

DESIGN AND DEVELOPMENT OF PNEUMATIC POWERED HACKSAW MACHINE

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ABSTRACT:-

The objective of this work is to automate the conventional power hacksaw machine in order achieve high productivity of work pieces than the power hacksaw machine using pneumatic power. Pneumatic is a huge topic of science and engineering dealing with the mechanical properties of air. In our project we take this pneumatic and a hacksaw for cutting purpose, The pneumatic reciprocating high-speed hacksaw machine has an advantage of working in high pressure, the hacksaw used in this is reciprocate such that required shape can be cut according to the requirement. The hacksaw is the metal cutting machine tool designed to cut metal by applying pneumatic pressure. Hacksaws are used to cut thin and soft metals the operation of the unit is simplified to a few simple operations involving a cylinder block and piston arrangement.

KEYWORDS:Power hacksaw, Pneumatic cylinder, Compressor, Testing.

1. INTRODUCTION

The hacksaw is the metal cutting machine tool designed to cut metal by applying pneumatic pressure. Hacksaws are used cut thin and soft metal the operation of the unit is simplified to a few simple operation involving a cylinder block and arrangement. The hacksaw is the metal cutting machine tool designed to cut metal by applying pneumatic pressure. The machine exclusively intended for mass production and they represent fasten and more efficient way to cut a metal. Hacksaws are used to cut thin and soft metals the operation of the unit is simplified to a few simple operations involving a cylinder block and piston arrangement. There are numerous systems in hacksaw machine .The main function of pneumatic hacksaw is to cut thin and soft metals by pneumatic power.

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Fig 1.Power Hacksaw Machine

Air at Intake conditions namely at atmosphere pressure and normal ambient temperature.

Materials Use :

1. Control unit
- 2.Solenoidal valve
3. Pneumatic cylinder
4. Hack saw
5. Air compressor
6. Handle
7. Pressure Regulator
8. Connecting ports
9. Houses
10. Actuator

1. 1. Element of the Pneumatic System:

i)Compressor: A pump which compresses air, raising it to a higher pressure, and delivers it to the pneumatic system (sometimes, can also be used to generate a vacuum).

Control valve: one-way valve that allows pressurized air to enter the pneumatic system, but prevents backflow (and loss of pressure) into the compressor when it is stopped. Solenoid valve:

controls the flow of pressurized air from the source to the selected port. Some valves permit free exhaust from the port not selected. These valves can be actuated either manually or electrically (the valves typically provided in the FIRST kits use dual solenoids to change the direction of the valve, based on input signals from the control system).



Fig. 2:Pneumatic Compressor

ii)Actuator: Converts energy stored in the compressed air into mechanical motion. A Linear piston is shown. Alternate tools include rotary actuators, air tools, expanding bladders, etc. control unit: It is used control the solenoid by ON and OFF valve. To the requirement of air flow in further way to in and out for the working of pneumatic cylinder.

1.2Parts Of Pneumatic Cylinder:

i)Piston:The piston is a cylindrical member of certain length which reciprocates inside the cylinder. The diameter of the piston is slightly less than that of the cylinder bore diameter and it is fitted to the top of the piston rod. It is one of the important parts which convert the pressure energy into mechanical power. The piston is equipped with a ring suitably proportioned and it is relatively soft rubber which is capable of providing good sealing with low friction at the operating pressure. The purpose of piston is to provide means of conveying the pressure of air inside the cylinder to the piston of the oil cylinder. Generally piston is made up of-Aluminums alloy-light and medium work. Brass or bronze or CI-Heavy duty

The piston moves forward when the high-pressure air is turned from the right side of cylinder. The piston moves backward when the solenoid valve is in OFF condition. The piston should be as strong and rigid as possible. The efficiency and economy of the machine primarily depends on the working of the piston. It must operate in the cylinder with a minimum of friction and should be able to withstand the high compressor force developed in the cylinder and also the shock load during operation.

Noise.

