DESIGN AND FABRICATION OF AUTOMATIC PNEUMATIC RAMMING MACHINE

A thesis
by

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DEPARTMENT OF MECHANICAL ENGINEERING
SONARGAON UNIVERSITY (SU)

MAY 2023

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of
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MAY 2023

Letter of Transmittal

May 2023

To

Nuruzzaman Rakib
Assistant Professor
Department of Mechanical Engineering
Sonargaon University (SU)

Subject: Submission of Project Report.

Dear Sir,

We are pleased to submit the project report on **"Design and Fabrication of Automatic Pneumatic Ramming Machine".** It was a great pleasure to work on such an important topic. This project has been done as per instruction of your supervision and according to the requirements of the Sonargaon University (SU).

We expect that the project will be accepted by the concerned authority we will remain happy to further explanation that you may feel necessary in this regard.

Thank You

Sincerely yours,

Shoylen Chakma
Bijoy Chandra Mohonto
Farhana Easmin Sorna
Mahbubul Hassan
Md. Sazzadul Alam

DECLARATION

We do hereby solemnly declare that, the work presented here in this project report has been carried out by us and has not been previously submitted to any University/ Organization for award of any degree or certificate.

We hereby ensure that the works that has been prevented here does not breach any existing copyright.

We further undertake to indemnify the university against any loss or damage arising from breach of the foregoing obligation.

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CERTIFICATE

This is to certify that the project report on **"Design and Fabrication of Automatic Pneumatic Ramming Machine"** is the bona fide record of project work done by **Shoylen Chakma, Bijoy Chandra Mohonto, Farhana Easmin Sorna, Mahbubul Hassan, Md. Sazzadul Alam** for partial fulfillment of the requirement for the award of the degree of Bachelor of Science in Mechanical Engineering from Sonargaon University (SU).

This report has been carried out under my guidance and is a record of bona fide work carried out successfully.

I wish them every success in the future.

Supervised By

……..
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Assistant Professor

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ACKNOWLEDGEMENT

This thesis is accomplished under the supervision of Nuruzzaman Rakib, Assistant Professor, Department of Mechanical Engineering, Sonargaon University (SU). It is a great pleasure to acknowledge our profound gratitude and respect to our supervisor for this consistent guidance, encouragement, helpful suggestion, constructive criticism and endless patience through the progress of this work. The successful completion of this thesis would not have been possible without his persistent motivation and continuous guidance.

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Thank you all

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Executive Summary

This project is a study about the design and fabrication of automatic pneumatic ramming machine, which shows the capability to design a concept using variety of components. As the name implies, pneumatic systems use pressurized gases to transmit power. Typically, pneumatic systems use air as the fluid medium, because it is low cost, safe and easily available fluid. The automatic pneumatic ramming machine is designed using various components. The components are MS Frame, MS Plate, Air Compressor, Solenoid Valve, Timing Control Unit, Pneumatic Cylinder and Ramming Box, The pneumatic cylinder is used to obtain the ramming action. The pneumatic rammer used for ramming the sand uniformly and plastic water bottles folding around the pattern has wide applications in small scale industries. To operate this rammer, an air compressor is required. For the operation of ramming a butt is attached to the bottom of the piston rod. In this project, the solenoid valve is used as a direction control valve. This solenoid valve management is led by the electronic control timing unit. The compressed air passes through the pneumatic double acting cylinder. The ram is fastened at one end of the pneumatic cylinder. The compressed air pushes the pneumatic cylinder in order that the piston moves downward by giving air supply in one direction of the pneumatic cylinder. The solenoid valve changes the airflow in the opposite way by the small-time delay. Due to the changing of the airflow direction, the pneumatic cylinder piston moves upward in this time. This airflow direction is controlled by the solenoid valve.

Different pneumatic systems works efficiently at different operating pressure conditions. Therefore, **"Design and Fabrication of Automatic Pneumatic Ramming Machine"** for molding the sand evenly throughout the box and folding the plastic water bottles throughout the box.

Keywords: Pneumatic System, Actuators, Control Valves

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CHAPTER 1

INTRODUCTION

1.1 Project Background

In the Present global rationalization and competitive world most of the industries set up unmanned industry in order to eliminate labour cost and to increase productivity.

The pneumatic rammer is used for ramming the sand uniformly and folding the water bottles around the pattern. It can be used even in small scale industries. To operate this rammer an air compressor is needed. A butt which is attached to the bottom of the piston rod does the operation of ramming. The pressure developed inside the cylinder reciprocates the piston and hence the butt. This rammer is handled by an operator just by moving it over the molding sand and folding water bottles. The butt rams the sand and plastic water bottles at places moved and the sand is uniformly rammed and folding the plastic water bottles throughout the box. This rammer reduces the ramming time and labor. Due to this the cost is reduced considerably. So this machine finds application in foundries

1.2 Objectives

The objectives of this project are:

- To reduce labor work, improve work safety, low production cost, less time, high profit & reduces dependency.
- To provide high rate of mould making as compared to conventional ramming Machine
- To use in road construction, concrete and other plastic or hard objects demolition
- To make facility easily portable
- To achieve uniform compaction of sand
- To have accurate control over the working of the ramming tool.
- To provide a better ramming machine than conventional ramming machine economically.
- To Automatic & Manual Ramming Machine Design.
- To Pneumatic Based Control System.
- To Microcontroller based speed and time intervals adjustments.
- To move anywhere easily.

1.3 Methodology

- Creating an idea for Design and construction of two design & construct Three Dimensional Automatic Pneumatic Ramming Machine and designing a block diagram to know which components need to construct it.
- Collecting the all components and assemble to controlled the system.
- Setting all components with appropriate design.
- Then assembling the all block in a board and finally run the system & checking.

1.4 Designing Process

To make any machine part, the material should be properly and carefully selected, considering safety. The selection of materials for engineering applications is governed by the factors like availability, cost of the material & the suitability of the material required for components.

1.5 Selection of material

We have selected this project, because it is readily available in the market, economical for use and is available in standard sizes. Its mechanical properties are good i.e. it is easily mechanical, has moderate factor of safety.

CHAPTER 2

LITERATURE REVIEW

2.1 Pneumatic Ramming Machine

The pneumatic ramming machine is a new innovative concept. This machine has been mainly developed for foundry based industries. This machine is very useful in foundry for ramming the green sand to make the core used inside the pattern cavities. In this machine, we have using the pneumatic cylinder for ramming the core. Pneumatic machine is very powerful and used for heavy loads. By doing the manual process it consumes more time and large amount of man power required. By using this machine we can save the time and man power requirement in industries. The project consisted of MS Frame, Air Pipe, Air Nipple, Air Compressor, Solenoid valve, Timer Control unit, Pneumatic cylinder, Ramming tool and Pressure Gauge.

Efficiency of moulding is affected by various parameters permeability, collapsibility, adhesiveness etc. So it is a must to avoid defects in casting. The defects occur in sand castings post a great problem in foundry. On account of defects more than 10% castings are rejected. Due to improper ramming the following defects may occur in castings.

BLOW HOLES	-	Due to very hard ramming
SCAB	-	Due to uneven ramming of sand
SWEELL	-	Due to very soft ramming
METEL PENETRATION	-	Due to soft ramming
HOT TEAR	-	Due to hard ramming
INCLUSIONS	-	Due to soft ramming
DROPS	-	Due to soft ramming

2.2 Conventional Ramming Machine

The cam is actuated by a user by rotating the handle, causing a cam to lift the weight and let it fall freely on the frame attached to the ram head. This produces a standard compacting action to a pre-measured amount of sand. Variety of standard specimen for Green Sand and Silicate based (CO_2) sand are prepared using a sand rammer along with accessories the sand rammer machine can be sued to measure compatibility of prepared sand by filling the specimen tube with prepared sand so that it is level with prepared sand so that it is level with the top of the tube. The tube is then placed under the ram head in the shallow cup and rammed three times. Compatibility in percentage is then calculated from the resultant height of the sand inside the specimen tube.

