DEVELOPMENT OF PNEUMATIC LAUNCHER

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ABSTRACT

Compressed air is used to propel a grenade from a closed cavity. Pressure change in a closed environment will result in propelling of object from the closed chamber. The pneumatic source can be stored in a chamber for portability and even a live source can be directly connected to the gun. The grenade will accelerate with the compressed air, when the air is trying to escape in to the low-pressure atmosphere air. The acceleration of the grenade depends upon the pressure of the air and higher pressure will generate more acceleration. Inside the closed chamber if the air is supplied through a small opening and if the attachment is being attached to the opening then the pressure created will be less and the grenade will start rotating inside the chamber. To overcome this, that attachment should not be attached with the opening it should be placed over a very small distance from the gun, so that a vacuum will be produced from the atmosphere and the grenade could be launched at a high pressure.

KEYWORDS

Pneumatic actuation system, Pneumatic actuator, Pneumatic air rifle, Pneumatic air ram, Pneumatic air guns.

RELATED WORK

Krantikumar et al [1] discussed that in manual method snipping tool is used to cut the sheet metal. This may cause sheet metal wastage because of mistakes happened such as wrong dimension etc. and also the main drawback of using this is a simple sheet metal cutting may take long time. For these hydraulic machines are used but the cost of that hydraulic system is so high. By using pneumatic system, it will simplify the process. Here they use a pneumatic hand lever operated two-way control valve. And the control valve is operated by using air compressor.

Tony Thomas et al [2] discussed that in cooking process, the main drawback is the time taken for cutting vegetables, as food cannot be cooked without vegetables. So, this process is made automated by many means but this method is an effective way. Automated vegetable cutting machine uses hopper arrangement and pressure block which is powered by a pneumatic cylinder and has a cutting grid which is fixed. The cylinder is supplied by a 5/2 DCV. The machine even automates the feeding of vegetables which is not available in any of the system like electric, where the cutting alone is done automatically by a rotating blade and a manual feeding is required. The automated vegetable cutting machines are now installed in mega kitchens were the food is to be served for several thousands of people.

Poonam G. Shukla et al [3] discussed that the machine is powered by compressed air. The machine has got more advantages over a hydraulic machine such as more efficiency and less operating and maintenance cost. The machine uses two cylinders and a 5/2 DCV for control purposes. The machine uses one cylinder for injection of plastic and the second cylinder for opening and closing of die automatically. The machine increases productivity and reduces risk of operation for the operator using the machine.

Rajesh Kumar Mahapatra et al [4] discussed that the fault detection and control of sequential operation based on fluid power actuators has always been challenging. Here, the case study of electro-pneumatic actuator role and its control in the sequential operation for automatically punching and placing the materials in the predefined states. The controlling of sequential operation has been carried out using PLC as well as relay, contactor, solenoid and watchdog timer. Implementing the principle of electro-pneumatics requires an integration of timer, counter & watchdog timer in a sequential control system for better safety and control. A watchdog timer (WDT) is a hardware timer that automatically generates a system reset if the main program neglects to periodically service it. It is often used to automatically reset an embedded device that hangs because of a software or hardware fault.

Murugeswari et al [5] discussed that the packaging industries are using form fill and seal machines in a wide range for packaging purpose. This conventional process uses a gear and cam mechanism. This system requires periodic maintenance over magnetic clutch because of overheating. A low cost automated packing machine can be used by small scale

industries which would help to reduce their cost of the automation. This low cost automated machine uses simple pneumatic, mechanical and electrical systems. Here is a low cost pouch packing machine and also an additional weighing and pouring mechanism has been added to increase the accuracy of the system. Various processes involved in the pouch packaging are neatly aligned and properly timed to get optimum production rate. A mechatronics system, developed for this machine takes feedback from sensors and accordingly controls the machine. The advantage of the system is number of pouch packing is increased, Improved quality, Increased productivity.

