod transmits the developed force to the object to be moved.

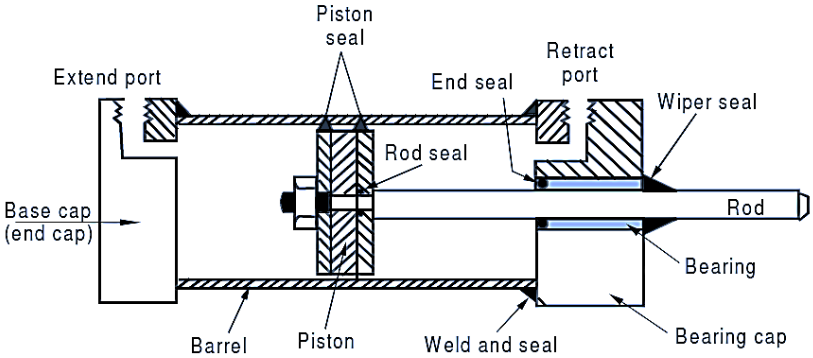
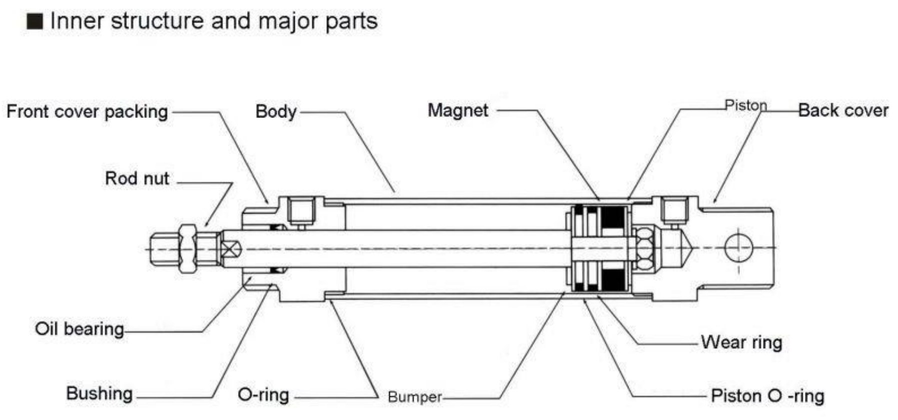


Figure 3.2.2: Block diagram of Pneumatic Air Cylinder.

3.2.3DifferentParts of the Cylinder

1. Pneumatic Cylinder Bore
2. Piston
3. Piston Rod
4. Piston Cushioning
5. Piston Static Seal
6. Piston Seal
7. Piston Guide Rings
8. Tie Rods



3.2.3 Figure: Diagram of Different Parts of the Cylinder

3.3 Solenoid valve

A solenoid valve, also known as an electrically-operated valve, is a valve that uses electromagnetic force to operate. When an electrical current is passed through the solenoid coil, a magnetic field is generated which causes a ferrous metal rod to move. This is the basic process that opens the valve and it works either directly or indirectly on the air.

Solenoid valves can be normally open or normally closed:

- Normally Open ,the valve remains open when the solenoid is not charged.

- Normally Closed, the valve remains closed when the solenoid is not charged.

Figure 3.3: Solenoid Valve

3.4 Nipple

In plumbing and piping, a common pneumatic component is the pipe nipple. A pipe nipple consists of a short piece of pipe that is male threaded at each end. Pipe nipples are commonly used for connecting two other pneumatic fittings.

3.4.1 Hex Nipples

A hex nipple is a specific type of pipe nipple. Generally, these types of pneumatic components have a hexagonal section in between the male threads for wrench grasping capabilities. Hex nipples function like a nut that can be gripped by a normal wrench. This provides a greater mechanical advantage

Figure 3.4.1: Nipple

3.5 Air Hose pipe

Air hoses are used to convey compressed air for pneumatic systems. These air hoses must have high strength to handle high pressures in order to prevent leakage and damage. In addition, oil-based lubricants are sometimes added to the compressed air for smooth running of the equipment.