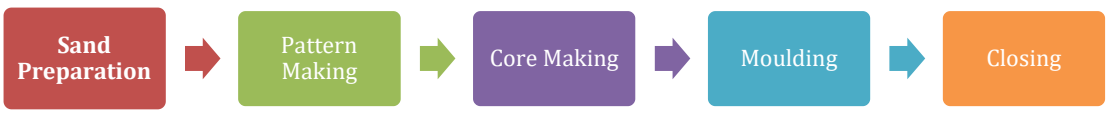


Figure 2.1 Moulding Process in Conventional Ramming Machine

2.3 Block Diagram and Components

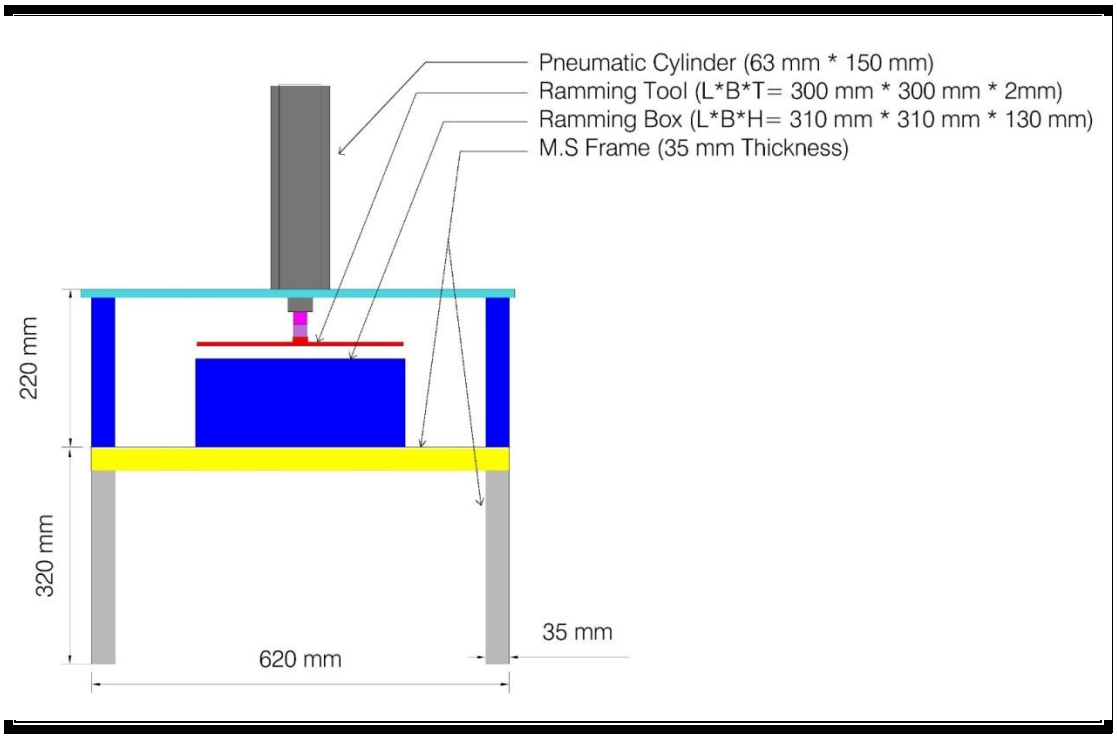


Figure 2.2 Automatic Pneumatic Ramming Machine

2.4 Schematic Diagram

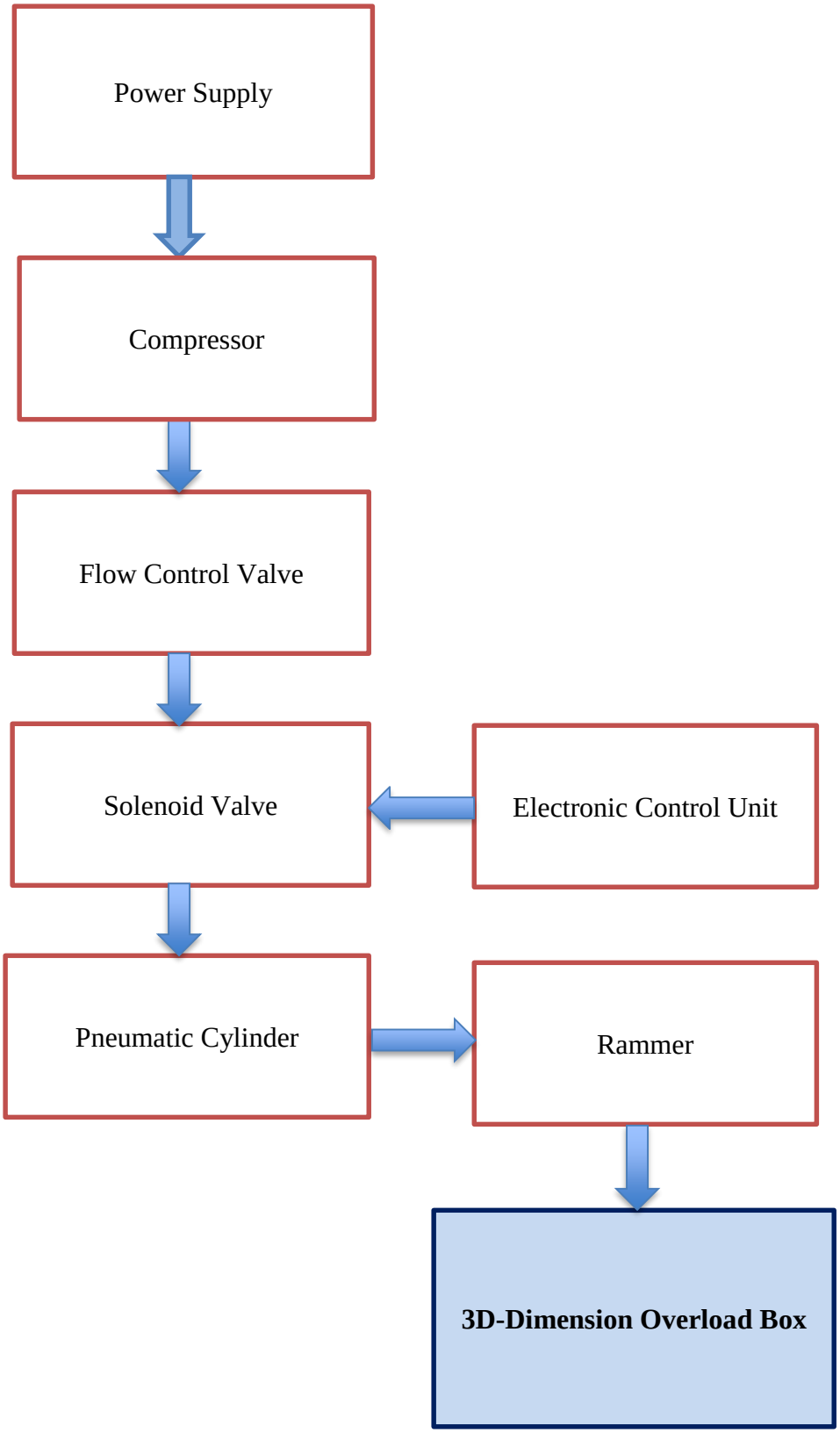


Figure 2.3 Schematic Diagram of Pneumatic Ramming Machine

2.5 Working Principle

In our project, the solenoid valve is used to control the flow direction of compressed air. This solenoid valve is controlled by the electronic control timing unit. The ramming time is varied by adjusting the timing control of the electronic unit by the timer.

The compressed air goes to the flow control Valve. The flow control valve is used to control the flow of air. It is an adjustable one. We have to adjust the lever, so that the required pressurized air goes to Solenoid Valve.

The compressed air goes to the pneumatic double acting cylinder. The ram is fixed at one end of the pneumatic cylinder. The compressed air pushes the pneumatic cylinder, so that the piston moves downward by giving air supply in one direction of pneumatic cylinder. The solenoid valve is changing the air flow in the opposite direction by the small time delay. In this time the pneumatic cylinder piston moves upward due to changing of the air flow direction. This air flow direction is controlled by the solenoid valve.

Hence, in design and fabrication of automatic pneumatic ramming machine the pneumatic rammer is operated pneumatically. By using rammer moulding sand will be packed evenly throughout the box.

