A PROJECT REPORT
ON
"SOFT DOOR CLOSER"

Submitted by

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In fulfillment for the the award of the Degree
Of
BACHELOR OF ENGINEERING
IN
MECHANICAL ENGINEERING
UNDER THE GUIDANCE
Of
Prof. NAFE MOMIN

DEPARTMENT OF MECHANICAL ENGINEERING

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UNIVERSITY OF MUMBAI

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Affiliated to MUMBAI UNIVERSITY)

Plot No. 2 & 3, Sector - 16, Near Thana Naka, Khandagaon, New Panvel, Navi Mumbai, Maharashtra 410206

CERTIFICATE

This is to certify that the project entitled

SOFT DOOR CLOSER

Submitted by

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Of the Kalsekar Technical Campus, New Panvel is a record of bonafide work carried out by him under supervision and guidance, for fulfilment of the requirements for the award of the degree of Bachelor of Engineering in Mechanical Engineering as prescribed by University Of Mumbai is approved.

Signature of the Guidance	Signature of the HOD	Signature of the Principal
Prof.Nafe Momin	Prof.Zakir Ansari	Dr.AbdulRazzak

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DISSERTATION APPROVAL SHEET

This is to certify that this B.E. project titled, **SOFT DOOR CLOSER** submitted by

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SIDDIQUI HUSSAIN

Approved for the DEGREE OF BACHELOR IN ENGINEERING, in MECHANICAL ENGINEERING from University of Mumbai. Certified further that, to the best of my knowledge this report represents the work carried out by this student.

Internal Examiner **Seal of the Institute**

Date:

Dedication

Dedicated to our beloved family and friends & staff members

ACKNOWLEDGEMENTS

In the name of Allah, the Most Benevolent, the most Merciful. I wish to record immeasurable gratitude and thankfulness to the One and The Almighty Creator, the Lord and sustainer of the universe, and mankind in particular. It is only through His mercy and help that this work could be completed and it is ardently desired that this little effort be accepted by Him to be of some service to the cause of humanity.

I am grateful and would like to express my sincere gratitude to my supervisors Professor **NAFE MOMIN** for their germinal ideas, invaluable guidance, continuous encouragement and constant support in making this research possible. I also sincerely thank them for the time spent proofreading and correcting my many mistakes. I really appreciate the consistent support from the first day I applied to this graduate program to these concluding moments. I am truly grateful for their progressive vision about my training in science, their tolerance of my naive mistakes, and his commitment to my future career.

I would like to express my special thanks to my comrades Mr. Arif, shahid, Ranjeet, and Hussain, for supporting me in this thesis.

My sincere thanks go to all my lab mates and members of the staff of the Mechanical Engineering Department, AIKTC, who helped me in many ways and made my stay at AIKTC pleasant and unforgettable.

I acknowledge my sincere indebtedness and gratitude to my parents for their love, dream and sacrifice throughout my life, who consistently encouraged me to carry on my studies in Mumbai University.

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ABSTRACT

A door closer is a mechanical device that closes a door, which is open by push or pull action manually or automatic. The closer available in a market can involve the consideration of a variety of criteria. In addition to the closer's performance in fire situations, other criteria is resistance to opening forces (for use by disabled or infirm), control over the rate of closing, safety, durability, risk of vandalism, and aesthetics. This paper review the existing door closer available in a market. also gives the detail concept and mechanism for the new design of door closer , by using compressive spiral spring, reed valve and simple cylinder arrangement.

CHAPTER 1

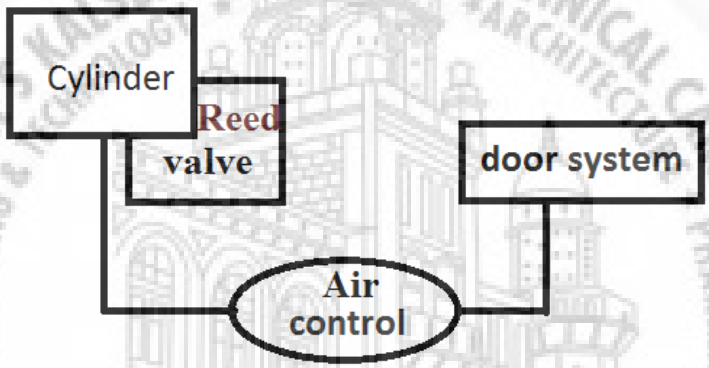
INTRODUCTION

1.1 Introduction :

Nowadays Automation occupies various electronic sections by its comfortable nature. This is an era of automation where it is broadly defined as replacement of manual effort by pneumatic power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased. Degrees of automation are of two types, viz.