Fig : 3.5 Air Hose pipe

3.6: SMPS

A switched-mode power supply (SMPS) is an electronic circuit that converts power using switching devices that are turned on and off at high frequencies, and storage components such as inductors or capacitors to supply power when the switching device is in its non-conduction state.

Switching power supplies have high efficiency and are widely used in a variety of electronic equipment, including computers and other sensitive equipment requiring stable and efficient power supply.

A switched-mode power supply is also known as a switch-mode power supply or switching-mode power supply.

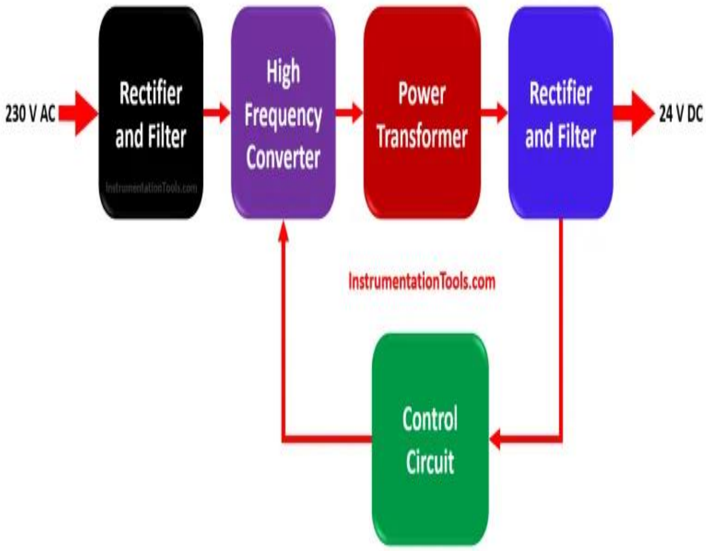
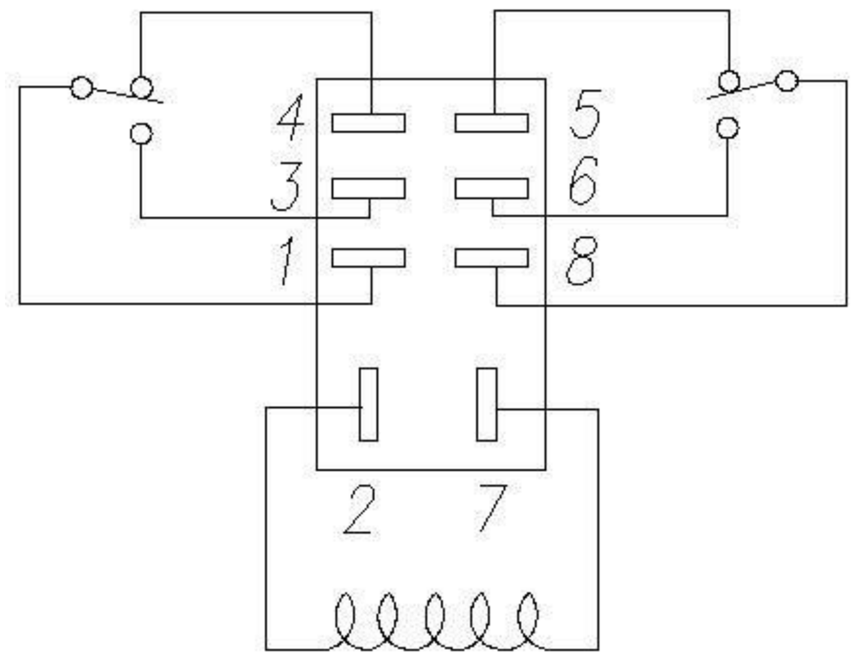


Figure3.6: Diagram of SMPS

3.7:Relay

Relay is the main component of power system protection. A relay is a device consisting of coil which can act as an electromagnet while exciting with small currents especially known as fault currents. The relay is based on the principle of electromagnetic attraction. So it is a protection device which has a coil and is excited using small curents and are coupled with the circuit breakers. When the small current is passed the switch is closed by the action of electromagnetic attraction and the circuit breaker acts and breaks the circuit in case of any fault.



