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# Design of Air Gun Using Solar

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**ABSTRACT:** In this present project compressed air is used to propel a grenade from a closed cavity. Pressure change in a closed environment is utilised to propel 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 accelerates 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 generates more acceleration. The air inside the closed chamber is supplied through a small opening and the attachment is being attached to the opening the pressure created will be less and the grenade will start rotating inside the chamber. To overcome this, the 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:** Renewable Energy, Air Gun, High Pressure.

## I. INTRODUCTION

Using pneumatics there are number of research going on, in this project 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 project 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.

## II. LITERATURE SURVEY

### Coda Enterprises, Inc., Mesa, Arizona

Air Gun: A capture air gun (Coda Enterprises, Inc., Mesa, Arizona) was obtained and numerous techniques were tested with deployment of the air. A small Styrofoam float is attached to the air with a 15 meter nylon string so it could be retrieved after deployment. It is obviously important to shoot the air on water with depths less than the retrieval line length. Although the air gun worked well, it is dependent on calm seas to attain proper speed for capture and to safely operate the boat. This technique is very labor intensive; often 5-10 shots are necessary for each duck captured. Also, airs are occasionally lost, which adds to the cost of this technique. In March 2001, the first scoter (a male surf scoter) was captured from a fast moving boat from approximately 10 m. A total of 15 surf scoters have been captured using the air gun in Chesapeake Bay during 2001-02.

### Department of Fisheries and Wildlife, Oregon State University, ~orvallis, OR 97331-3803 U.S.A.

A remotely fired air-gun was used at a waterhole for capturing wild goats and urial in an area where helicopters could not be used. Twenty-six goats and eight urial were caught, with a capture effort of 12.5 person-hours per goat, and 59.5 person-hours per urial. Up to four animals were caught at once, multiple captures accounting for 74% of all captures for both species. A remotely fired air-gun should be effective for capturing other species at waterholes or other sites where the animals' presence can be predicted.

### Department of Resources, Wildlife, & Economical Development, North Slave Region

In 1997, we captured 57 grizzly bears (39 adults, 16 cubs, 2 subadults) during spring, summer and fall capture efforts. Air-gunning from a helicopter was first tried in the spring for cubs only, using a skid mounted air-gun. Effectiveness was limited because if a cub was not airted properly after the first shot, the helicopter had to land to reload the air-gun. Air-gunning was not available for our summer session. In the fall, we airted bears of all ages using a hand-held air-gun and a skid-mounted air-gun as a backup. All but two bears were airted before being tranquilized. Once airted, most bears were shot with a tranquilizer dart from the helicopter. Cubs-of-the-year and occasionally yearlings were injected by hand once we were on the ground.

### SDSU research improves helicopter captures of deer, antelope-

Wildlife managers and researchers using helicopter air-gun tactics to capture pronghorn and white-tailed deer can minimize animal mortality by limiting pursuit time and eliminating animal transport. Those are among the important findings in a multi-year study led by South Dakota State University researchers that evaluated the effects of seven variables in such captures, a valuable technique for researchers and wildlife managers. Helicopter air-guns have been used successfully to capture many ungulate species including white-tailed deer and pronghorn, and studies have generally found low mortality for white-tailed deer, but there is conflicting evidence about whether the technique is safe and efficient for pronghorn. Some animals die from injuries during capture and others die afterward as a result of what biologists call capture myopathy, a condition that can be brought on by over-exertion leading to biochemical imbalances. The researchers wanted to learn whether mortality of deer and pronghorns could be reduced by changing capture and handling procedures during helicopter air-gunning. Distinguished professor Jonathan Jenks of SDSU's Department of Wildlife and Fisheries Sciences and SDSU graduate student Christopher Jacques, now with the Wisconsin Department of Natural Resources, led the study. During the winters of 2001–2006, the researchers captured 208 white-tailed deer (*Odocoileus virginianus*) and 281 pronghorn (*Antilocapra americana*) by helicopter air-gunning throughout the Northern Great Plains. The study area involved southern Minnesota, parts of north-central and western South Dakota, and the southwestern corner of North Dakota. Of those 281 pronghorn, 25, or 8.9 percent, died from capture-related injuries. Of those, 12 died from direct injuries during capture, and 13 died after release. Of 208 deer, 3, or 1.4 percent, died from injuries sustained during helicopter captures, with no mortalities documented after release.