- Full automation.
- Semi automation.

In semi automation a combination of manual effort and pneumatic power is required whereas in full automation human participation is very negligible.



Fig,1 Block diagram

1.2 Role and Responsibilities

My roles and responsibilities include:

- Prepare a requirement document to reach expectations of the project and to come up with functionalities which are needed to be implemented.
- Documentation of expected output for various aspects with accepted margin error was also documented.
- To design overall system based on workflow requirements.
- Discussion with the project guide and Head of Department on ways to improve the design and to optimize performance.
- Choosing suitable components and methods based on the configurations availability and requirements.
- Testing and remedies.

Recommendations:

As a trainee mechanical engineer, I wanted to work on project work that would showcase my engineering knowledge. I got the opportunity to work on **soft door closer**. This project was very important as it evaluated my skills and talents in my institution.

Fig.2 system cylinder

Why to install soft door closer ?

A soft door closer will stop the high impact on the door frame
And stop the door from getting damage.

CHAPTER 2

LITERATURE SURVEY

AUTOMATIC PNEUMATIC SOFT DOOR CLOSER

2.1 Field of the Invention

The present invention relates to door open and close, and relates more particularly to an automatic pneumatic door opener / closer.

2.1.1 Pneumatics

The word 'pneuma' comes from Greek and means breather wind The word pneumatics is the study of air movement and its phenomena is derived from the word pneuma. Today pneumatics is mainly understood to mean the application of air as a working medium in industry especially the driving and controlling of machines and equipment.

Pneumatics has for some considerable time between used for bikerving out the simplest mechanical tasks in more recent times has played a more important role in the development of pneumatic technology for automation Pneumatic systems operate on a supply of compressed air which must be made available in sufficient quantity and at a pressure to suit the capacity of the system.

When the pneumatic system is being adopted for the first time, however it wills indeed the necessary to deal with the question of compressed air supply The key part of any facility for supply of compressed air is by means using reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and delivers the air at a high pressure.

Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of the air at intake conditions namely at atmosphere pressure and normal ambient temperature. The compressibility of the air was first investigated by Robert Boyle in 1962 and that found that the product of pressure and volume of a particular quantity of gas.

2.2 Cylinder Equation

The usual written as PV = C (or) P / Vi - P.V.

In this equation the pressure is the absolute pressured which for free is about 14.7 Psi and is of courage capable of maintaining a column of mercury, nearly 30 inches high in an ordinary barometer. Any gas can be used in pneumatic system but air is the mostly used system now a days.

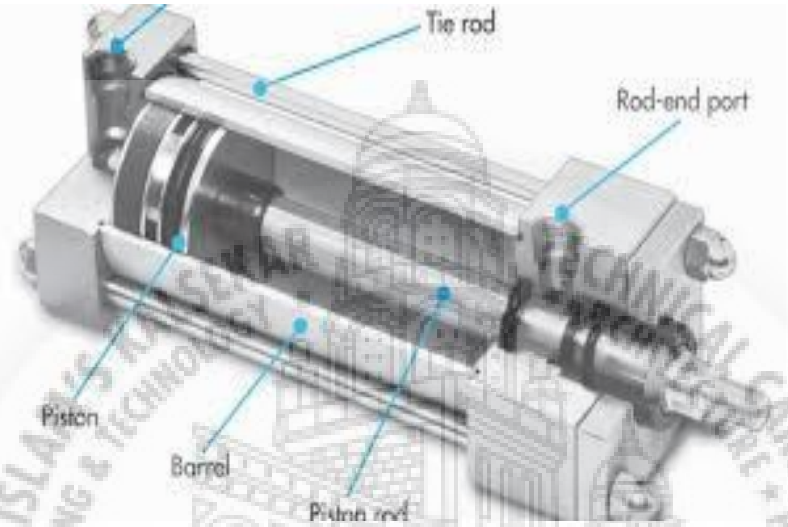


Fig.3 Cross Section of piston and Cylinder

2.3 Reed Valve

Reed valves are a type of check valve which restrict the flow of fluids to a single direction, opening and closing under changing pressure on each face. Modern versions often consist of flexible metal or composite materials (fiberglass or carbon fiber).