3.7 Figure: diagram of Relay

3.8 Proximity Sensor

Proximity sensor is an intelligent sensor that can detect the presence of objects within its vicinity without any actual physical contact. Proximity sensors, which are often used in collision warning and collision avoidance systems, have the ability to detect the presence of a target within a defined range. A proximity sensor might use, sound, light, infrared radiation (IR) or electromagnetic fields to detect a target.

Proximity sensors are commonly used in industrial applications and consumer robotics. They are also used in vehicles for detecting the physical closeness of other vehicles, as well as for parking-assist functions.

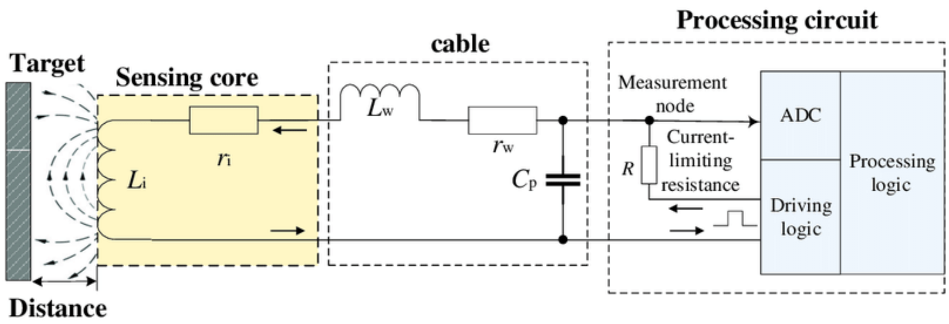


Figure 3.8: Diagram of Proximity Sensor

3.9 Two pin plug

2-pole means that the device plug is not earthed and it normally has two pins that transmit electricity. Originally, all electrical devices were fitted with 2-pole plugs, which means that the devices were not earthed and that all mains sockets were constructed for 2-pole plugs.

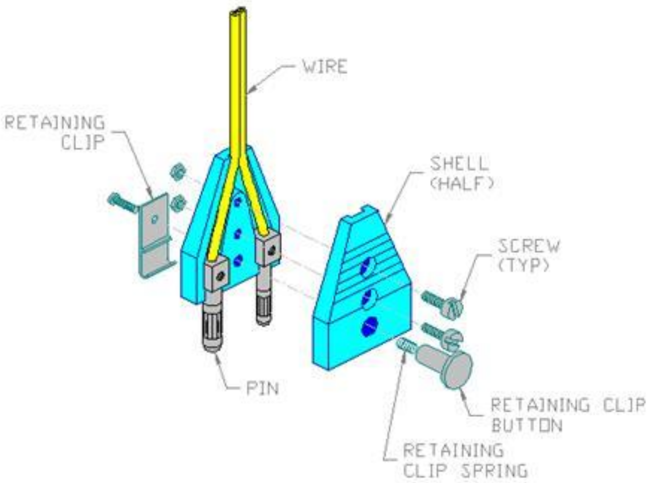


Fig 3.9:Diagram of Two pin plug

Chapter 4

EXPERIMENTAL SET UP

4.1 Introduction

The whole project consists of several electrical and mechanical function as mentioned earlier. As the project is to design an automatic system of nail hammering and nail pulling the persons needed.

