iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** VIII **Month of publication:** August 2017

DOI: http://doi.org/10.22214/ijraset.2017.8215

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue VIII, August 2017- Available at www.ijraset.com

Development of Vacuum Damped Recoil System

Pankaj W. Wanjari[1], Dr. C. C. Handa[2], Prof. A. P. Ninawe[3]
[1]M. Tech Student, [2]Professor, [3]Assistant Professor, Department of Mechanical Engineering
K. D. K. College of Engineering, Nagpur, Maharashtra, India.

Abstract: ***Recoil system is a core part of any artillery weapon and time required between two consecutive firing of weapon is largely depends on it. Recoil system is used to absorb the recoil force during firing and to return the connecting parts in original firing position. Generally the recoil systems are used in artillery weapon like canon comprised of a hydraulic type system which consist of spring - mass - dashpot. Since these systems are all quite complexes and contain several moving parts, their reliability is limited. So here an attempt is made to design and develop a prototype recoil system which is more reliable and simple by using a vacuum damped system for canon. To study the vacuum damped recoil system an experimental model is developed to measure an various parameters to establish the relationship between the pneumatic cylinder. Recoil system is a core part of any artillery weapon and time required between two consecutive firing of weapon is largely depends on it. Recoil system is used to absorb the recoil force during firing and to return the connecting parts in original firing position. Generally the recoil systems are used in artillery weapon like canon comprised of a hydraulic type system which consist of spring - mass - dashpot. Since these systems are all quite complexes and contain several moving parts, their reliability is limited. So here an attempt is made to design and develop a prototype recoil system which is more reliable and simple by using a vacuum damped system for canon. To study the vacuum damped recoil system an experimental model is developed to measure an various parameters to establish the relationship between the pneumatic cylinder.***

Keywords: Recoil time, Recoil length, Total cycle time, Damping system, Pneumatic cylinder.

I. INTRODUCTION

Now-a-days heavy and bulky conventional recoiling mechanisms are used in a canon. Recoiling mechanism consist of spring-mass-dashpot system which is employed with critically damped system. When a cannon is fired, it impart strong impulse load on structure. This impulse load is mitigating by using recoil system. . Generally the recoil system utilize component such as stiff spring, a damper etc. after firing artillery weapon recoil and moves outward. Due to certain damping system it move inward and retain its initial position. The time required for outward and inward motion is called as total cycle time. For any artillery weapon it is important that time between consecutive firing should be minimum.

II. METHODOLOGY

The experimental setup below is proposed for study of vacuum damped recoil system. To fabricate the vacuum damped recoil system the Pneumatic cylinder is used. The pneumatic cylinder as shown in following fig.1 is important part of vacuum damped recoil system.

Fig.1 Pneumatic Cylinders

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
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The pneumatic cylinder has two ports say port 1 and port 2. The port 1 is firmly closed and port 2 is open to atmospheric pressure as shown in following fig. 2.

When piston star to move from its initial position to outward direction the vacuum is generated in portion A of the cylinder because of port 1 is closed as shown in figure 3. The vacuum is goes on increasing with increase of displacement of piston, the vacuum generated in portion A try to resist outward movement of piston and at certain position piston stop to move because of high vacuum in portion A whereas portion B open to atmospheric pressure through port 2. When the displacement of piston is stop, on one side of piston i.e. portion B atmospheric pressure is act while on other side of piston i.e. portion A there is high vacuum, as a result of which piston displaces to its initial position. The same technic is used in vacuum damped recoil system to complete the recoil movement of system.