## III. PROBLEM DEFINITION

As a renewable and clean energy resource, solar power can be used for replacement of fossils fuels. At the border of our country we see many times the enemies tries to cross the border and enter in our areas. Our aim is to design a gun which can work on solar power to warn enemy instead of using guns or missiles. Solar energy which is collected at day time can be stored in battery for later use. Places like LAC (Line of Actual Control) where use of guns are not allowed there we can use this weapon for warning which is less harmful and can stop the enemy from entering in Indian territory

## IV. METHODOLOGY

### METHODOLOGY OF DESIGN AND ANALYSIS

A parameter study is done to evaluate the most crucial parameters for FE analysis of axial ball bearings. The parameters that are evaluated are mesh density, contact stiffness, osculation, load level, geometrical nonlinearity and material nonlinearity. The studies are performed by means of the FE software ANSYS. The accuracy of finite element analysis depends on different parameters such as element type, boundary condition and how the loads are applied etc. Therefore, the FE model is nothing else but an approximate realization of the reality. The parameter study can be done by physical tests. However, it will increase the cost, time and resources consumed and therefore FE analysis is more suitable choice, at least for parameter evaluation.

### Theoretical aspects of the work

In this study, the finite element method is adopted using Pro Engineer and ANSYS as a commercial CAD and FE program. The following chapter contains some fundamentals of the applied theories provided that the reader has an initial knowledge of basic structural mechanics, machine components, and fundamentals of the finite element method.

### Finite element method

Finite element method (FEM) is a method for approximate solutions of partial differential equations. The domain of interest is divided into finite elements on which the solution is approximated by piecewise-polynomials. The finer the partition (Mesh) is, the more accurate the solution.

### Nonlinear Analysis

Nonlinear analysis is used when a structure behaves nonlinear when loaded i.e. the deformation and the stress state does not have a linear relation to the applied load. The three main sources to nonlinear behaviour's are: contact, geometric nonlinearities and material nonlinearities. In order to manage such calculations with a linear process the Newton Raphson method can be used.

### Newton-Raphson method

Newton-Raphson is an iterative method for finding solution to nonlinear equations and equation systems. In FE calculations, the method is used for non-linear problems and the relations between force and displacement for one degree of freedom. The procedure for Newton-Raphson method is as follows: The load is applied and the displacements are calculated. From the displacements, new conditions are calculated and the displacements are recalculated. This procedure is repeated until the solution is converged i.e. reach a certain value or level.

The iterative procedure is as follows:

### Material nonlinearities

A nonlinear stress-strain relationship results in a nonlinear behaviour. Plasticity is a nonlinear stress-strain relationship as shown. Definition of Plasticity according ANSYS (2007) is "When a ductile material experiences stresses beyond the elastic limit, it will yield, acquiring large permanent deformations."

