International Journal of Mechanical and Industrial Technology ISSN 2348-7593 (Online)
Vol. 3, Issue 1, pp: (67-70), Month: April 2015 - September 2015, Available at: www.researchpublish.com

Pneumatically Actuating Rammer

Kaveriappa M B[1], Kaushik N D[2], Amanyu R N[3], Harikrishnan A[4], Milton P Mathew [5], Ramiz Muhammed [6]

[1,2] Assistant professor, [3,4,5,6] UG Scholar, Department of Mechanical Engineering, Coorg Institute of Technology, South Coorg, India

Abstract: **Casting is one of the important moulding processes in a manufacturing industry. Many investigations are being carried related to casting for increasing the efficiency & operator safety. Where efficiency is affected parameters like permeability, collapsibility, adhesiveness etc... Automation in this field helps to improve the foundry & its accuracy of a cast part. So, a pneumatically controlled rammer has been developed to control the sequential movement of double acting cylinders which is further automated by 5/2 way pilot operated direction control valve and 3/2 way Roller limit switches for movement of rammers. The dead weight of the rammer has been increased to 12.5 Kg. So, we are able to achieve effectiveness in ramming with limited time.**

Keywords: **3/2 way flow control valve, 5/2 way pilot operated direction control valve, Double actuating rammer.**

I. INTRODUCTION

Casting is a manufacturing process where usually a hollow cavity of the required shape called mould is poured with liquid material and then allowed to solidify. Usually the hollow cavities are made inside a cope and drag arrangement where it is filled with sand. This sand has to be packed compactly to get the required shape of cavity. To enable this compatibility a piece of equipment is used in foundry i.e. a Sand rammer. A conventional Sand rammer used to have a calibrated sliding weight actuated cam, which used to be actuated manually on to the required specimen, but this method was not satisfactory when it comes to mass production with large mould. Hence several experimentation have been going on to improve the quality and reduce time used for ramming process, where pneumatically actuated rammer is one type of idea where the rammer is completely actuated with the help of pneumatic controls and the time used for ramming is also reduced to an effective duration.

[1] The compressed air is directed to direction control valve, which is operated by solenoid. It is controlled by electronic controlled timing unit. A double acting cylinder is used for the ramming operation. They are able to use a force of 804.3652N for a 32mm diameter and 65mm stroke length. [3] The extending and retracting of cylinder is controlled by pneumatic circuit which further actuated by a 5/2 way direction control valve. [4] They have constructed a pneumatic device for press fitting pins into holes. Here 3/2 way push button flow control valves are used which are controlled manually. 5/2 way pilot operated valve are used for actuating double acting cylinders.

A. Pneumatics:

Pneumatics is a branch of technology that deals with the study and the application of pressurized gas to effect mechanical motion. Pneumatic systems are extensively used in Industry. This is because a centrally located and electrically powered compressor that powers cylinders and other pneumatic devices through solenoid valves. Valves is often able to provide motive power economically, safer, more flexible and reliable than a large number of electric motors and actuators. Basically a pneumatic system consist of a compressor where air from surrounding is compressed; it is connected with pressure gauge to maintain the required pressure in the present sequencing station of about 6 bar.

II. WORKING PRINCIPLE

The compressed air goes to air service unit where the amount of moisture content is removed. The flow is further transferred to a distributor manifold and is regulated by a pressure gauge for a working pressure of 6 bars. Later the air pressure is distributed to pneumatic a device which is in-line as shown in circuit.