2.6 Comparison of Hydraulic and Pneumatic System

The comparison of Hydraulic and Pneumatic System are given below;

Sl. No.	Hydraulic System	Pneumatic System
1.	It employs a pressurized liquid as fluid.	It employs compressed gas usually air as a fluid.
2.	Oil hydraulics system operates at pressure up to 700 bar.	Pneumatic systems usually operate at 5 to 10 bar.
3.	Generally designed for closed systems.	Pneumatic systems are usually designed as open system.
4.	System get slowdown of leakage occurs.	Leakage does not affect the system much more.
5.	Valve operation is difficult.	Easy to operate the valves.
6.	Heavier in weight.	Light in weight.
7.	Pumps are used to provide pressurized liquids.	Compressors are used to provide compressed gas
8.	System is unsafe to fire hazards.	System is free from hazards.
9.	Automatic lubrication is provided.	Special arrangements for lubrication needed.

2.7 Advantage and Disadvantage of Pneumatic System

Advantages:

- It is simple construction.
- Installation is simplified very much.
- It gives very simplified operation.
- Manual power is not required.
- Checking and cleaning are easy; because the main parts are screwed.
- It requires simple maintenance.
- Replacement of parts is easy..
- Lifting cost will be less.
- Less power consumption.
- No oil consumption.
- Reduced stroke length of cylinder.
- Reduced cost in pneumatics.
- Reduced weight of the system.
- Less skill technicians is sufficient to operate.
- Ease of operation.

Disadvantages:

- Separate air tank or compressor is required
- Initial investment is high when compared to hand ramming
- Air leakage affects the efficiency.

2.8 Applications of Pneumatic Systems

Material Handling	Manufacturing	Other Applications
Clamping	Drilling	Aircraft
Shifting	Turning	Cement Plants
Positioning	Milling	Chemical Plants
Orienting	Sawing	Coal Mines
Feeding	Finishing	Cotton Mills
Ejection	Forming	Diaries
Braking	Quality Control	Forge Shops
Bonding	Stamping	Machine Tools
Locking	Embossing	Door Control
Packaging	Filling	Turning Parts
Feeding	-	-
Sorting	-	-
Stacking	-	-

Table 2.1 Applications of Pneumatic Systems

2.9 Aim and Scope

After using this machine, it will help labour for easy and simple ramming process. Also the process of ramming by using our machine will become less hectic and will reduce dependency of labour on enhancing and reducing supply of labor. Also the process will be economical. In future, this machine can be used in road construction, concrete and other plastic or hard objects demolition.

3.0 List of Project components with Price:

Sl.no	Particulars	Specification	Qty.	Unit Price	Total Price	Market Price
1	Air Compressor	5 Way	1	3,000	3,000	60,000/-
2	Pneumatic Cylinder	SDA 50X50	1	2,000	6,000	
3	Solenoid Valve (Manual)	5 Way	1	1,000	1,000	
4	Solenoid Valve (Piloted), 4V210-08	0.15-0.8 MPa, 5 Way	1	1,000	1,000	
5	Timer (DH46S-S) Digital	220 V AC,8 Pin	1	5,000	5,000	
6	Pressure Gauge Set	1.5-8.5 bar	1	1,000	1,000	
7	Air Nipple	-	5	30	150	
8	Air Pipe	8m Korea 30Feet	10	30	300	
9	Design & Fabrication	-	-	-	10,000	
10	Others	-	-	-	6,000	
Total Taka					**33,450.00**	

Table 2.2 List of Project components with price

CHAPTER 3

CONSTRUCTION

3.1 Air Compressor

3.1.1 Definition

An air compressor is a pneumatic device that converts power into potential energy stored in pressurized air. The compressor is a mechanically operated machine that increases the air or gas pressure by reducing its volume. If the compressor is uses gas as a working fluid, it is known as a gas compressor. However, if the air is used as a working fluid, it is known as an air compressor.

3.1.2 How air compressors work

Basically, it works by decreasing the volume of the gas or air. It uses a piston or diffuser to increase the pressure of the working fluid.

When the air enters the diffuser, it changes the speed of the air into pressure energy. In this way, a compressor compresses the gas or air.

After the compression process, the compressed air is transformed into a storage tank. Many industries have used compressors to increase production, which has led to the development of many new industries.

Figure 3.1 Air Compressor

3.1.3 Types of air compressors

Compressors may be classified according to the pressure delivered:

1. Low-pressure air compressors (LPACs), which have a discharge pressure of 150 psi or less
2. Medium-pressure compressors which have a discharge pressure of 151 psi to 1,000 psi
3. High-pressure air compressors (HPACs), which have a discharge pressure above 1,000 psi

Compressors can also be classified in many ways, but the following are important from the object point of view:

1. According to the method of compression
    a) Reciprocating compressors
    b) Rotary compressors, and
    c) Centrifugal Compressors
2. According to the number of working strokes
    a) Single acting compressors, and
    b) Double acting compressors.

3. According to the number of stages
    a) Single-stage (or single-cylinder) compressors, and
    b) Multi-stage (or multi-cylinder) compressors.

4. According to the method of drive employed
    a) Direct drive compressors, and
    b) Belt drive compressors.

5. According to the location of the prime mover
    a) Semi-hermetic compressors (direct drive, motor and compressor in separate)
    b) Hermetic compressors (direct drive, motor and compressor in same housings).

In the market, there are many different types of compressors available, in terms of both of enclosure type and compression system. Here are some options for evaluating the most common types (DETR, 1999):

- **Reciprocating compressors** are positive displacement machines, available for every application. The efficiency of the valve systems has been improved significantly on many larger models. Capacity control is usually by cylinder unloading (a method which reduces the power consumption almost in line with the capacity.)
- **Scroll compressors** are rotary positive displacement machines with a constant volume ratio. They have good efficiencies for air conditioning and high-temperature refrigeration applications. They are only available for commercial applications and do not usually have inbuilt capacity control.
- **Screw compressors** are available in large commercial and industrial sizes and are generally fixed volume ratio machines. Selection of a compressor with the incorrect volume ratio can result in a significant reduction in efficiency. Part-load operation is achieved by a slide valve or lift valve unloading. Both types give a greater reduction in efficiency on part load than the reciprocating capacity control systems.

3.1.4 Expectation from the compressors

The compressors are expected to meet the following requirements:

- high reliability
- long service life,
- easy maintenance,
- easy capacity control,
- quiet operation,
- compactness, and
- cost effectiveness.

3.1.5 Compressor selection criteria

In the selection of a proper refrigerant compressor, the following criteria are considered:

- refrigeration capacity,
- volumetric flow rate,
- compression ratio, and
- Thermal and physical properties.