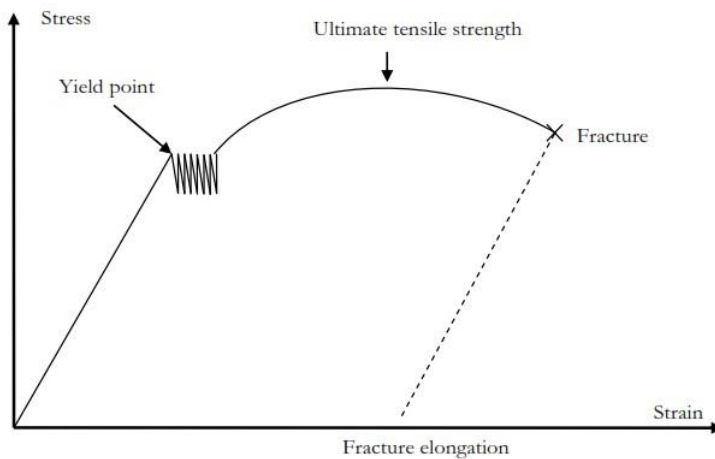


Fig. 4.3 Relationship between Stress & Strain

### ANSYS

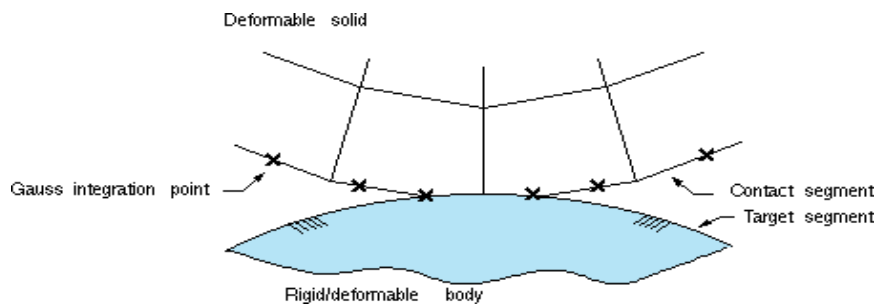
ANSYS is a commercial, general-purpose FE software, which has been on the market since 1971. It can be used in several applications for example to study the thermal heat flow, fluid flow, magnetic fields, acoustics/vibrations and last but not least structural mechanical problems.

### Contact in ANSYS

A handful of ways to handle contact are available in ANSYS. However, the one described here is penalty-based contact since it provides short calculation times and therefore is used.

**Penalty based contact**

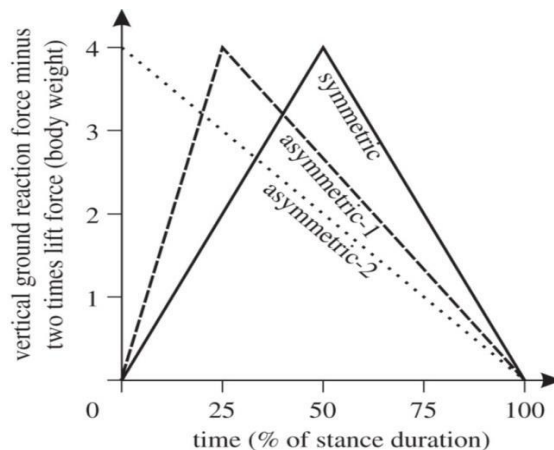
When a penalty-based contact is used, ANSYS adds a spring coefficient (k factor) when two surfaces come in contact with each other, in order to prevent penetration and to transfer load. However, penetration will occur in order to transfer force, which is not the case in reality. Therefore, the penalty-based methods are sensitive to the choice of the spring coefficient. The spring coefficient ANSYS uses during calculations is the product between the “normal stiffness factor” specified by the user and a reference factor calculated by the program. An additional aspect (apart from the accuracy) to consider when selecting the “normal stiffness factor” is the convergence behaviour. A stiffer contact will result in more calculation iterations, since bouncing might occur.



**Fig. 4.4 Contact Stiffness**

**Asymmetric Behaviour**

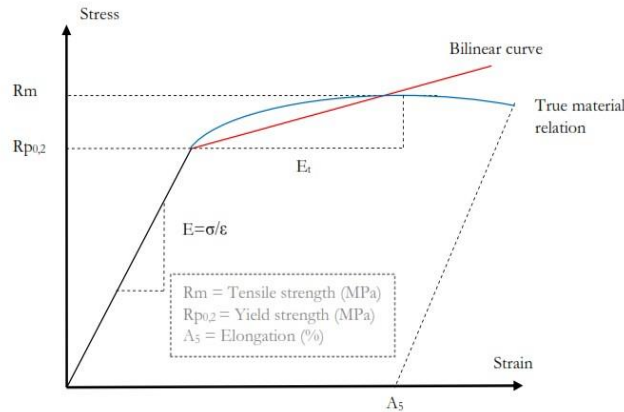
A contact condition can be either symmetric or asymmetric. When the contact condition is symmetric, none of the surfaces can penetrate each other, while when the contact is specified, as being asymmetric only one of the surfaces is prevented from penetrating the other i.e. the contact surface cannot penetrate the target surface but the opposite is possible. Figure illustrates the importance of selecting the correct contact pair.