The main components of this project are as follows:

1. Air Compressor
2. Pneumatic Air Cylinder
3. Nipple
4. pipe
5. Solenoid valve
6. SMPS
7. Connecting wire
8. Proximity sensor
9. Relay

4.2 Air Compressor

Air compressors work by forcing air into a container and pressurizing it. Then, the air is forced through an opening in the tank, where pressure builds up. Think of it like an open balloon: the compressed air can be used as energy as it’s released. They’re powered by an engine that turns electrical energy into kinetic energy. It’s similar to how a combustion engine works, using a crankshaft, piston, valve, head and a connecting rod. From there, the pressurized air can be used to power a variety of tools. Some of the more popular options are nail pullers, impact wrenches, sanders and paint sprayers. There are different types of air compressors and each one has a different specialty. Generally, the differences aren’t too severe: it all boils down to the way a compressor handles air displacement. There are two methods of achieving air compression: positive and dynamic displacement.

Figure 4.2: Air Compressor

4.3 Pneumatic air Cylinder

A pneumatic cylinder uses the pressure of a gas to perform work, specifically linear work. The word "pneumatic" comes from the Greek and refers to air, which is the least expensive and most common type of gas used in pneumatic cylinders. Air can be easily taken in and compressed to refill pneumatic systems, and does not pose the same danger as other gases. Some inert gases may be used instead, but these must be ordered or manufactured pre-compressed in tanks and have more limited uses.

4.4: Double acting Pneumatic air Cylinder

A pneumatic cylinder uses the pressure of a gas to perform work, specifically linear work. The word "pneumatic" comes from the Greek and refers to air, which is the least expensive and most common type of gas used in pneumatic cylinders. Air can be easily taken in and compressed to refill pneumatic systems, and does not pose the same danger as other gases. Some inert gases may be used instead, but these must be ordered or manufactured pre-compressed in tanks and have more limited uses.

Figure 4.4: Double Acting Pneumatic air Cylinder.

4.5 Air Solenoid valve

Solenoid is the generic term for a coil of wire used as an electromagnet. It also refers to any device that converts electrical energy to mechanical energy using a solenoid. The device creates a magnetic field from electric current and uses the magnetic field to create linear motion. Common applications of solenoids are to power a switch, like the starter in an automobile, or a valve, such as in a sprinkler system. A solenoid is a coil of wire in a corkscrew shape wrapped around a piston, often made of iron. As in all electromagnets, a magnetic field is created when an electric current passes through the wire. Electromagnets have an advantage over permanent magnets in that they can be switched on and off by the application or removal of the electric current, which is what makes them useful as switches and valves and allows them to be entirely automated.

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Figure:4.5 Air Solenoid valve

4.6 Nipple

In plumbing and piping, a nipple is a fitting, consisting of a short piece of pipe, usually provided with a male pipe thread at each end, for connecting two other fittings.

The length of the nipple is usually specified by the overall length with thread. It may have a hexagonal section in the center for a wrench to grasp (sometimes referred to as a "hex nipple"), or it may simply be made from a short piece of pipe (sometimes referred to as a "barrel nipple" or "pipe nipple"). A "close nipple" has no unthreaded area; when screwed tightly between two female fittings, very little of the nipple remains exposed. A close nipple can only be unscrewed by gripping one threaded end with a pipe wrench which will damage the threads and necessitate replacing the nipple, or by using a specialty tool known as a nipple wrench (or known as an internal pipe wrench) which grips the inside of the pipe, leaving the threads undamaged. When the ends are of two different sizes it is called a reducer or unequal nipple.

Fig: 4.6 Nipple

4.7 Air Pipe

How a pneumatic transport system works: a tube links the sending and receiving stations. The air compressor pump at the receiving station can suck or blow air. When it sucks, it pulls canisters along the tube toward it; when it blows, it pushes the canisters in the opposite direction.

Fig : 4.6: Air pipe

4.8 Proximity sensor

A proximity sensor is a sensor which detects the presence of nearby objects without any physical contact. This can be done using the electromagnetic field or electromagnetic radiation beam in which the field or return signal changes in the event of the presence of any object in its surrounding.