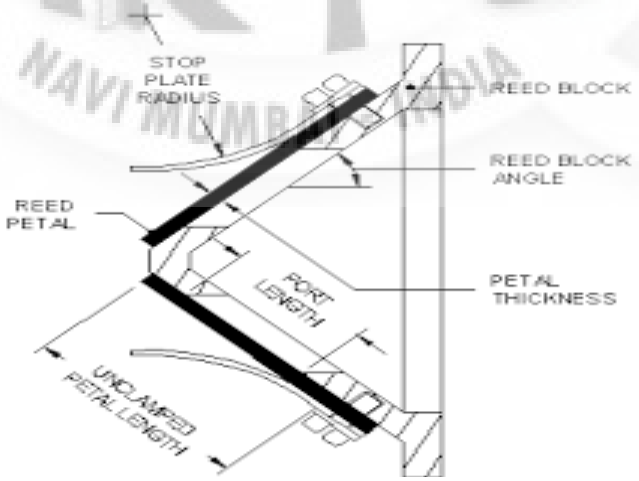


Fig.4 Reed Valve

2.4 Design and Modelling

Reed valves are designed considering the pressure gradient and mass flow.[2] The pressure gradient is used to evaluate the valve lift during open condition; the lift and overall component geometry (considering also a pressure loss coefficient) are then used to calculate the mass flow.

For high speed applications (compressors and engines) the dynamic response has to be considered. A simple approach consists in the evaluation of first Eigen value that is compared with exciting frequency.

Design of reed valves can be refined using simulations. The dynamic of petals can be studied neglecting the coupling between fluid and structure: in this case the evolution of the structural part are simulated using lumped parameters models or FEM models, discharge coefficients at various valve lift are evaluated with experiments or CFD simulations. The study of the complete system needs an integrated Fluid-structure interaction model.

2.5 Review Papers

Paper 1

Title

DESIGN OF DOOR CLOSER USING COMPRESSIVE SPRING AND GEAR TRAIN(2008)

Abstract

A door closer is a mechanical device that closes a door, which is open by push or pull action manually or automatic. The closer available in a market can involve the consideration of a variety of criteria. In addition to the closer's performance in fire situations, other criteria are resistance to opening forces (for use by disabled or infirm), control over the rate of closing, safety, durability, risk of vandalism, and aesthetics. This paper gives the detail concept and mechanism for the new design of door closer with design , by using compressive spiral spring and simple gear train arrangement.

Advantage

- Smooth operation
- Less wear and tear
- More durable
- Easily available in market

Disadvantage

- High cost
- High maintenance

Conclusion

The present study is centered toward the design of a door closer that would conveniently alleviate the problem of oil leakage which effects the life of the product. This is innovative design. To verify the mechanism provide to the arrangement working model has been fabricated which run successfully

Paper 2

Title

Experimental Measurement Design of Required Operating Torque for Hinged Door(2013)

Abstract

The lacks of operating standards and measurement methods make the universal design of the door difficult to achieve. Thus, in this study, a force measurement system for hinged door operation has been developed, and a series of operating force measurement for hinged door were carried out with and without door closer. Specially, a quarter arc guiding track was designed to confirm that the do or required operating torque could be measured successfully. The results showed that as door closers were applied, the operating forces increased greatly.

Advantage

- More reliable
- Smooth operation
- Easy installation

Disadvantage

- High stress on door frame
- Oil leakage problem
- Bulky system
- High cost

Conclusion

In this study, an appropriate measurement systems and methods of operating force for hinged door has been established, especially considering the use of a door closer. Due to a self designed quarter arc guiding track mounted on the door, the operating torque for the hinged door could be measured simultaneously.

Paper 3

Title

WORKING OF NEW DESIGN OF DOOR CLOSER (2010)

Abstract

A door closer is a mechanical device that closes a door, which is open by push or pull action Manually or automatic. The closer available in a market can involve the consideration of a variety of criteria. In addition to the closer's performance in fire situations, other criteria are resistance to opening forces (for use by disabled or infirm), control over the rate of closing, safety, durability, risk of vandalism, and aesthetics. This paper gives the detail concept and mechanism for the new design of door closer which is tested on fabricating model.