3.1.6 A portable single-stage air compressor

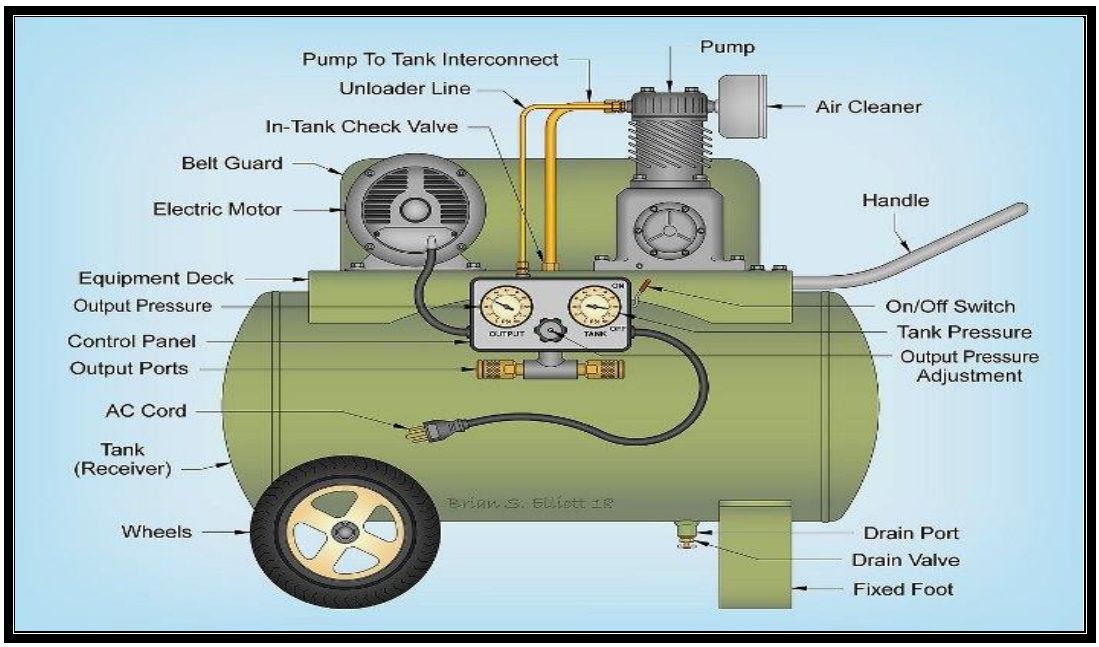


Figure 3.2 Technical Illustration of portable single-stage air compressor

3.1.7 A portable double-stage air compressor

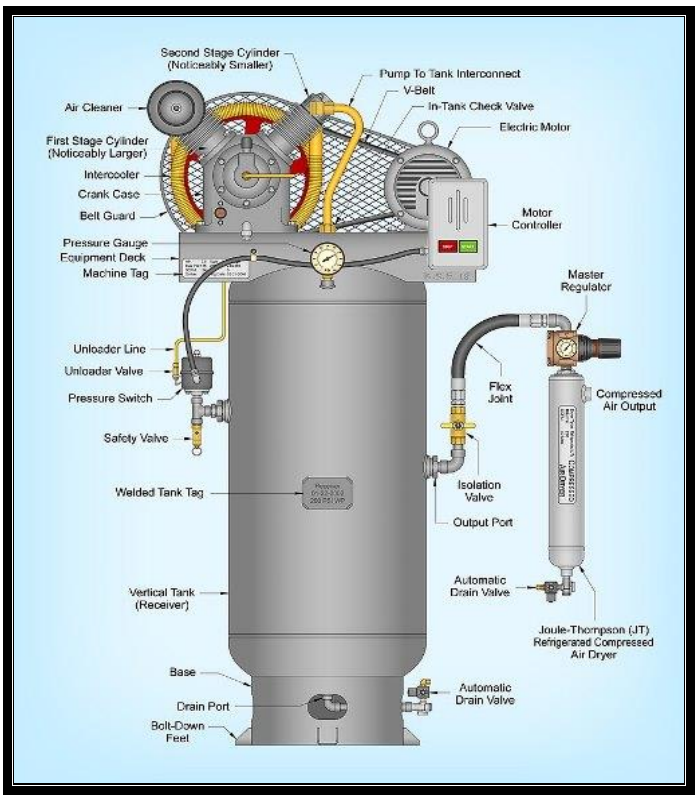


Figure 3.3 Technical illustration of portable double-stage air compressor

3.1.8 Specification of air compressor

Horse Power	5 HP/3.677 KW
Air Tank Capacity	5 Liter
Cooling Method	Air Cooled
Voltage	220 V-240 VAC
Material	Copper

Table 3.1 Specification of air compressor

3.2 Solenoid Valve

3.2.1 Definition

Solenoid valves are electromechanical devices that are control the flow of air or process gas. They are usually used for controlling pneumatic actuators such as cylinders, turbines (pneumatic motors), diaphragms, and tubes. The solenoid valves are res responsible for reciprocating motion of the Ram.

3.2.2 Solenoid Valve- How they work

As the solenoid valve is an electrically controlled this is an electric coil with a movable ferromagnetic core (plunger) in its center. In the rest position, the plunger closes off a small orifice. An electric current through the coil creates a magnetic field. The magnetic field exerts an upwards force on the plunger opening the orifice. This is the basic principle that is used to open and close solenoid valves.

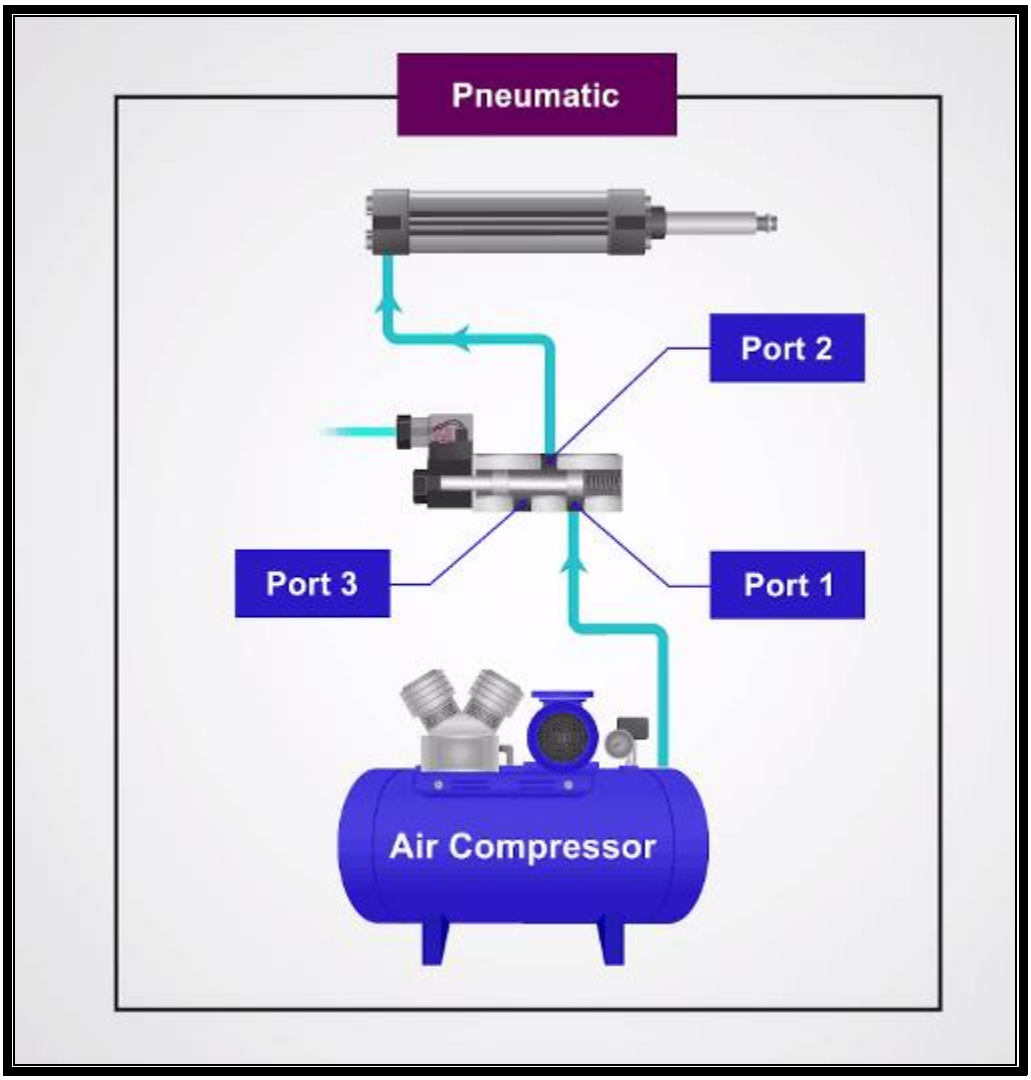


Figure 3.4 Working process of a Solenoid Valve

Here let's consider from the above figure:

a) The pneumatic air supply is connected to the inlet port 1.
b) Port 2 is connected to the pneumatic cylinder extend connection.
c) Port 3 is unconnected as it is exhaust port.

In the normal state without the actuator being operated nothing will happen as the spool is physically blocking the airflow at port 1 and the cylinder is retraced because ports 2 and 3 are connected due to the spool position. So any air already within the system would escape to the atmosphere through the exhaust port.

3.2.3 Types of spool

Spool is of two types namely sliding and rotary. Sliding spool is cylindrical in cross section, and the lands and grooves are also cylindrical. Rotary valves have sphere-like lands and grooves in the form of holes drilled through them.