Fig:4.8 Proximity sensor

4.9 SMPS

SMPS stands for Switched Mode Power Supply. It is an essential part of an electrical power circuit. Basically, power is required in different forms for various circuits. So, we just cannot feed raw AC power to them. Such type of conversion is done by SMPS. Its role is to provide the necessary supply voltage to electrical circuits in their required form. As the name implies, the power supply is altered and obtained in various forms by means of switching devices inside it. They switch the power in various ways to provide the final output voltage. These switching devices are nothing but power electronic devices like triac, diac, transistor, MOSFET, capacitors, resistors, etc. SMPS is majorly categorized into four types –AC to DC converter. In this post, we will have a look at the working of one of the most widely used types – AC to DC converter. AC to DC converter is used to provide regulated DC supply voltage to electrical circuits. The 230V AC supply is converted to a 24V DC supply. Let us have a look at the inside circuit of this converter. As seen in the below figure, the SMPS consists of an input rectifier and filter, a high-frequency switching device converter, power transformer, output rectifier, and filter and control circuitry. This is the primary stage of the converter. The rectifier and filter circuit is used to convert AC supply into DC voltage. But this DC output voltage is unregulated. It has many variations as the circuit inside is only used to convert and not process it accurately. This unregulated DC voltage is then given to a high-frequency converter consisting of switching devices. This is done to ensure that we get a constant DC output voltage every time. The deviations are monitored and nullified again by the whole circuit once again. SMPS find their application in almost every electrical circuit, as most of the devices require DC voltage; and not just DC voltage, SMPS provides a regulated voltage as discussed before in the types of SMPS.

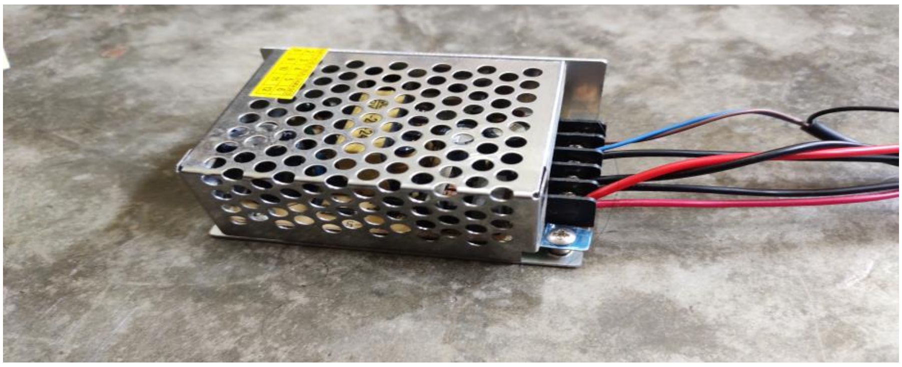

Figure 4.9: SMPS

4.10 Relay

Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. As relay diagrams show, when a relay contact is normally open (NO), there is an open contact when the relay is not energized. When a relay contact is Normally Closed (NC), there is a closed contact when the relay is not energized. In either case, applying electrical current to the contacts will change their state. Relays are generally used to switch smaller currents in a control circuit and do not usually control power consuming devices except for small motors and Solenoids that draw low amps. Nonetheless, relays can "control" larger voltages and amperes by having an amplifying effect because a small voltage applied to a relays coil can result in a large voltage being switched by the contacts.

Protective relays can prevent equipment damage by detecting electrical abnormalities, including overcurrent, undercurrent, overloads and reverse currents. In addition, relays are also widely used to switch starting coils, heating elements, pilot lights and audible alarms.