Advantage

- Low initial cost
- Easy installation
- Low maintenance

Disadvantage

- Wear and tear problem
- Irritating noise
- Break easily

Conclusion

The present study is centered toward the design of a door closer that would conveniently alleviate the problem of oil leakage which effect the life of the product. This is innovative design. To verify the mechanism provide to the arrangement working model has been fabricated which run successfully. The analysis of the arrangement done but that is not given in this paper. Some modification also required in this arrangement.

Technical Review

The main problem with the conventional door closer is that It requires a lot of effort to operate also It create a huge impact on the frame of the door also the maintenance of conventional door closer is more which is the reason more number of institute don't use such kind of conventional door closer in their premises but using the design which is more reliable and easy to install and operate the selecting door closer would be easy task.

Advantage

- Easy to install
- Less building cost
- User friendly
- Smooth operation
- Cost is less
- No operating sound

Reason to use this technology

- It reduces the tremendous amount of stress on the door frame
- No oil is required since it uses air as a working medium
- It is more durable than other conventional door closer
- Maintenance is not required

CHAPTER 3

PROBLEM IDENTIFICATION

3.1Problem Definition

Door closer with hydraulic system mostly used overhead hydraulic system. It accomplishes this by using spring tension modulated by hydraulic fluid. As the user opens the door, hydraulic fluid passes from one reservoir to another, and as the spring pushes the door closed again, the hydraulic fluid passes back to the previous reservoir through a series of valves that control the speed. The following problems are identified in the existing overhead hydraulic system.

• If oil is leaking from your door closer, throw it away and buy a new one.

• If your door closer is slamming the door and cannot be adjusted to do otherwise, either the fluid has leaked out or the valve seals are worn out. Either way, your best option is to replace it.

• If the door closer has no spring tension and the spring tension adjustment turns round and round with no effect, the spring is broken the door closer must be replaced.

Fig.5 conventional door closer

This type of door closer is generally used in ever place since It is he only option available in he market.
This door closer consist of so many mechanical parts and components its maintenance is very difficult and we have to replace the whole assembly also it required very high push to open the door.

3.2 Design analysis

Small springs can be wound from pre-hardened stock, while larger ones are made from annealed steel and hardened after fabrication. Some non-ferrous metals are also used including phosphor bronze and titanium for parts requiring corrosion resistance and beryllium copper for springs carrying electrical current (because of its low electrical resistance).

When a spring is compressed or stretched, the force exerts is proportional to its change in length. The rate or Spring constant of a
spring is the change in the force it exerts, divided by the change in deflection of the spring. That is, it is the gradient of the force versus deflection curve.17

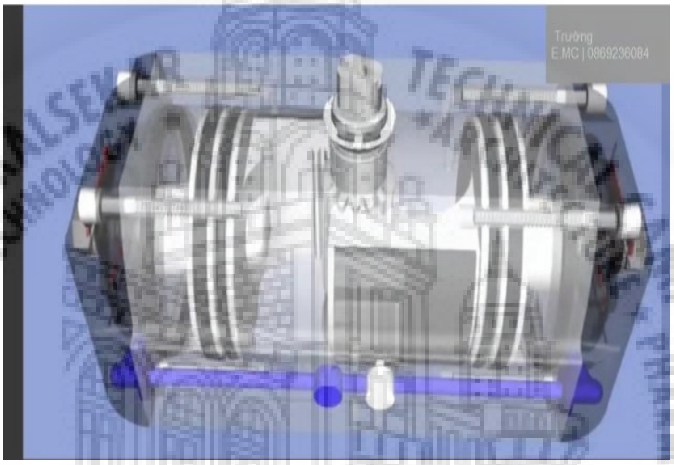


Fig.6 assembly of door closer

3.3Project motivation

Both intrinsic and extrinsic motivation will help the project, and both will achieve a the employee to have a higher efficiency. While intrinsic motivation is the preferred motivation to aim for, as it will create a need or desire to complete the project, extrinsic motivation could also have a positive effect.

CHAPTER 4

METHODOLOGY

4.1 Method

The compressed air is used as the force medium for this operation. There are pneumati, Direction control valve; flow control valve used. The arm from the compressor enters to the floe control valve. The controlled air from the flow control valve enters to the direction control valve. The function of direction control valve is used to move the cylinder piston rod forward / reverse depends upon the valve position. In one position air enters to the cylinder and pusses the piston, so that the gate will open. The next position air enters to the other side of the cylinder and pusses the piston return back, so that the releasing stroke is obtained. In that time the door is closed. The speed of the close and releasing stroke is varied by the direction control valve manually when the door is in open condition the valve will suck he air from he atmosphere and collect the air in the cylinder.