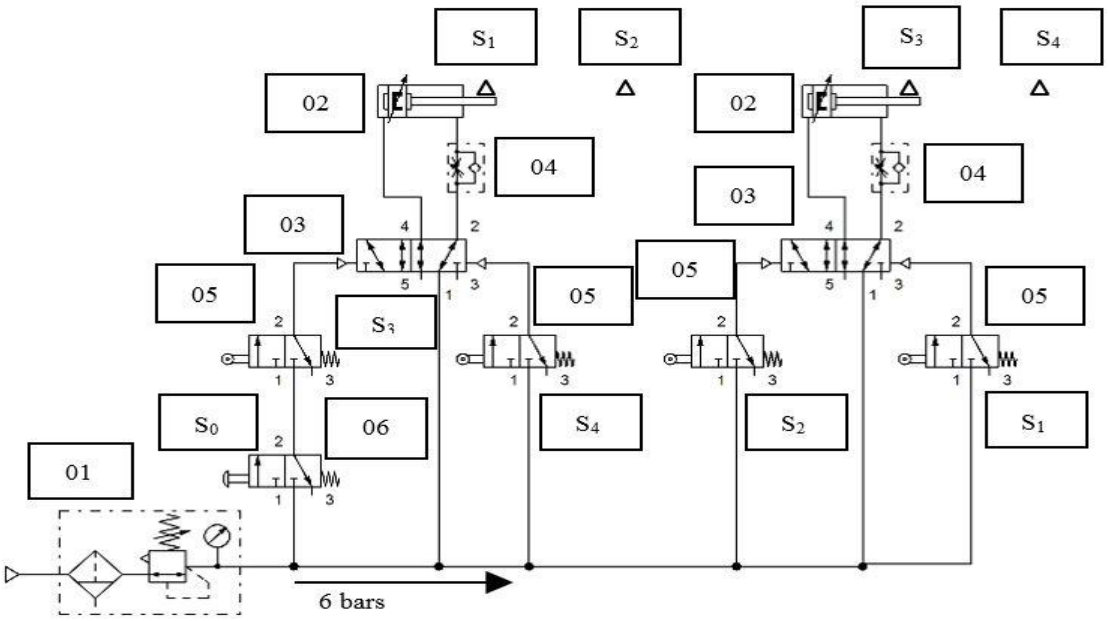


Fig. 1. Pneumatic Circuit Diagram of Complete Assembly

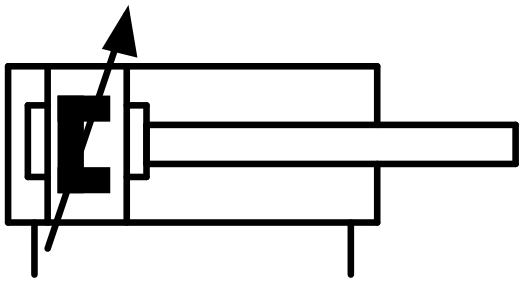
TABLE I: COMPONENT DISCRIPTION

Position	Quantity	Description of components
01	01	Air Service unit (Filter regulatory assembly)
02	02	Double acting cylinder
03	02	5/2 way direction control valves (Double piloted)
04	02	One way flow control vale (Adjustable)
05	04	3/2 way roller lever limit switch (S1,S2,S3,S4)
06	01	3/2 way push button valve (NC) (S0)

The compressed air further gets transmitted to two double acting actuators through a two 5/2 way pilot operated direction controlled valves where these actuators gets actuated sequential through four 3/2 way roller limit switch. These limit switches helps in actuating an alternate movement of two double actuating cylinders. Further double actuating cylinders are connected to two 12.5Kg of dead weight rammers. Hence the sand is rammed by the combined forces of dead weight, gravitation as well as pressure force.

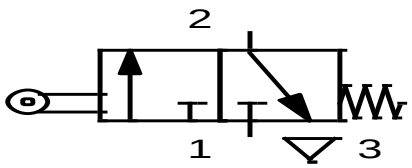
III. COMPONENT DESCRIPTION

A. Double Acting actuator:



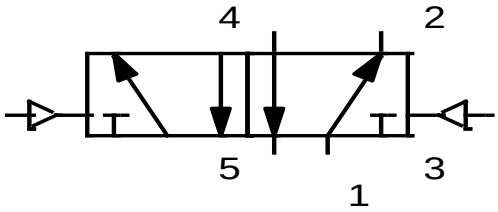
Double acting actuators use the force of compressed air in both compression and expansion strokes. For inlet and outlet there are two ports. As the air enters into the cylinder it exerts force on the piston due to that the piston moves forward. The outlet port is connected with a one way flow control valve (Adjustable) so that air will move out of the system but not into the cylinder.