INTRODUCTION

Using pneumatics there are number of research going on, in this paper a few of them are being listed out to give you an overview of what is being done by using pneumatics in industries and home applications. This paper deals with semi automatic pneumatic gun. The semi-automatic pneumatic gun is used to launch a grenade from a closed chamber. The grenade is fed into the closed chamber through a channel which is positioned up-right to the gun. This system uses pneumatic devices such as a 5/2 pilot operated DCV, a flow control valve, a pressure relief valve, a storage tank, and a double acting cylinder.

CIRCUIT DESIGN

Pneumatic circuits are designed using basic pneumatic components and the same is shown in figure 1. The compressed air from the air filter is given to the FRL unit. From the FRL unit the compressed air is given to the input port of 5/2 DCV. From that the required connections are made to the double acting cylinder. The 5/2 DCV is double pilot operated with spring return type.

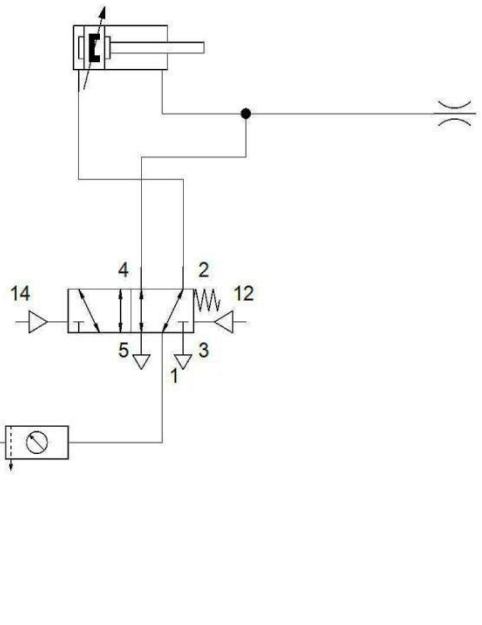

Figure 1

- **SIMULATION:**

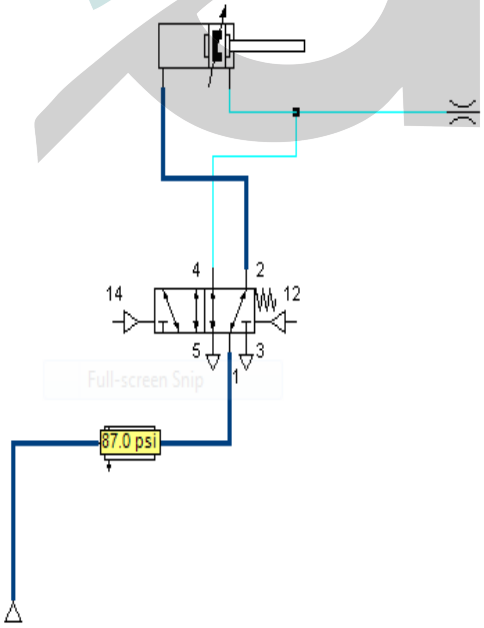

Figure 2

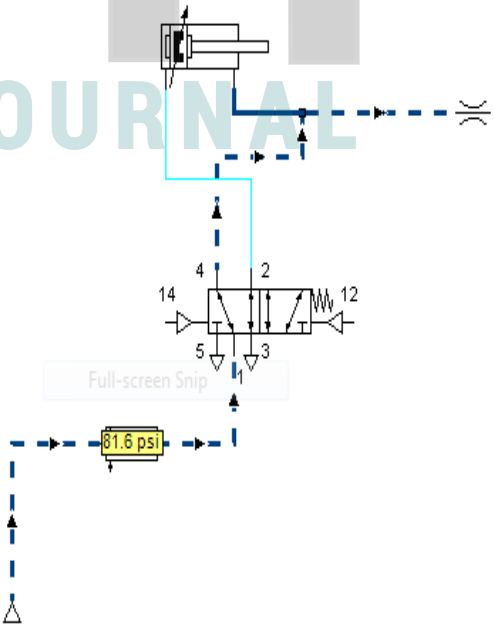

Figure 3

In figure 2 the DCV will be in first position so that the air will pass through port 1 and the cylinder will be extended. In figure 3 the DCV will be in second position so that the air will pass through port 1' and the cylinder will be retracted, and the excess or remaining air will be sent out through the nozzle.