Figure 3.5 Manual Type Solenoid 5 way, 2 positions Valve

3.2.4 Specification of Manual Type Solenoid Valve

Model	4H210-08
Type	5 port 2 position hand lever valve
Valve type	2 position
Material	Aluminum
Media	Air
Operating	Direct acting
Orifice size	16㎜²(Cv=1.67)
Port size	In= Out=PT1/4"
Exhaust	1/8"
Operating Pressure range MPa	0~0.8
Temp Range	-5~60℃
Lubrication	Not required
Operating angle	+-15%
Code	200 series
Dimension	76.7 * 35 * 22mm

Table 3.2 Specification of Manual Type Solenoid Valve

Figure 3.6 Piloted Type Electrical Solenoid 5 way, 2 positions Valve

3.2.5 Specification of Piloted Type Solenoid Valve

Model	4V210-08
Type	5 port 2 position Piloted Type valve
Material	Aluminum
Pilot Type	Internal
Coil Voltage	AC 220 V
Voltage range	AC187V-253V
Port size	In= Out=PT1/4"
Electrical Entry	Terminal
Operating Pressure range MPa	0.15-0.8 MPa (21~114Psi)
Temp Range	-5~60℃
Lubrication	Not required
Item Dimensions	4.6 x 2.6 x 0.8 inches
Maximum action frequency	5 Times per second

Table 3.3 Specification of Piloted Type Solenoid Valve

3.3 Pneumatic Actuators

3.3.1 Definition

A pneumatic actuator is a device that converts energy typically in the form of compressed air into mechanical motion. Within the industry, pneumatic actuators are recognized by several different names including pneumatic cylinders, air cylinders, and air actuators; all of which are one and the same.

Consisted of a piston, cylinder, and valves or ports, a pneumatic actuator can convert energy into linear or rotary mechanical motions. This is dependent on whether the application is using a pneumatic rotary actuator or a linear actuator.

3.3.2 How a pneumatic actuator works?

Pneumatic actuators are mechanical devices that use compressed air acting on a piston inside a cylinder to move a load along a linear path. Unlike their hydraulic alternatives, the opening fluid in a pneumatic actuator is simply air, so leakage doesn't drip and contaminate surrounding areas. The basic pneumatic cylinder consists of a cylindrical chamber with a movable piston and intake and exhaust channels. When compressed air or other gas is pumped into the bottom of the cylinder, the gas expands, pushing the movable piston upwards and generating force. Pneumatic cylinders, also known as air cylinders, have advantages over hydraulics in some cases and are used in a wide variety of applications.

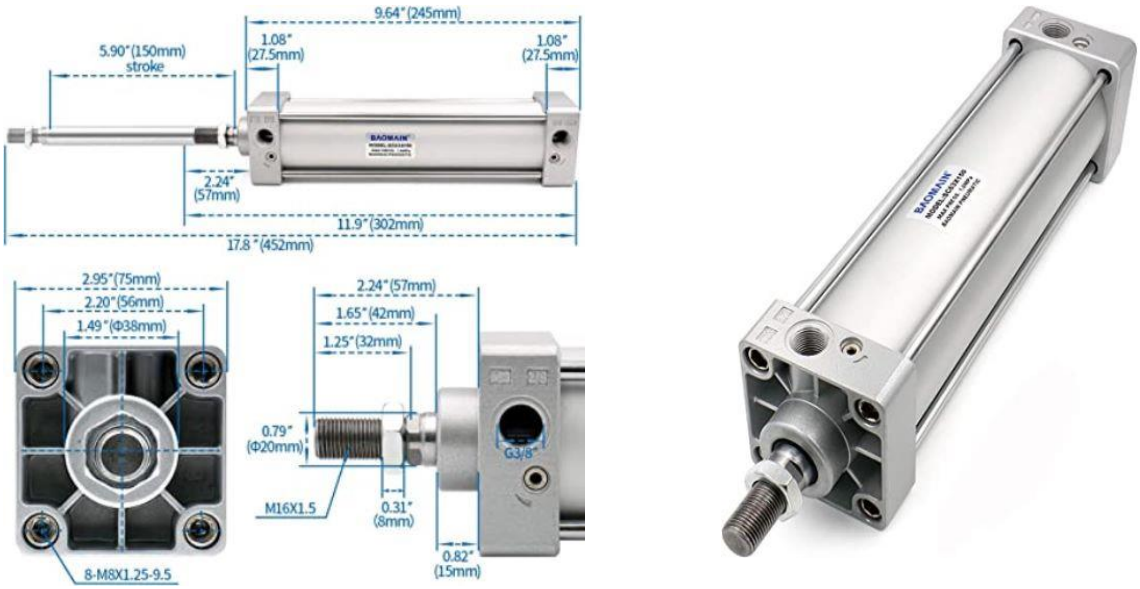


Figure 3.7 A Pneumatic Cylinder

3.3.3 Technical Details

Manufacturer	CHLED
Part Number	SC 63×150
Port Size	PT3/8
Action Type	Double Acting, Rod Type: Single Rod
Max Pressure	1.0 MPa
Piston Port Size	M16×1.5
Weight	3.92 pounds/1879g
Item Model Number	SC 63×150
Is Discontinued By Manufacturer	No
Material	Aluminum
Shape	Rectangle
Batteries Included?	No
Batteries Required	No

Table 3.4 Technical Details of Pneumatic Cylinder

3.3.4 Features

- 63mm bore and 150mm stroke, double action and single rod, adjustable cushion on both cylinder end covers to make sure the cylinder works very smoothly, safely and with low noise.
- With self-lubricating bearing, the piston rod is lubrication free.

3.3.5 Applications of Pneumatic Cylinder

The pneumatic Cylinder is widely applied to the automatic equipment in light industry, Chemical industry, Textile industry, Electronic and Machinery industry.

3.3.6 Applications of Actuators

Applications of pneumatic actuators include the following

Pneumatic actuators are applicable in a wide range of applications like different industrial areas and some of the application areas of these actuators are;

- Air Compressors
- Aviation
- Railway application
- Packaging and production machinery
- Combustible automobile engines

- These actuators are commonly used in pistons & ignition chambers of gasoline powered vehicles. So they utilize the air ignition and gasoline to generate the pressurized energy that moves the piston eventually and changes energy into the crankshaft of the car. But, these actuators mostly depend on pressurized gas through no ignition to generate the preferred mechanical force.

3.3.7 Advantages of using pneumatic actuators over other alternatives

Most of the benefits of choosing pneumatic actuators over alternative actuators, such as electric ones, boil down to the reliability of the devices, as well as the safety aspects. The fact that they do not require ignition or electricity makes these devices highly sought after where parking and combustion are not tolerated. This is because a pneumatic actuator can store compressed air and use it again efficiently without the risk of fire.

Pneumatic actuators are also extremely durable and can, therefore, reduce the costs required to maintain its performance. Less maintenance means a longer product lifecycle and therefore greater output.

3.4 Timer

3.4.1 Definition

A time switch is also sometimes called a time switch. Some people also call it a timer. Going by its name, the device should time events that are switch power at a predetermined time or schedule; it does that, usually mechanically or digitally, depending on the type of timer used.

The timer switch can also be a device that we plug into wall outlet, or a gadget that we install in/on a wall. It can also be an indoor or outdoor timer switch for street light, security light, or even a sprinkler system.

3.4.2 The Switch Function

The main timer switch function is to eliminate the need for leaving electrical circuits or equipment running, thereby conserving energy and saving money. This ranges from having a device turn on at specific times to automatic shutoff.

Timer switches also provide added security when we are away from home, as we can program it to turn on/off for a certain period of time, simulating someone is in our home.

In today's age of the smart home, the electrical timer switch plays an important role in providing the convenience of auto control, with digital timer switches offering the option for wireless control among other benefits.

3.4.3 The Switch Symbol and Wring Diagram

The timer switch electrical symbol is represented (**in a wiring diagram fig 3.8**) as a normal on/off, single pole single throw, type of switch. However, the symbol also includes timing icon to it. This makes it easy to spot or identify in a given timer switch circuit diagram.

For example, the symbol may appear as an on/off switch within a given schematic circuit diagram, with a timer icon on the upper or side of it. This indicates that the component is a time switch and not just a normal on/off switch in the circuit.