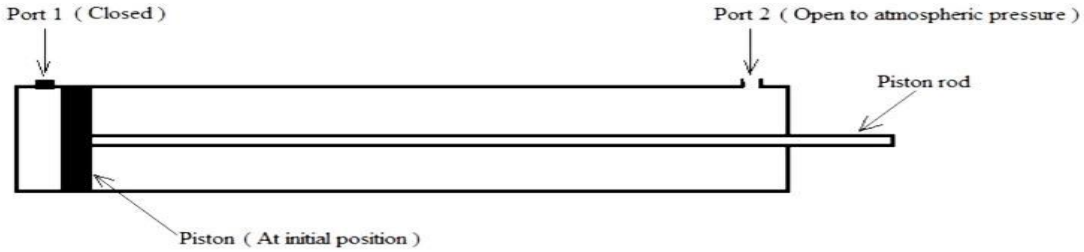

Fig. 2 Schematic of pneumatic cylinder

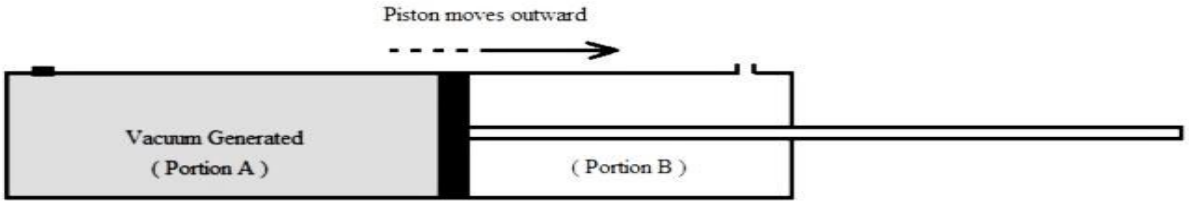

Fig. 3 Vacuum generated in portion A

III. MAIN COMPONENTS OF EXPERIMENTAL SETUP

Followings are the major components of experimental setup-

A. Pneumatic Cylinder

Pneumatic cylinder is main part of vacuum damped recoil system.

B. Load Cell

load cell is used to measure the force in experiment model. In order to convert force into electrical signals, we bond a sensor called a "strain gauge" to the load cell. The strain gauge utilizes this principle and detects a strain by changes in resistance. A load cell is made by bonding strain gauges to a spring material. To efficiently detect the strain, strain gauges are bonded to the position on the spring material where the strain will be the largest.

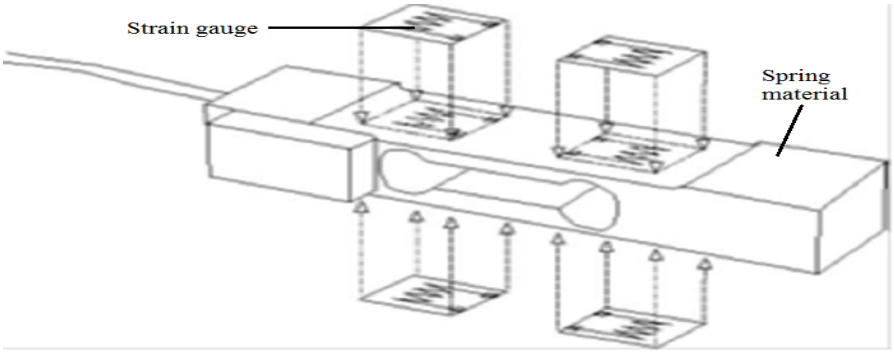

Fig. 4 Load cell

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C. Indicator

Indicator is used to display magnitude of force which is measured by load cell.

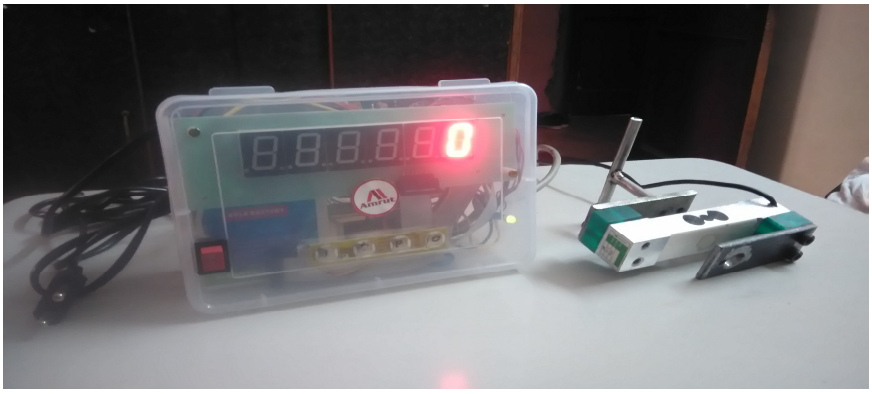

Fig. 5 Indicator

D. Vacuum Gauge

Vacuum gauge is used to measure the vacuum pressure generated in pneumatic cylinder. The vacuum gauge is of mechanical type and having capacity of 760 mm of Hg.