WORKING PRINCIPLE

The pneumatic gun uses compressed air, closed chamber and uses the velocity of the air to propel the grenade. The grenade gains momentum till the end of barrel. Conventional guns use chemical explosives such as **PENTAERYTHRITOL TETRANITRATE (PETN)** for generating rapid expansion of air here alternatively we directly use high compressed air to propel the grenade which makes it easy to create low cost bullets and it can avoid the poisonous gases entering the atmosphere. The gases which are inside the conventional bullets produces harmful effects on the environment. The grenade is being launched by introducing compressed air inside barrel. When the trigger in the gun is pressed, then the grenade will be launched with the help of pneumatic air. A double acting cylinder is used to load the grenade automatically when the trigger is pressed. The grenades are loaded manually as of now through a channel which is positioned up-right to the launcher.

EXPERIMENTAL ANALYSIS

Table 1 Experimental Results

EXPERIMENTS	PRESSURE (bar)	TRIAL	DISTANCE (m)	AVERAGE
1-4	3	1	1	1.16
		2	1.15	
		3	1.2	
		4	1.3	

5-8	4	1 2 3 4	1.8 2 2.4 2.8	2.25
9-12	5	1 2 3 4	3.4 3.9 4.3 5	4.2
13-16	6	1 2 3 4	4 3.9 4.1 3.8	3.9
17-20	7	1 2 3 4	3.2 2.8 2.5 2	2.6

Table 1 show that the experimental results which the pneumatic gun was tested by varying the air pressure and the distance were recorded. Air pressure was varied from 3 bar pressure to 7 bar pressure and for each increment 4 trails were conducted. Figure 4 shows that the outcome of the experimental analysis. It is evident from the graph, 5 bar pressure is launches the grenade at a maximum rate of 4.2 m. Based on the experimental results the grenade was improved and shown in figure 5.