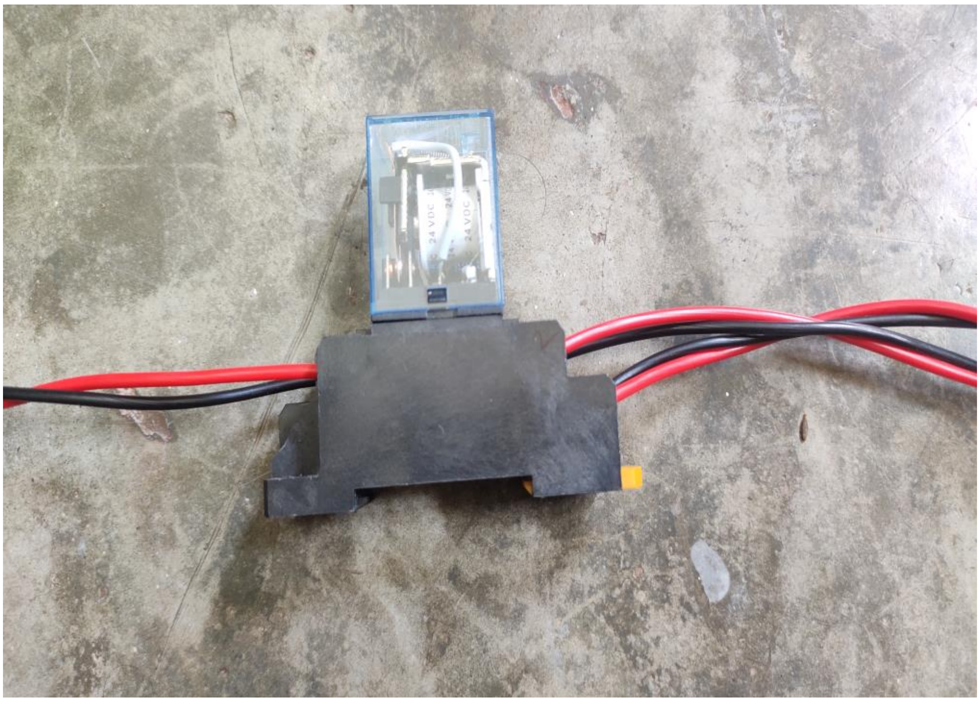

Figure 4.9.1 : Relay

Chapter 5

RESULT & DISCUSSION

5.1 Result

Finally, we have completed our project .Inserting and Removing nails is very easy. After tireless work we have reached our goal**.**

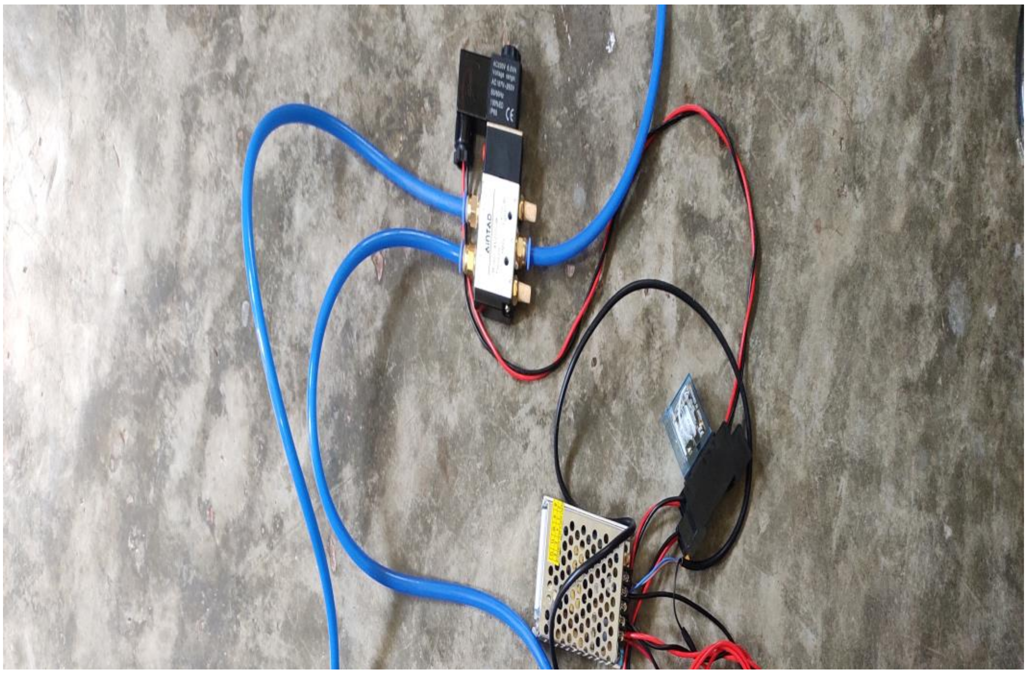

Figure 5.1:Model Of Pneumatic Hammer

Data collection:

- Cylinder thrust for double acting in forward stroke, then cylinder thrust for double acting in return stroke.
- Where dis diameter of bar in mm
- P=pressure in bar (a bar P=0.1N/ mm^2) ,d= 25 mm Piston rod diameter, Bore D=32 mm, F=?

  F=(π / 4)x(D-d)xPx2

  F=(3.1416/4)x(32-25)x0.1x2

  =1.099N

- After pushing corresponding valve according to equation, We can get that as per our consideration. The maximum force exerted by our cylinder is 1.099N.

Theoretical air consumption:

- Where P is pressure P=0.1bar, Bore D=32mm,d=25mm is piston Rod diameter. stroke Length L=150mm
- C={($\pi/4$)D^2x (p+1) x L}/1000

  C={(3.1416/4)$(32)^2$x(0.1+1)x150}/1000
  = 13.27 liter.
- Air Consumption of our pneumatic machine.

5.1.2Discussion

Every engineering project makes us learn about decision making regarding the selection of the material, methodology, and design constraints. These are critical and need strong decision making using your engineering knowledge. The overall project gives opportunities for making appropriate decisions. Some of them are the following:

• Choice of the project for this course

• Choice of the team members for the project

• Choice of the appropriate methodology

• Choice of the appropriate parts for each member in the project taking in mind their expertise.

• Best suitable material section All team members gave take part in deciding all these factors and making a decision regarding the completion of the project. Where all of us didn't have any idea, we took help from books, journals articles and so.

Chapter 6

CONCLUSION

6.1.1 Advantages

There are many advantages of using pneumatic hammers. They can be mounted on light trucks that are capable of providing adequate compressed air pressure – this installation will require minor modifications. The high power to weight ratio makes them more convenient in space-saving compared to hydraulic hammers. There are many advantages of using pneumatic hammers. They can be mounted on light trucks that are capable of providing adequate compressed air pressure – this installation will require minor modifications. The high power to weight ratio makes them more convenient in space-saving compared to hydraulic hammers.

6.1.2 Disadvantage

Disadvantages of pneumatic hammer with flat or pointed chisel. A disadvantage is that the pneumatic hammer with pointed/flat chisel is less suitable. Even if demolition work (or removal of material) inside a building can be done by do-it-yourselfers, it should not be carried out with a pneumatic hammer.

6.2 CONCLUSION

The researchers have proven that the design of pneumatic hammer is ergonomic based on the anthropometric measurement. Such motion was found true upon asking industrial engineering students and Ms. Jelyn Rodriguez, an industrial engineering professor. The design of the pneumatic hammer is proven to be successful based on the data gathered upon testing it. The developed machine is said to be more efficient than the conventional one. Other factors may have affected the results of this study. These factors should be taken into consideration on the conduct of other studies pertinent to it.The researchers concluded that nailing using pneumatic hammer lessens the exertion of force needed to finish the operation. It was concluded that a pneumatic hammer is a device that is available for all users because it is easy to be used.

RECOMMENDATION

The researchers observed that the nail holder is causing hassle when a nail is being loaded in it. Hence, it is recommended that more appropriate and operable design of the nail holder be done. Likewise, the developed model of the hammer insignificantly heavy causing the user to use it with less accuracy. The researchers recommend to find ways on how the weight of the device could somehow be lessened.

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APPENDIX –A

Specifications of Air Compressor

Air Compressor Specifications	
Output	1HP
Volt	220V
Pressure	120 PSI