4.2Piston and reed valve arrangement

Reed valves are a type of check valve which restrict the flow of fluids to a single direction, opening and closing under changing pressure on each face. This valve is connected with the piston in such a way that the reed valve is movable with the piston moment.

The figure shows the arrangement of piston and reed valve.

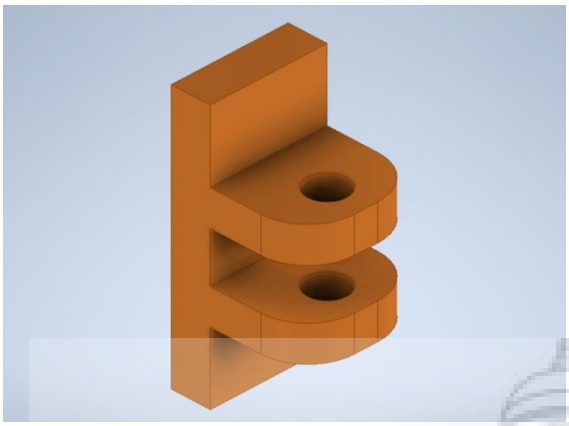
Fig. 7 piston and reed valve arrangement

4.3 Material

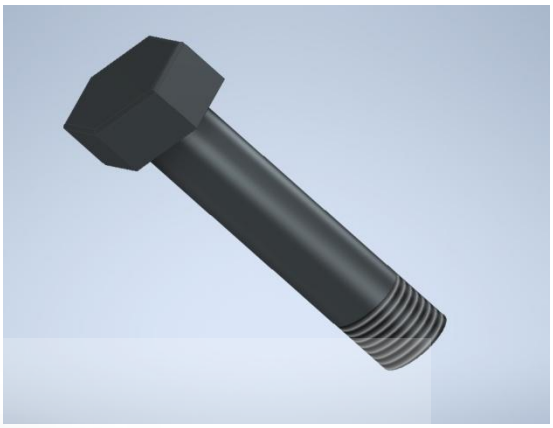
The materials used to make reed valves vary widely, although steel was a popular choice for many years. Available in a wide range of thicknesses as shim stock, it is in many ways an ideal material. In recent times though, steel has been replaced to a large extent by composite reeds. Glass-fibre reinforced plastics were very popular for this application, offering good fuel resistance and low mass. These have, however, as we might expect, been supplanted largely by carbon-fibre composites.