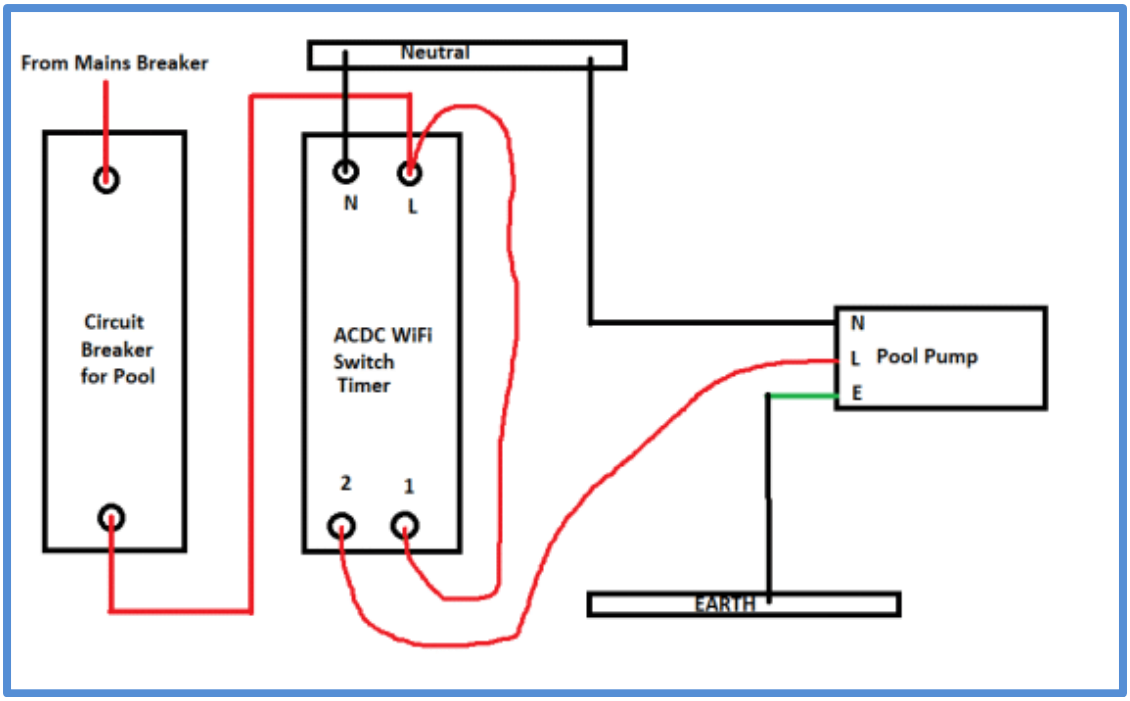


Figure 3.8 Timer Switch Wiring Diagram

Figure 3.9 A Digital Timer Switch

3.4.4 Types of Timer Switch

We can choose from 4 main types of timer switch devices: The different types of timer switches are mechanical, digital, astronomic, and photocell timer switch. As we would expect, each type has its own advantages and disadvantages.

1. Mechanical Timer Switch:

Also known as a mechanical timer, analog timer switch or even automatic timer switch, this is the most basic type of timer switch available. It uses physical components like springs and gears to set the timing.

As mentioned earlier, mechanical timer switches are usually manually adjusted using a knob in order to change when power is switched on and off. This timing switch has its pros and cons.

One of the main benefits of mechanical timers is that they are low cost and easy to set. However, they are also mostly bulky. A mechanical timer will also require more in terms of maintenance, given that it uses moving parts.

2. Digital Timer Switch:

A digital timer switch is typically powered by electricity, DC or AC, and can also be called an electrical timer switch. At its heart is a microcontroller. That means it contains no mechanical/moving parts.

We can easily change the timing of a digital timer switch directly using the control buttons on its face. This allows us to quickly adjust the intervals of daily tasks or activities like to suit our need.

Among the biggest advantages of digital time switches is their accuracy and versatility. They come with more settings that let we easily customize the timing to suit our specific needs, which means more actions from the device.

3. Astronomic Timer Switch:

An astronomic timer, also called astronomical timer, is a type of timer that uses the position of the sun to set its timing. Usually electronic or digital, astronomic timer switches rely on a built-in memory or software program that stores the necessary data to tell them when to switch on and off.

This data includes the longitude, latitude, and other location-specific information of the device's present location. This information is then used to accurately identify and calculate sunrise and sunset times in any given location.

From there, the astronomic time switch can be programmed to turn on or off lights, appliances, and other electronic devices at specific times of the day or night relative to the sunrise and sunset, with an accuracy level of up to a minute.

4. Photocell Timer Switch:

In situations where we want to turn devices on and off according to the amount of ambient light present, a photocell timer is the perfect solution among the different types of timer switches.

These types of timers use an optical sensor or photo detector to detect the amount of light. This allows us to set lights to switch on when it gets dark, and off again when light comes back.

A photocell timer can be a timer switch for street light, a timer switch for security lights in a home, or business, or other uses. As we can imagine, this type of timer switch adds a whole new level of convenience to any home or business.

3.4.5 How Does a Timer Switch Work?

Mechanical Timer Switches:

A mechanical timer switch is an analog timer that uses a clockwork mechanism to control when the power is turned on and off. This kind of switch has a knob for programming the desired time interval to turn the power on or off in hours or minutes. A mechanical or analog timer switch can be adjusted manually to change the time that power is turned on or off. This type of timer switch has no memory, though, and every adjustment is manual.

Electronic Timer Switches:

An electronic timer switch is a digital type of switch that uses an internal clock and microprocessor to control when the power is turned on and off. This kind of switch can be programmed with required time intervals in minutes, hours or days.

The electronic timer also comes with additional features like randomization settings, which vary the times each day to help prevent burglars from noticing a set switch pattern and other reasons. The digital display of this timer switch makes it easier to view and program the desired settings.

3.4.6 Application of Timer Switch

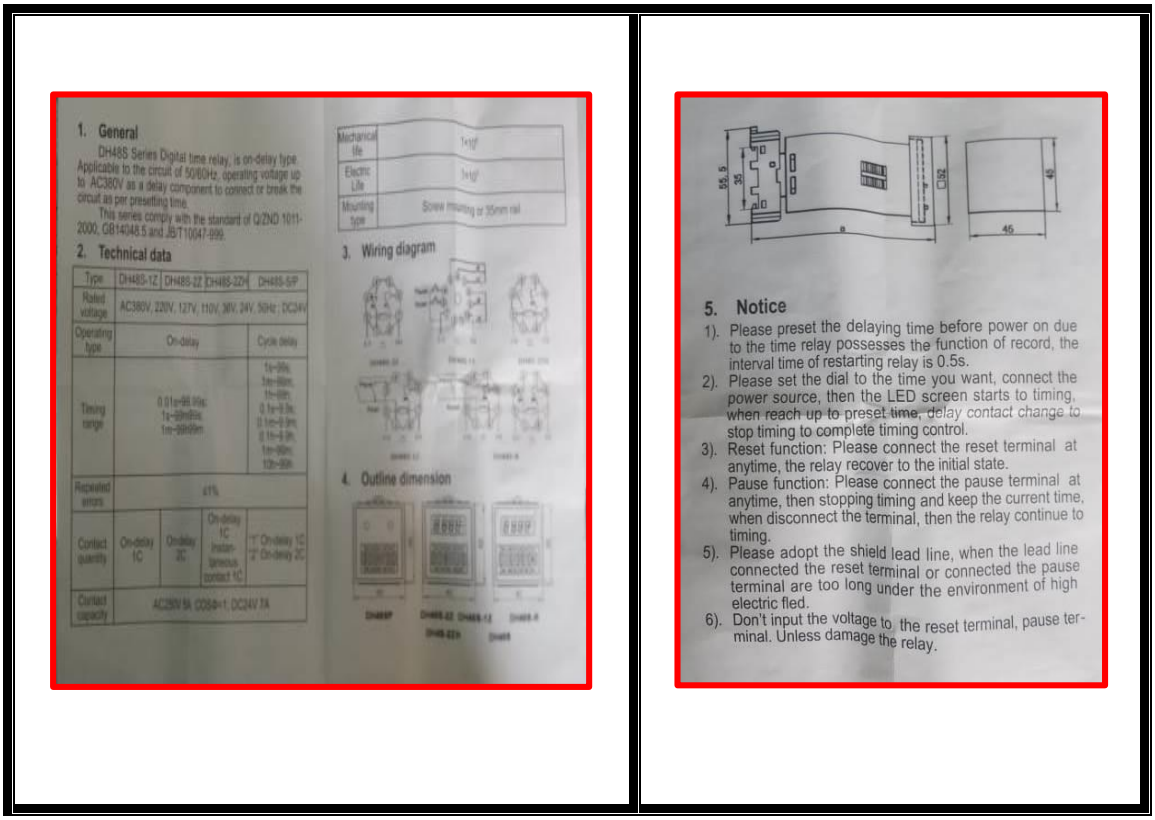
Timers are very important for industrial applications as well as for both residential and commercial applications, some examples of their use include;

- Flashing Light control and traffic light signals
- Motor soft-start delay control: instead of starting large electric motors by switching full power from a dead stop condition, reduced voltage can be switched for a softer start.
- Conveyor Belt sequence Delay: Especially when multiple conveyor belts are arranged to transport material
- Subroutines that take place consecutively for specific time.