Fig. 6 Vacuum gauge

E. Barrel

Is connected to piston rod of cylinder and which is of 2 kg in weight. Barrel is of diameter 30mm and length 350mm. at the one end of barrel nut and bolt arrangement are provided to hold the load cell.

Fig. 7: Barrel

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IV. FABRICATION OF EXPERIMENTAL MODEL

The proposed experimental setup used in this study is shown in Fig.

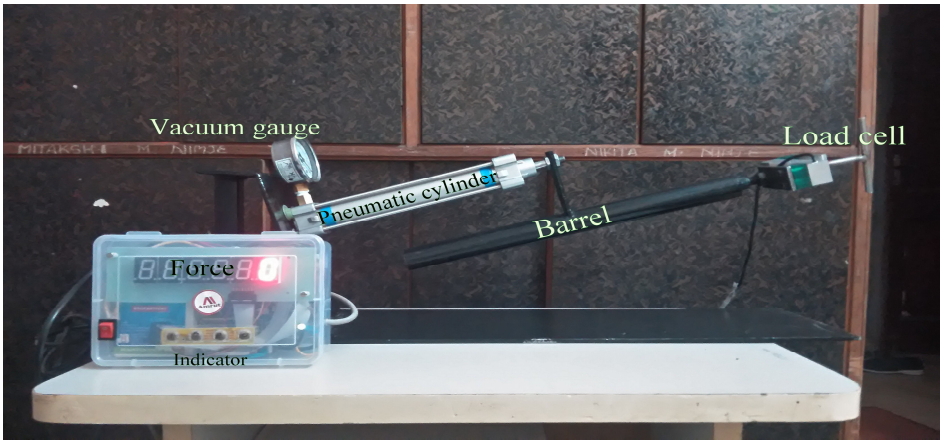


Fig. 9 Experimental Model of vacuum damped recoil system

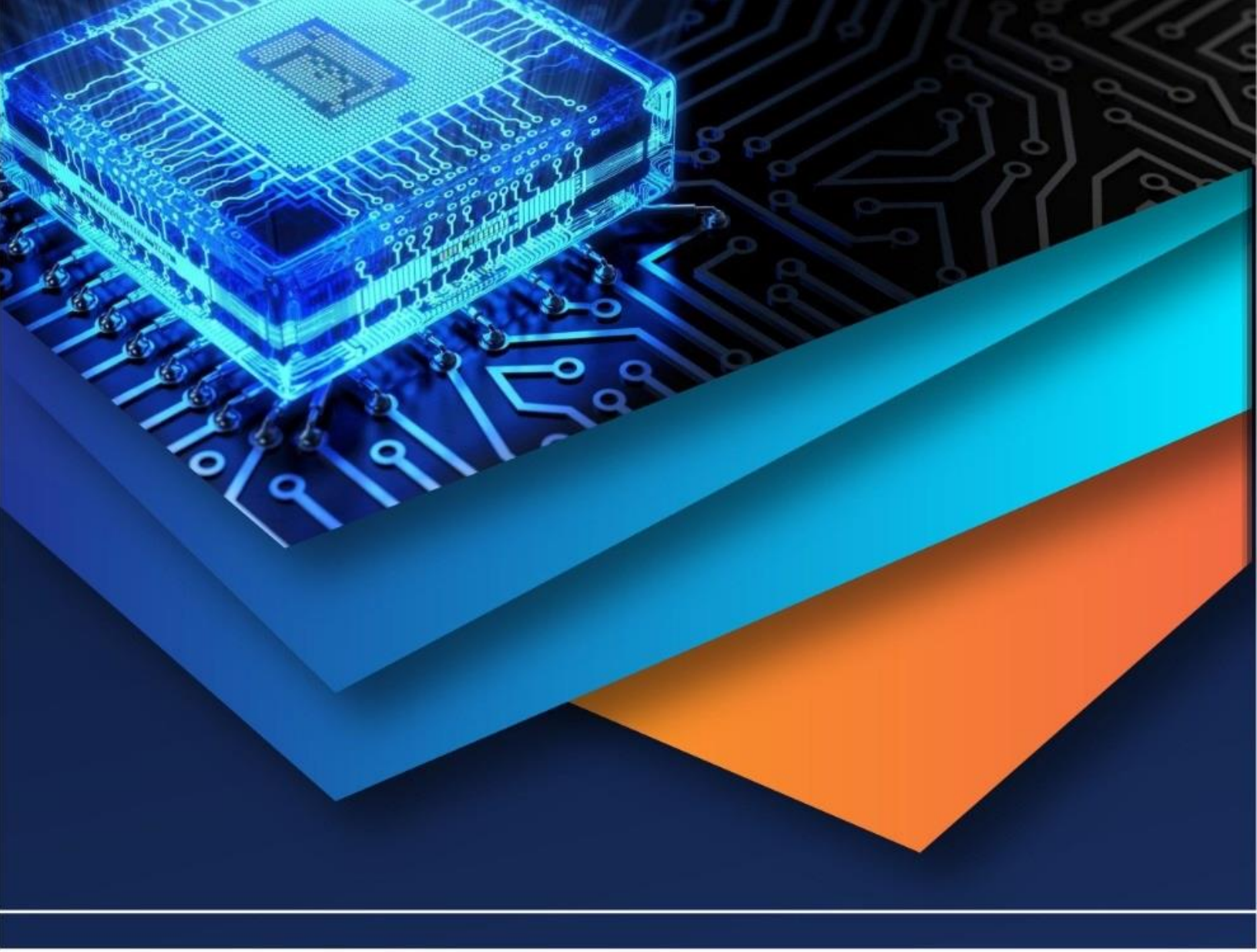
Which is consist of pneumatic cylinder, load cell, indicator, barrel, vacuum gauge as already discus. in this model used two pneumatic cylinder are of size 32*160 and second cylinder size is 40*300. The stand is fabricated to hold the pneumatic cylinder and other components as shown in above figure. After fixing the cylinder the barrel is connected to the end of piston rod. Vacuum gauge is fixed in port 1 and port 2 open to atmospheric pressure. The vacuum created in cylinder is measured by this vacuum gauge. Load cell is connected to the end of barrel used to measure force required to pull the barrel, the magnitude of force is indicate by indicator which is connected to load cell by four wire cable. The same arrangement is used for both the cylinders.

V. CONCLUSION