Fig.8 Reed Valve Representation Picture

4.3AUTOCAD INVENTOR FILE



Connecting part



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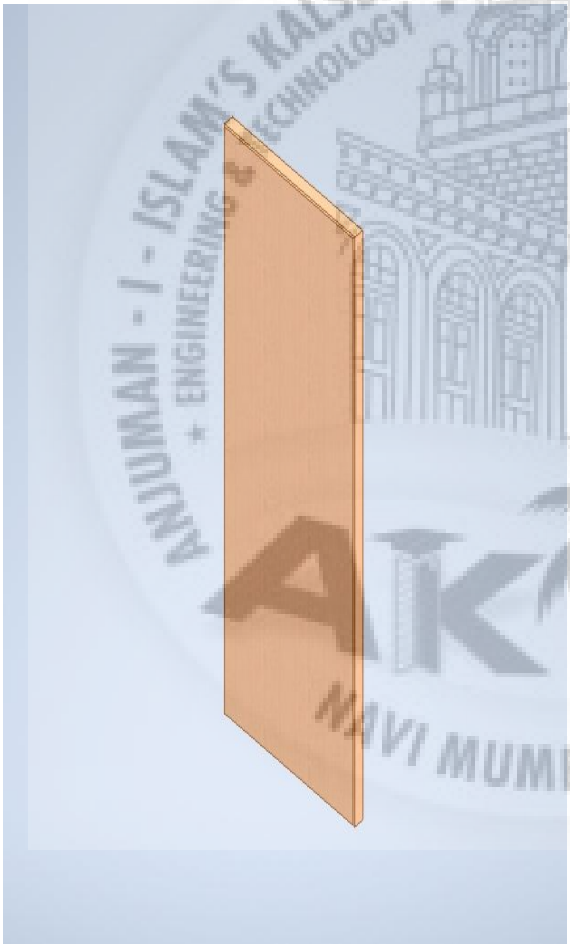
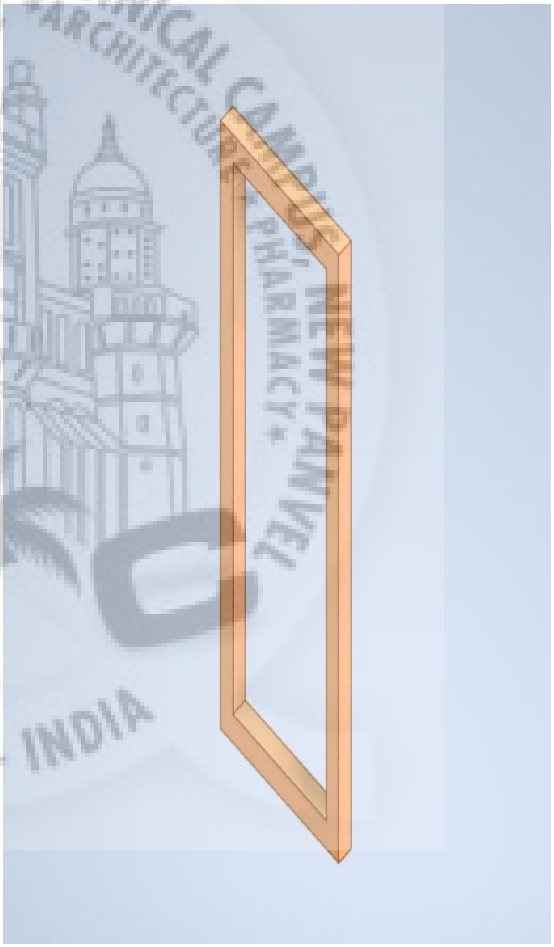


Door



Frame

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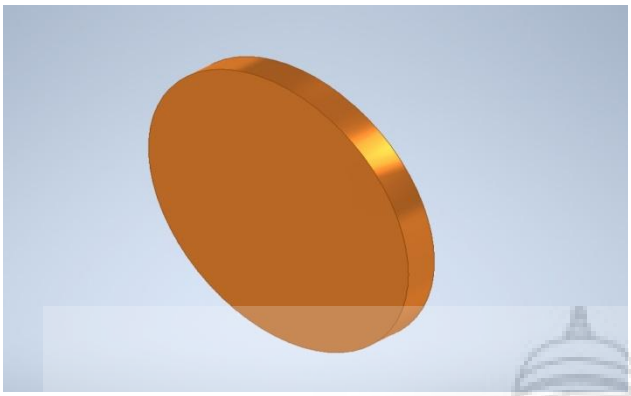
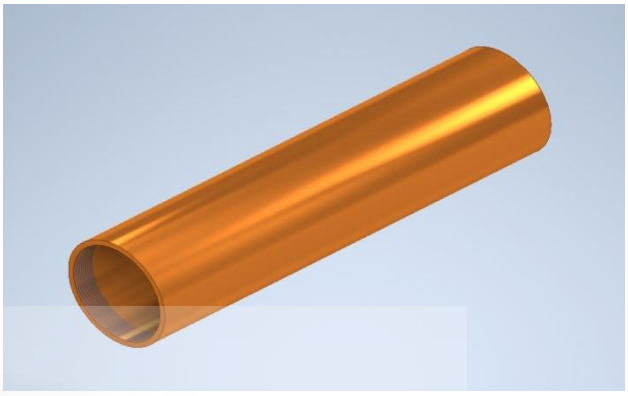
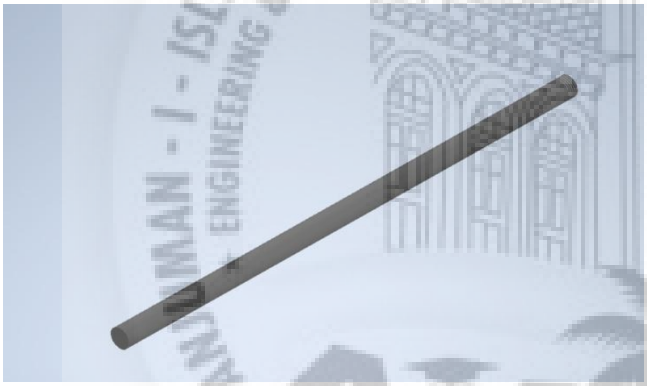