3.4.7 Technical Data of Timer Switch

Type	DH48S-1Z	DH48S-2Z	DH48S-2ZH	DH48S-S/P
Rated Voltage	AC380V, 220V, 127V, 110V, 36V, 24V, 50Hz; DC24V			
Operating Type	On Delay			Cycle Delay
Timing Range	0.01s~99.99s; 1s~99m99s; 1m~99h99m			1s~99s; 1m~99m; 1h~99h; 0.1s~9.9s; 0.1m~9.9m; 0.1h~9.9h; 1m~99m; 10h~99h
Repeated Errors	≤1%			
Contact Quantity	On-Delay 1C	On-Delay 2C	On-Delay 1C Instantaneous contact 1C	"1" On-Delay 1C "2" On-Delay 2C
Contact Capacity	AC250V 5A COSΦ=1;DC24V 7A			
Mechanical Life	1×10^6			
Electric Life	1×10^5			
Mounting Type	Screw Mounting or 35mm Rail			

Table 3.5. Technical Data of Timer Switch



1. General

DH48S Series Digital time relay, is on-delay type. Applicable to the circuit of 50/60Hz, operating voltage up to AC380V as a delay component to connect or break the circuit as per presetting time.

This series comply with the standard of Q/ZND 1011-2000, GB14048.5 and JB/T10047-999.

2. Technical data

Type	DH48S-1Z	DH48S-2Z	DH48S-2ZH	DH48S-S/P
Rated voltage	AC380V, 220V, 127V, 110V, 36V, 24V, 50Hz ; DC24V			
Operating type	On-delay			Cycle delay
Timing range	0.01s~99.99s; 1s~99h59m; 1m~99h59m			1s~99s; 1m~99m; 1h~99h; 0.1s~9.9s; 0.1m~9.9m; 0.1h~9.9h; 1m~99m; 12h~99h
Repeated errors	±1%			
Contact quantity	On-delay 1C	On-delay 2C	On-delay 1C instantaneous contact 1C	"1" On-delay 1C "2" On-delay 2C
Contact capacity	AC250V 5A COSΦ=1, DC24V 7A			

Mechanical life	1×10⁷
Electric Life	1×10⁵
Mounting type	Screw mounting or 35mm rail

3. Wiring diagram

4. Outline dimension

5. Notice

1). Please preset the delaying time before power on due to the time relay possesses the function of record, the interval time of restarting relay is 0.5s.
2). Please set the dial to the time you want, connect the power source, then the LED screen starts to timing, when reach up to preset time, delay contact change to stop timing to complete timing control.
3). Reset function: Please connect the reset terminal at anytime, the relay recover to the initial state.
4). Pause function: Please connect the pause terminal at anytime, then stopping timing and keep the current time, when disconnect the terminal, then the relay continue to timing.
5). Please adopt the shield lead line, when the lead line connected the reset terminal or connected the pause terminal are too long under the environment of high electric fled.
6). Don't input the voltage to the reset terminal, pause terminal. Unless damage the relay.

Figure 4.0 DH48S Series Digital Time Relay Instruction Book

CHAPTER 4

DESIGN AND FABRICATION

4.1 Cutting

Cutting is the separation or opening of a physical object, into two or more portions, through the application of an acutely directed force. Implements commonly used for cutting are the knife and saw, or in medicine and science the scalpel and microtome. However, any sufficiently sharp subject is capable of cutting if it has a hardness sufficiently larger than the object being cut, and if it is applied with sufficient force. Even liquids can be used to cut things when applied with sufficient force (see water jet cutter).

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The material as our required size. The machine used for this operation is power chop saw. A power chop saw, also known as a drop saw, is a power tool used to make a quick, accurate crosscut in a work piece at a selected angle. Common uses include framing operations and the cutting of moulding. Most chop waws are relatively small and portable, with common blade sizes ranging from eight to twelve inches.

Figure 4.1Cutting Operation of MS Plate

The chop saw makes cuts by pulling a spinning circular saw blade down onto a work piece in a short, controlled motion. The work piece is typically held against a fence, which provides a precise cutting angle between the plane of the blade and the plane of the longest work piece edge. In standard position, this angle is fixed at 90^0 · A primary distinguishing feature of the tire saw is the miter index that allows the angle of the blade to be change relative to the fence. While most miter saws enable precise one-degree incremental changes to the miter index, many also provide “stops” that allow the miter index to be quickly set to common angles (such as 15^0, 22.5^0, 30^0, and 45^0). The time required for this operation is 50 minutes.

4.2 Welding

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by using high heat to melt the parts together and allowing them to cool causing fusion. Welding is distinct from lower temperature metal jointing techniques such as brazing and soldering, which do not melt the base metal. In addition to melting the base metal, a filler material is typically added to the joint to form a pool of milten material (the weld pool) that cools to form a joint that, based on weld configuration

(butt, full penetration, fillet, ect.), can be stronger than the base material (parent metal). Pressure many also be sued in conjunction with heat, or by itself, to produce a weld. Welding also requires a form of shield to protect the filler metals or melted metals from being contaminated or oxidized. Square pipes of different lengths to make frame. The machine used for this operation is electric arc welding. Electrical arc welding is the procedure used to join two metal parts, taking advantage of the heat developed by the electric arc that forms between an electrode (metal filler) and the material to be welded.

Figure 4.2 Welding Operation of MS Plate

The welding arc many be Powered by an alternating current generator machine (welder). This welding machine is basically a single-phase static transformer Suitable for melting RUTILE (sliding) acid electrodes. Alkaline electrodes may also be melted by alternating current if the secondary open-circuit voltage is greater than 70 V. The welding current is continuously regulated (magnetic dispersion) by turning the hand wheel on the outside of the machine, which makes it possible to select the current value, indicated on a special graded scale, with the utmost precision.

4.3 Drilling

Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool, often multi-point. The bit is pressed against the work-piece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the work-piece, cutting off chips (swarf) from the hole as it is drilled. In rock drilling, the hole is usually not made through a circular cutting motion, though the bit is usually rotated. Instead, the hole is usually made by hammering a drill bit into the hole with quickly repeated short movements.

Figure 4.3 Drilling process .

Drilled holes are characterized by their sharp edge on the entrance side and the presence of burrs on the exit side (unless they have been removed). Also, the inside of the hole usually has helical feed marks. Drilling may affect the mechanical properties of the work piece by creating low residual stresses around the hole opening and a very thin layer of highly stressed and disturbed material on the newly formed surface. This causes the work piece to become more susceptible to corrosion and crack propagation at the stressed surface. A finish operation may be done to avoid these detrimental conditions. For fluted drill bits, any chips are removed via the flutes. Chips may form long spirals or small flakes, depending on the material, and process parameters. The type of chips formed can be an indicator of the machinability of the material, with long chips suggesting good material machinability.

4.4 Finishing

Finishing is a broad range of industrial processes that alter the surface of a manufactured item to achieve a certain property. Finishing processes may be employed to: improve appearance, adhesion or wettability, solder ability, corrosion resistance, tarnish resistance, chemical resistance, wear resistance, hardness, modify electrical conductivity, remove burrs and other surface flaws, and control the surface friction. In limited cases some of these techniques can be used to restore original dimensions to salvage or repair an item. An unfinished surface is often called mill finish. The edges with grinder using grinding wheel. The machine used for this operation is hand grinder. An angle grinder, also known as a side grinder or disc grinder, is a handheld power tool used for cutting, grinding and polishing. Angle grinders can be powered by an electric motor, petrol engine or compressed air. The motor drives a geared head at a right angle on which is mounted an abrasive disc or a thinner cut-off disc, either of which can be replaced when worn. Angle grinders typically have an adjustable guard and a side-handle for two-handed operation. The time required for this operation is 20 minutes.