- It should be frictionless.
- It should withstand high pressure.

ii)Piston Rod :The piston rod is circular in cross section. It connects piston with piston of other cylinder. The piston rod is made of mild steel ground and polished. A high finish is essential on the outer rod surface to minimize wear on the rod seals. The piston rod is connected to the piston by mechanical fastening. The piston and the piston rod can be separated if necessary. One end of the piston rod is connected to the bottom of the piston. The other end of the piston rod is connected to the other piston rod by means of coupling. The piston transmits the working force to the oil cylinder through the piston rod. The piston rod is designed to withstand the high Compressive force.

iii)Cylinder Cover Plates:

The cylinder should be enclosed to get the applied pressure from the compressor and act on the pinion. The cylinder is thus closed by the cover plates on both the ends such that there is no leakage of air. An inlet port is provided on the top cover plate and an outlet ports on the bottom cover plate. There is also a hole drilled for the movement of the piston. The cylinder cover plate protects the cylinder from dust and other particle and maintains the same pressure that is taken from the compressor. The flange has to hold the piston in both of its extreme positions. The piston hits the top plate during the return stroke and hits the bottom plate during end of forward stroke. So the cover plates must be strong enough to withstand the load.

2.DESCRPTION OF EQUIPMENTS

2.1.Pneumatic Cylinder

Cylinder Technical Data

- i)Piston Rod:M.S. hard Chrome plated
- ii)Seals:Nitrile (Buna – N) Elastomer
- iii)End Covers:Cast iron graded fine grained from 25mm to 300mm
- iv)Piston:Aluminium
- v)Media: Air
- vi)Temperature Range: 0°C to 85°C

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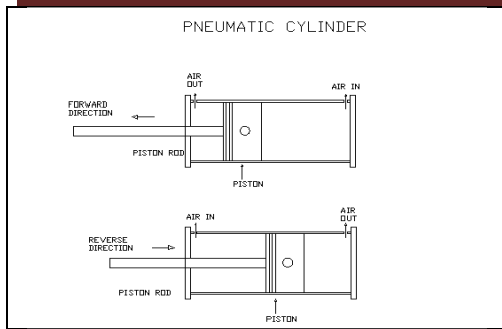


Figure No3: Pneumatic cylinder

The piston is single acting spring returned type. The piston moves forward when the high-pressure air is turned from the right side of cylinder. The piston moves backward when the solenoid valve is in OFF condition. The piston should be as strong and rigid as possible. The efficiency and economy of the machine primarily depends on the working of the piston. It must operate in the cylinder with a minimum of friction and should be able to withstand the high compressor force developed in the cylinder and also the shock load during operation.

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Cylinder Cover Plates:-The cylinder should be enclosed to get the applied pressure from the compressor and act on the pinion. The cylinder is thus closed by the cover plates on both the ends such that there is no leakage of air. An inlet port is provided on the top cover plate and an outlet ports on the bottom cover plate. There is also a hole drilled for the movement of the piston. The cylinder cover plate protects the cylinder from dust and other particle and maintains the same pressure that is taken from the compressor. The flange has to hold the piston in both of its extreme positions. The piston hits the top plat during the return stroke and

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2.2 Working

A pneumatic system is one in which power is transmitted from one place to another place through the medium of an compressible air. Usually pneumatic system have found versatile application in machine tool engineering .power transmission, by using an air as medium is called by a name pneumatic.it is more compact and eliminates the mechanical complicated linkages like gears, came and levers .It does not require any lubrication as aresult wear and tear of the moving components are considerably reduced .

The Pneumatic system components are connected by pipe lines .It provides flexibility in locating the components at any desired place .by varying. The quantity of air flow by means of a valve any amount of step less speed can easily be obtained The air used in system, provides cushioning effect for the shock loads. The life of the component is increased. Very large forces can easily be obtained and force multiplication is also possible with the minimum changes and losses. Whenever the pneumatic systems are over loaded the pressure's immediately relieved. Thus the system components are protected against the breakages and overstrain. The pneumatic air is compressible the system is very sensitive for instant operations. Thus backlashes in mechanical system will exist in pneumatic system. This system requires very simple maintenance cares. The heat generated in the bearings and moving parts are carried away by the air itself. Thus the system does not require any cooling arrangements. The system provides quick return motion of the components with the simple arrangements. Thus idle times of machining operations are reduced. The pneumatic system provides very high degree of dependability.