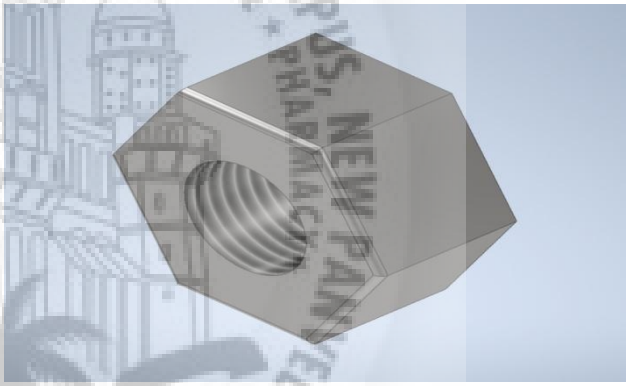
Cap



cylinder



Rod



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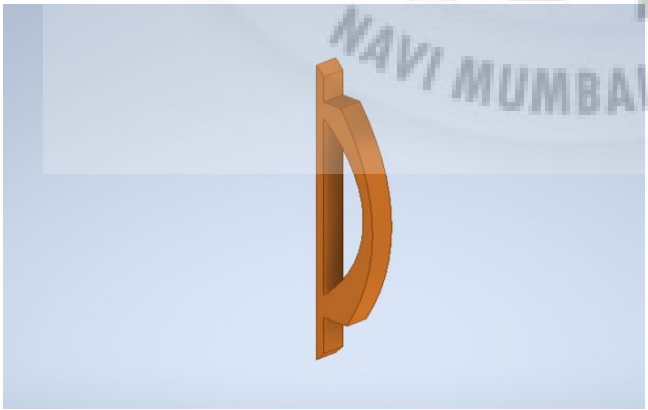

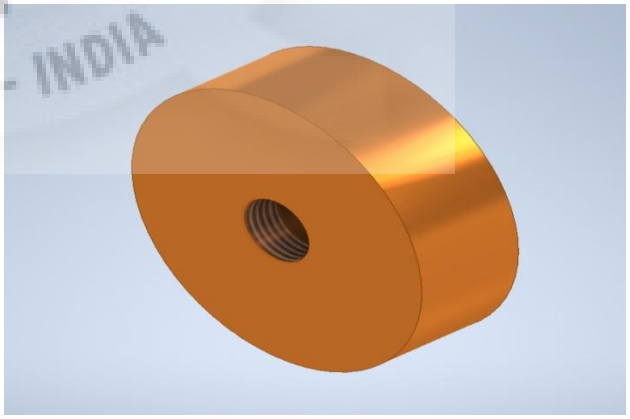

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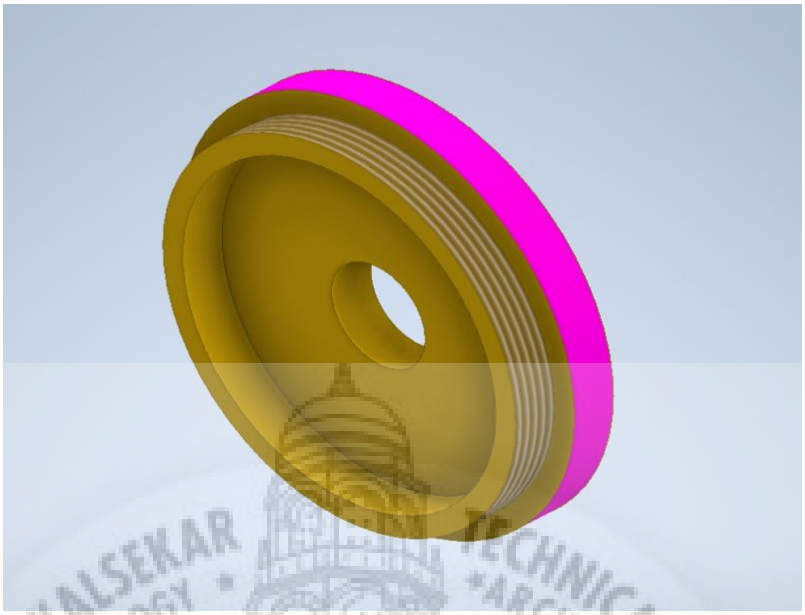

Assembly

CHAPTER 5

VALIDATION

5.1 VALIDATION OF SOFT DOOR CLOSER

From the above study it is analyzed that the impact of the door on the frame is drastically reduced and the door frame is not damage by the high impact of the door.By giving proper assembly to the door this door closer system reduce the high impact of the door which is cause by wind. By adjusting the control valve we can adjust the pressure as per the requirement of the door.