B. 3/2 way roller Limit switch:



Limit switch is a device which just acts as a sensor in this experimentation. Where it analyses the to and fro movement of the piston, inside double acting actuator and sends the pneumatic signals to the next device to operate. It consists of three ports and two actuations where it is actuated by a roller which is connected to a plunger inside and spring return.

C. 5/2 way Direction control valve:



Direction control valve is one of the important parts in pneumatic systems. It consists of five ports and two actuations. It consist of a spool inside which is connected to a pilot where it will be operated by pneumatic signals.

IV. DESIGN AND CALCULATIONS

Size of the rammer = 290 mm x 290 mm

Stroke length of piston = 150 mm

The diameter of the piston is

Force F = m x g

= 25 Kg x 9.81

= 245.25 N

F = P x A

Where,

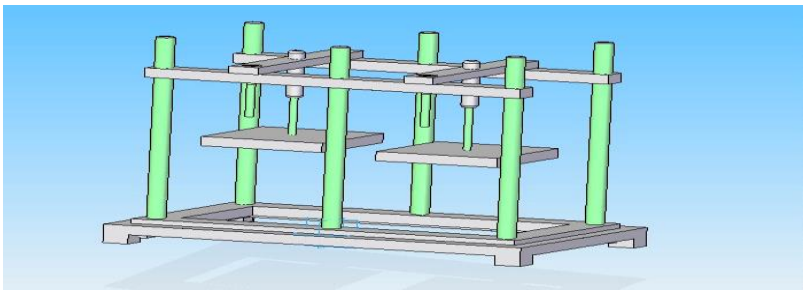
P = Compressed air pressure = 6 bars

A = Area of the cylinder

245.25 = 6 bars x Area

Area = 4.0875×10^{-4} m^2

Diameter = 22.82 mm



V. RESULTS AND DISCUSSIONS

The pneumatic ramming machine can be operated easily. The automated pneumatic ramming machine does not require any skilled labour. The ramming time is decreased and the amount of force for ramming one mould has been increased conventionally. Since it is having sequential motion we can balance the amount of shocks given to the base and vibration from two rammer has been balanced. Since the rammers are completely operated pneumatically without any electrical components, so maintenance is less. It is very effective and portable. The complete setup is controlled automatically, hence skilled labour is not required. Since we are using two rammers they can help reducing ramming time when it comes to mass production. The design is compact and portable.

VI. CONCLUSION

Sequential operation of pneumatically actuated ramming process is obtained. The force exerted for ramming has been increased uniformly with considerable decrease with time. When it comes to mass production this sequential operation of two actuators can also be increased so that we can connect many rammers. Since it is not having any electrical parts we can also implement this system in underwater application. Since we are using high pressure compressed air, leakages can be identified easily.

ACKNOWLEDGEMENT

Authors express sincere gratitude to Coorg Institute of Technology, Ponnampet for Technical assistance.

REFERENCES

[1] Chinmay Anegundi, Amogh Ganagi and Chandrashekar Tapashetti, "Automatic Pneumatic Ramming Machine", International Journal of Mechanical and Production Engineering, Volume – 2, Issue 9, Sept – 2014, Page 60-62.

[2] Shanmukha Nagaraj and Ramesh S, "Automated sequential controlling of modular work station", International Journal of Research and Engineering and Technology, Volume–1, Issue2, July–2013, Page 110–115.

[3] Mr. Ashok Kumar A, "Design of Pneumatic Quick Exhaust Circuit", International journal of Engineering trends and Technology", Volume-1, Issue- 2, May-2011, Page 1-6.

[4] V G Vijaya, "Design and fabrication of sequencing circuit with a single double acting cylinders", International journal of innovative research and science, Engineering and Technology, Volume-2, Issue-11, Page 6315-6322.