2.3 Solenoid Valve

Technical Data:

Size : 5/2"

Pressure : 0 to 10 kg / cm²

Media : Air

Purpose:This valve is used to speed up the piston movement and also it acts as a one – way restriction valve which means that the air can pass through only one way and it can't return back. By using this valve the time consumption is reduced because of the faster movement of the piston. The directional valve is one of the important parts of a pneumatic system commonly known as DCV. This valve is used to control the direction of air flow in the pneumatic system; the directional valve does this by changing the position of its internal

movable parts. His value was selected for speedy operation and to reduce the manual effort and also for the modification of the machine into automobile machine by means of using a solenoid valve. A solenoid is an electrical device that converts electrical energy into straight line motion and force. These are also used to operate a mechanical operation which in turn operates the valve mechanism. Solenoid is one which the plunger is pulled when the solenoid is energized. The name of the parts of the solenoid should be learned so that they can be recognized when called upon to make repairs, to do service work or to install them.

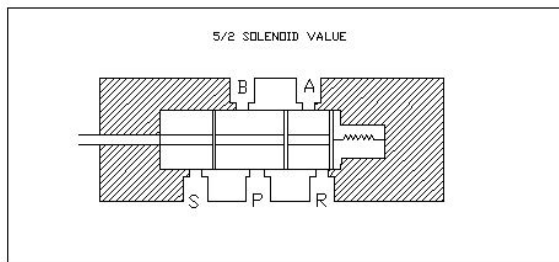


Figure no.4:-5/2 Solenoid Valve

Parts Of A Solenoid Valve:

1. Coil:-The solenoid coil is made of copper wire. The layers of wire are separated by insulating layer. The entire solenoid coil is covered with a varnish that is not affected by solenoid moisture. Cutting oil or other fluids. coils are rated in various voltages such as 115 volts AC, 230volts AC, 460volts AC, 575volts AC. 6volts DC, 12volts DC, 24 volts DC, 115volts DC & 230 volts DC. They are designed for such frequencies as 50Hz to 60 Hz.

2. Frame:-The Solenoid Frames Serves several purposes. Since it is made of laminated sheets, it magnetized when the current passes through the coil. The magnetized coils attract the metal plunger to move. The frame has provisions for attaching the mounting they are usually bolted or welded to the frame. The frame has provisions for receivers the plunger. The wear strips are mounted to the solenoid frame. And are made of materials such as metal or imagnated less fiber cloth.

3. Solenoid Plunger:-The solenoid plunger is the mover mechanism of the solenoid. The plunger is made of steel laminations which are riveted together under high pressure, so that there will be no movement of the lamination with respect to one another. At the top of the plunger a pin hole is placed for making a connection to some device. The solenoid plunger is moved by a magnetic force in one direction and it's usually returned by spring action. Solenoid operated valves are usually provided with cover either the solenoid or the

entire valve. It protects the solenoid from dirt and other foreign matter, and protects the actuator also.

4. Connectors, Reducer And Hosecollar:In our pneumatic system there are two types of connectors used; one is the hose connector and the other is the reducer. Hose connectors normally comprise an adapter (connector) hose nipple and cap nut. These types of connectors are made up of brass or Aluminium or hardened steel. Reducers are used to provide inter connection between two pipes or hoses of different sizes. They may be fitted straight "L" or other configuration.