4.5 Polishing

Polishing is the process of creation a smooth and shiny surface by rubbing it or using a chemical action, leaving a surface with a significant specular reflection (still limited by the index of refraction of the material according to the Fresnel equations.) In some materials (such as metals, glasses, black or transparent stones), polishing is also able reduce diffuse reflection to minimal values. When a repeated abrasion, those “mountains” are worn down until they are flat or just small “hills.” The process of polishing with abrasives starts with coarse ones and graduates to fine ones.

4.6 Painting

The project has been required to paint only not for enhancing attraction but also as a protective coating to protect our project from the damage, a lesser likelihood of rust and even another possible collision which naturally can do.

CHAPTER 5

DESIGN AND CALCULATION

Selecting Cylinder (SC 63×150):

For Manual Pneumatic Ramming Machine:

Pressure available from the compressor=350 psi=2413166 Pa [as 1 psi= 6894.76 Pa]
Diameter of piston = 63 mm
Cross sectional Area of the cylinder = $\pi/4\times63^2$ =3117.24 mm^2
Total Stroke length =452 mm
Working Stroke length =150 mm
Diameter of piston rod is = 20 mm.

We know that

Force = Pressure × Area

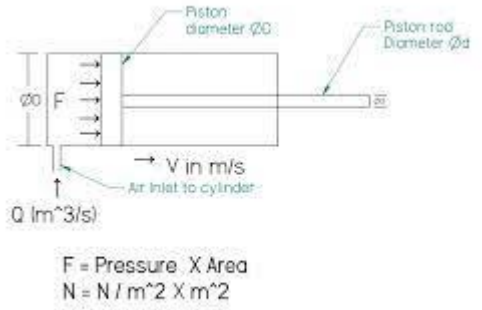

Figure 5.1 Diagrams of Piston Diameter and Piston Rod Diameter of Pneumatic Cylinder

Here, the piston force, F = P × A
= 2413166 Pa × 3117.24 $mm^2\times10^{-6}$
= **7522.42 N** [As 1 bar = 10^5 pa =10^5 N/m^2]

For Automatic Pneumatic Ramming Machine:

Pressure available from the compressor =5 kg/cm^2

Here,

Bar value = kg/cm^2 value x 0.980665
= 5 kg/cm^2 × 0.980665
= 4.90 Bar
Hence, Pressure available from the compressor =5 kg/cm^2 = 4.90 Bar

We know that

Force = Pressure × Area

Here, the piston force, F = P × A
= 4.90 × 10^5 Pa × 3117.24 $mm^2\times10^{-6}$
= **1527.45 N**

CHAPTER 6

Results and Discussion

- The rammer can be handled by an operator without feeling uneasiness. No separate skill is required to operate this rammer. The operation is quick and hence it is a time saving one. The operation is easy and consumes less cost. Due to the above reasons it finds its extensive application in manufacturing industries.

- It has an extensive application in both large scale and small scale industries because of its economy and easy handling. Strength uniform ramming of sand and folding of plastic water bottles are obtained by this rammer. The time consumption for ramming is reduced greatly.

- Skilled labor is not required.
- Easy operation
- It can be transported easily from one place to another
- Since dismantling and assembling is simple.
- It reduces more labor for ramming operation.
- Maintenance is easy.

CHAPTER 7

Project Output

We have finally been able to be established our project. In this project first we setup an air compressor with power supply. After that air pipe is added from compressor to Solenoid Valve (5 port 2 position Piloted Type Valve) through a timer circuit to the Pneumatic Cylinder which is attached in 3-Dimensional ramming machine. After passing the air from the air compressor, the solenoid valve is ON then the air pressure hit the Pneumatic double acting Cylinder. The piston moves downward by compressed air in one direction of pneumatic cylinder and the piston moves upward due to the changing of air flow direction of the Solenoid Valve.

The Timer Circuit is to acute the Solenoid Valve at regular interval of time to achieve proper lubrication at the desired interval.

In this project, **"Design and Fabrication of Automatic Pneumatic Ramming Machine",** the job is feeded, performed and rammed automatically. The main aim of this project is to acquire practical knowledge in the field. All the setup is working well with our accurate implementation and plan. In down below we provided the image of our project and our project input/output data:

Fig.(a) Pneumatic Ramming Machine

Fig. (b) Pressure Gauge

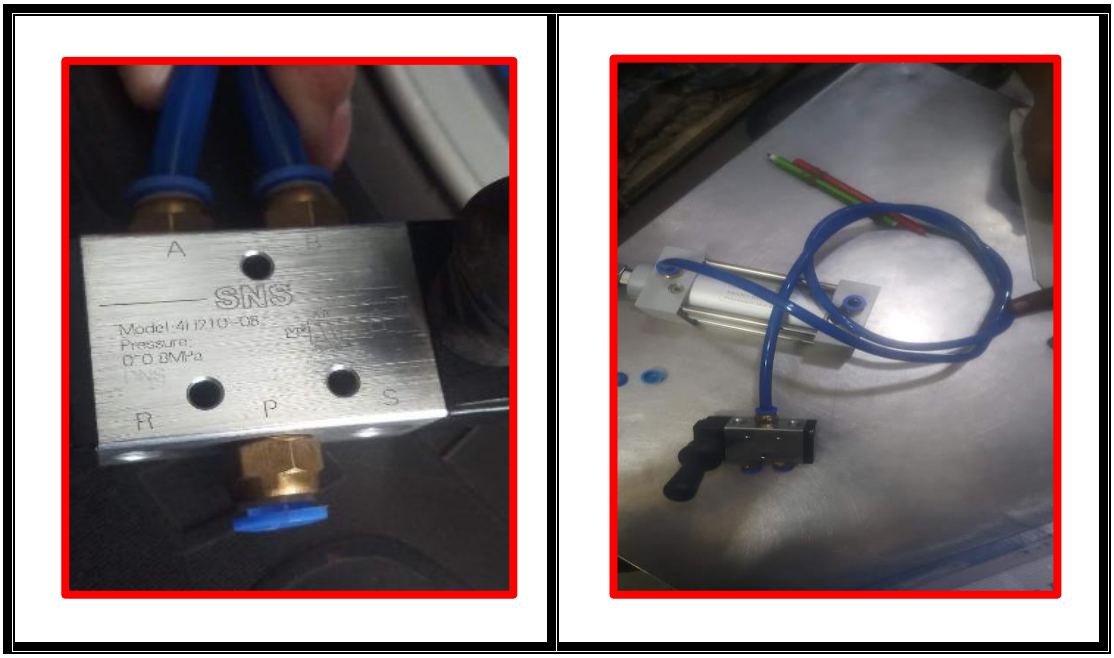

Fig. (c) Solenoid Valve to the Pneumatic Cylinder connectivity (Manual type)

Fig. (d) Air Compressor

Figure 7.1 Project of Manual Type Pneumatic Ramming Machine and components

Fig.(e) Auto Pneumatic Ramming Machine

Fig.(f) Pressure Gauge and Solenoid

Fig. (g) A digital timer

Figure 7.2 Projects of Automatic Pneumatic Ramming Machine and Components

Project input and output Data:

Pneumatic Ramming Machine Type	**at Input (in pressure)**	**at Output (in pressure)**
Automatic	Working Pressure 5 kg/cm^2 Interval time period 7s	1527.45 N
Manual	Working Pressure 350 Psi Interval time period : not required	7522.48 N

Table 7.1 Project input and output Data

CHAPTER 8

Conclusion

Punching or pressing process is one of the most important and necessary processing steps in sheet metal industry. If this process is done manually, it increases manufacturing lead time, cost and also reduces safety of the workers. Therefore, to improve the productivity and safety, automatic punching machine is developed. By automating this process one can have a greater control over the process. It is possible to achieve good results in the form of reduced manufacturing lead time, reduced cost and increased safety of the worker. Uniform ramming of sand and folding of plastic water bottles are obtained by this rammer. The time consumption for ramming is reduced considerably. It eliminates more labour for ramming operation and hence the labour cost is reduced. Skilled labour is not required to operate this machine. Transportation of this machine is easy. Maintenance is also easy, the reduction of production time and elimination of more labour for ramming operation reduce production cost, and thereby the economy is greatly achieved.

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17. https://www.geya.net/what-is-a-timer-switch/