Some of the following point was consider for this system

- The angle at which the door will close slowly is 15 degrees
- It require same amount of energy to pull/push the door.
- The rubber stand can additionally use to stop the door.
- Compressive spring force is used in the mechanism

  Hence the life of the door and the frame is been increased and the chances of accidents is been drastically decrease.

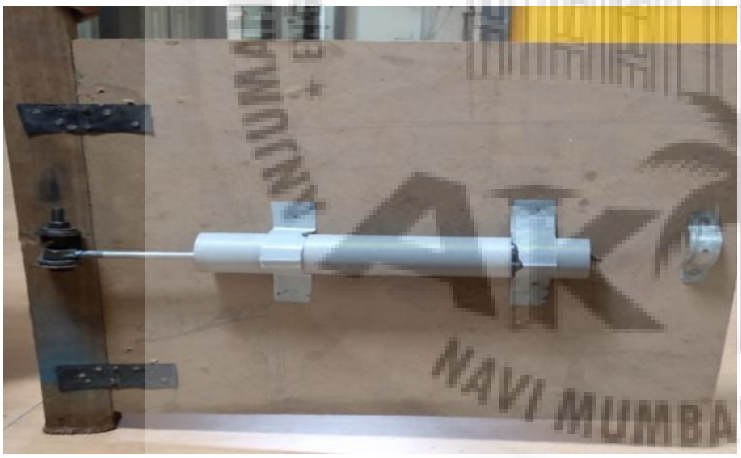

Fig.9 Cylinder arrangement prototype

Fig.10 Hinge arrangement

CHAPTER 6

Result and conclusion

6.1 Calculations:

Torque

Torque = force * radius of pinion
= 50 * 40/2
= 1000 N-mm
Total forces on gear
=Torque + K.E. + friction
= 1000 + 1.4224 + 1.5
=1003 N-mm
= 1 N.m (approximately)
Energy stored in operation
= 1 N.m

SPRING CALCULATION

Design the spring for storing energy more than 1 N.m
Design of spiral torsion spring
Ref:- PSG Data book
P= Safe mode
b= Width of spring leaf
h= thickness of (0.03to0.04)d
d= arbor diameter
[6]= design bending stress
P = bh2
[6]/6rk b=20mm, h=0.8, c=d/h=25, k=3c-1/3c-3 = 1.02
50 = 20 x (0.8)2 [6]/6x35x1.02
6 = 836 N/mm2
Deflection = plr2
/EI I= bt3
/12, 20x(0.80)3
/12 = 0.853
=50 x 1000x (35)2
/202x103 x0.853
=348.56mm
Energy stored, U= p x deflection/2
= 50 x 348.56
= 8.71x103 N-mm
= 8.71 N-m
Hence storage energy is more than required so the design is safe.

Result

By using this new design we tried to develop the new mechanism which is simple in construction, parts easily available in a market, replacement of single part done and that's why it is long life product.
In the above experimental project we have calculated the torque required in the system and the design of the spring required to operate the system hence we found out that the storage energy is more than required so the design is safe.

Conclusion

The present study is centered toward the design of a door closer that would conveniently alleviate the problem of oil leakage which affects the life of the product. This is innovative design. To verify the mechanism provide to the arrangement working model has been fabricated which run successfully. Some modification also required in this arrangement by which the force required to open the door will reduce.

CHAPTER 7

PROJECT COST

7.1 Cost of Product

Sr.no	Particular	Quantity	Cost
1	Pneumatic cylinder	**1**	**350**
2	Piston rod	**1**	**30**
3	Piston	**1**	**100**
4	Hinge	**2**	**40**
5	Reed valve	**1**	**100**
6	Screw	**8**	**20**
7	Connecting part	**1**	**200**
	Total		**840**

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