TechnicalData

1. Solenoid Valve
2. Pressure- $0.8 \times 10^5 \text{ N/m}^2$
3. Media: Air
4. Port size - $0.635 \times 10^{-2} \text{ m}$

5.Connectors

Maxworking pressure :- $10 \times 10^5 \text{ N/m}^2$
 Temperature:- $0-100^\circ$
 Fluid media :- Air

6.Hoses

Maxpressure $10 \times 10^5 \text{ N/m}^2$
 Outer diameter:- $6 \text{ mm} = 6 \times 10^{-3} \text{ m}$
 Inner diameter:- $3.5 \text{ mm} = 3.5 \times 10^{-3} \text{ m}$

3.DESIGN AND DRAWING:-

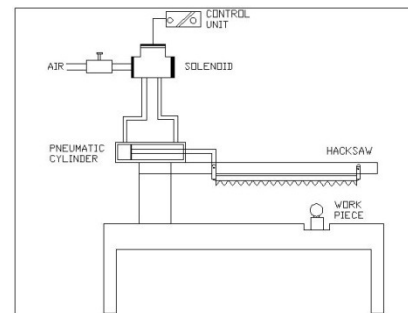


Figure No: 8 Drawing For Pneumatic Reciprocating Highspeed Hacksaw Machine

Working Principle-

The compressed air from the compressor reaches the solenoid valve. The solenoid valve changes the direction of flow according to the signals from the timing device. The compressed air passes through the solenoid valve and it is admitted into the front end of the cylinder block. The air pushes the piston for the cutting stroke. At the end of the cutting stroke air from the solenoid valve reaches the rear end of the cylinder block. The pressure remains the same but the area is less due to the presence of piston rod. This exerts greater pressure on the piston, pushing it at a faster rate thus enabling

faster return stroke. The weight attached at the end of the hacksaw frame gives constant loads which lower the hacksaw to enable continuous cutting of the work. The stroke length of the piston can be changed by making suitable adjustment in the timer.

4. ADVANTAGES

1. This new developed pneumatic cutting machine is useful in small & large scale industries instead of manual cutting machine for reducing effort of Human
2. It is portable & is compact one
3. This machine has Less maintenance.

5. APPLICATION

1. It is used in small scale industries and large scale industries.
2. It is useful when material need to cut in hazardous area such as oil & gas refineries.
3. It is used to cut small sized pipes or rods.

6. CONCLUSION:

Today, buyers are demanding quiet machines because of their concern about meeting in dusty's noise limits. Vickers is helping to meet this demand by supplying quiet pneumatic components. Sound levels of some pumps today, for example, there are fifty percentage of lower than the same model pumps of a few years ago. In the pneumatic the one major problem is leakage. In future we can avoid this leakage by taking proper activities.

7. REFERENCES

- 1] K.Sathishkumar¹, N.Ugesh², K.Vignesh³ and P.B.SanjeevaPrasath, "Pneumatic Reciprocating Hacksaw Machine" , International Conference on Breakthrough in Engineering, Science & Technology– 2016,6-10
- 2] John et al." Design and Fabrication of Automated Hacksaw Machine" Second National Conference on Trends in Automotive Parts Systems and Applications (TAPSA-2014) 261-269
- 3] RathodNayan J, "Discussed an identification of external structural load by measuring harmonic responses." Division of Solid Mechanics, Chalmers University of Technology.
- 4] Nagraj M harihar"Inverse finite element approach to determine the static and dynamic forces acting on vehicle model" Mtech project
- 5] S.G. Bahaley, Dr. Awate A.V, "Performance Analysis Of Pedal Powered Multipurpose Machine", IJERT, Volume-1, Issue-5, July-(2012).
- 6] T. Mohanraj, V. Siddhartha, "Design And Fabrication Of Automated Hacksaw Machine", IJRSET, Volume-3, Issue-2, April-(2014).
- 7] Analysis Of Multipurpose Hacksaw Machine",IJRAT,Volume-3, April-(2015)
- 8] Stephen Tambari, AyejahVictor."Study On The Design And Construction of Pedal Power Hacksaw Machine", IISN:-2320-334X, Volume-12, July-August-(2015)