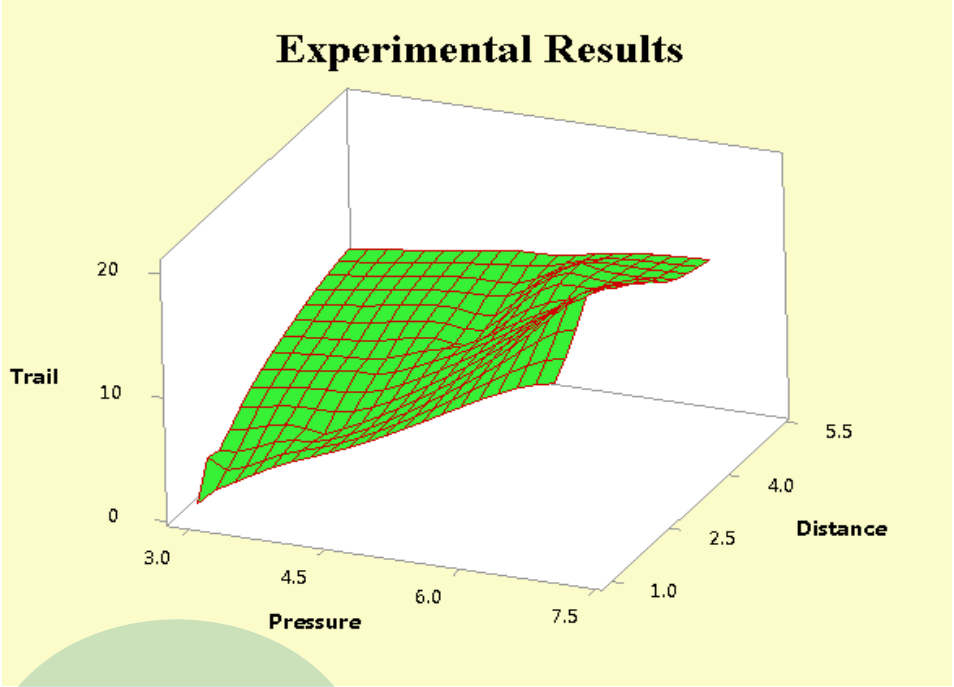

Figure 4 Outcome of the experiments

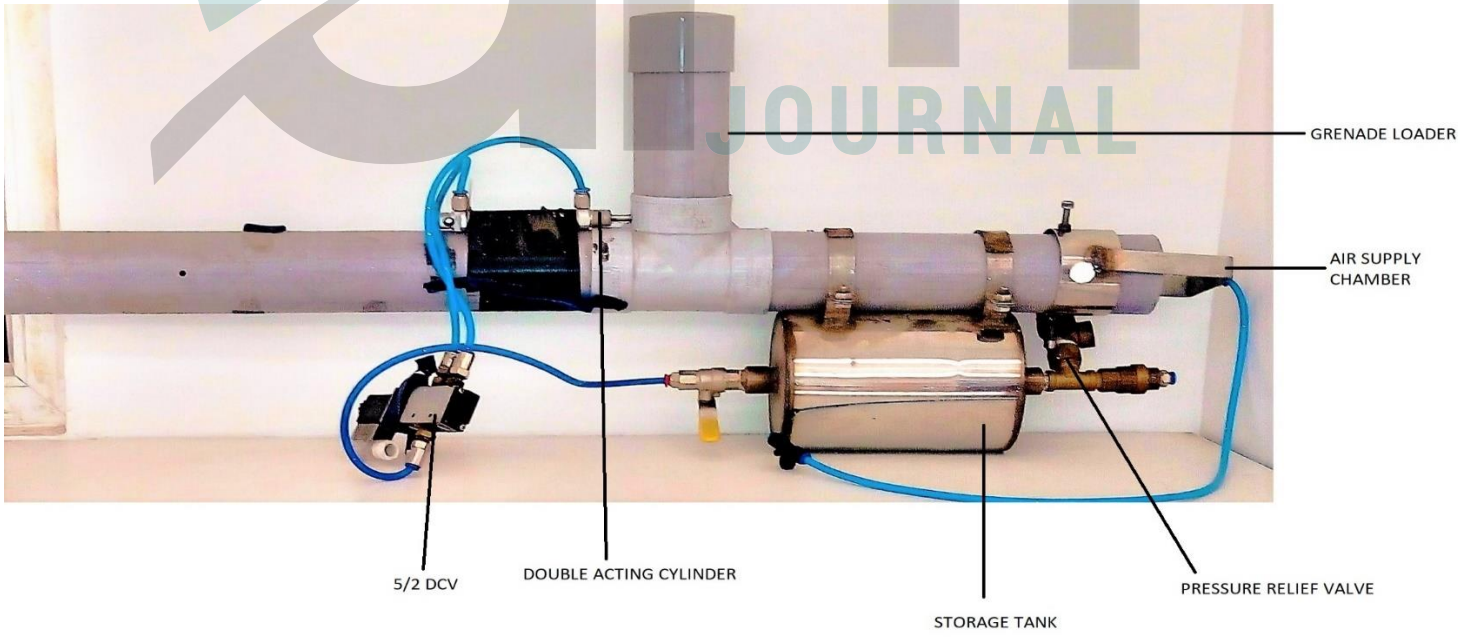

Figure 5 Assembled pneumatic launcher with storage tank

CONCLUSION

In this research, a concept of semi-automatic pneumatic gun has been implemented. Nowadays, all works are done by automation. Automation inventions all are concentrated on the main theme that is to reduce human effort and effective utilization of time. Our research is also implemented to reduce the harmful gases entering the atmosphere in order to reduce the harmful effects. The semi-automatic pneumatic gun has been designed, analyzed, simulated, and tested. The grenade launcher has been tested under several circumstances; if the pressure given is 5 bar then the grenade could be launched at a maximum rate of 4.2 m. If the pressure is beyond 5 bar then the grenade will start circulating inside the gun itself, (i.e.) it will not be launched at a high pressure and the distance to be travelled will be very less. Surely, this grenade launching system will enhance the needs of launching a grenade using small amount of pneumatic air in other fields in our developing modern world. In Future this project will throw light on using automatic feeders to feed the grenades inside the launcher. This helps in automatic feeding and thereby allowing fully automatic shooting. The advantages of using this is firstly it will give protection for a shooter, and also easy to monitor the number of grenades inside the launcher.

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