Thus the development of vacuum damped recoil system is done. The steps involved in development of vacuum damped recoil system are mentioned here. The recoil system is simple and reliable because of less moving parts. The model thus developed can be used in study the various important parameter of vacuum damped recoil system and can be useful for validation of mathematical model.

REFERENCES

[1] "Field artillery cannon weapon systems and ammunition handbook," U. S. Army field artillery school, Weapons Department, Fort Sill, Oklahoma.
[2] "Engineering design handbook carriages and mounts series recoil systems," headquarters, U.S. Army materiel command, September 1963.
[3] Deepak C. Akiwate, S. S. Gawade, "Design and Performance Analysis of Smart Fluid Damper for Gun Recoil System," International Journal of Advanced Mechanical Engineering, Volume 4, Number 5 (2014), pp. 543-550.
[4] Galal A. Hassaan, "On Dynamics of a Cannon Barrel- Recoil Mechanism with Nonlinear Hydraulic Damper and Air-Springs," IJRIT International Journal of Research in Information Technology,Volume 2, Issue 9, September2014, Pg. 704-714.
[5] Tomas Lucak, Roman Vitek, Linh Do Duc, Vladimir Horak, "Experimental mechanical device for recoil simulation," Scientific research and education in the air force doi: 10.19062/2247 3173.2016.18.1.4
[6] Pankaj W. Wanjari, Dr. C. C. Handa, Prof. A. P. Ninawe "Vacuum Damped Recoil System: A Review", International Journal of modern Trends in Engineering and Research (IJMTER), Volume 4, Issue 8, Aug. 2017.



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