**Fig. 4.5 Asymmetric behavior**

**Bilinear stress-strain curve**

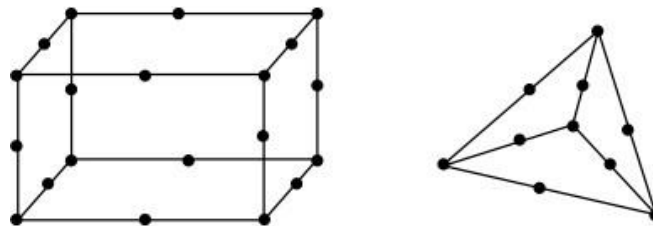
In context of the license version used, ANSYS tender a bilinear approximation of the stress-strain relationship as in figure. The bilinear stress-strain curve requires two input values, yield strength and tangent modulus. The yield strength is the value when plastics straining occurs and the tangent modulus is the slope of the stress-strain curve after yielding.



**Fig. 4.6 Relationship between Stress & strain, bilinear curve in Red & True Material Relation in blue**

**Method**

Method is a meshing control that provides the possibility to select different elements shapes. The different elements that are available are tetrahedron or quadrilateral. Tetrahedron elements are triangular pyramid like elements with 10 or 4 nodes and quadrilateral elements are cube elements with 20 or 8 nodes.



**Fig. 4.7 Method**

**Sizing**

Sizing is a meshing control that provides the possibility to mesh with different mesh densities at selected regions. By meshing fine in the area of interest and using coarse mesh in the remaining parts, one is able to reduce CPU time and memory usage. There are a couple of ways to select the region of a sizing control available in ANSYS. The region can be a surface. This will produce a fine mesh (or actually a mesh with the size specified) on the surface only. The region can also be an entire body, which will produce a fine mesh all over the body. If a contact region is to be analysed, ANSYS offers the possibility to specify the mesh size in the contact region and to capture a local behaviour it is possible to specify a so-called sphere of influence, which makes it possible to set the element size (mesh size) within the volume of a sphere. The sphere of influence can be used to enclose both faces and bodies.

**MATERIAL SELECTION**

The proper selection of material for the different part of a machine is the main objective. In the fabrication of machine. For a design engineer it is must that he be familiar with the effect, which the manufacturing process and heat treatment have on the properties of materials. The Choice of material for engineering purposes depends upon the following factors:

1. Availability of the materials
2. Suitability of materials for the working condition in service
3. The cost of materials
4. Physical and chemical properties of material
5. Mechanical properties of material



The mechanical properties of the metals are those, which are associated with the ability of the material to resist mechanical forces and load. We shall now discuss these properties as follows:

Strength	Elasticity
Stress	Plasticity
Stress	Ductility
Brittleness	Malleability
Toughness	Resilience

When a part is subjected to a constant stress at high temperature for long period, it will undergo a slow and permanent deformation called creep. This property is considered in designing internal combustion engines, boilers and turbines. **Hardness**

It is a very important property of the metals and has a wide verity of meanings. It embraces many different properties such as resistance to wear scratching, deformation etc. It also means the ability of the metal to cut another metal. The hardness is usually expressed in numbers, which are dependent on the method of making the test.

The hardness of a metal may be determined by the following test.

1. Brinell hardness test
2. Rockwell hardness test
3. Vickers hardness (also called diamond pyramid) test and
4. Share scaler o scope.

In engineering practice, the machine parts are subjected to various forces, which may be due to either one or more of the following:-The selection of the materials depends upon the various types of stresses that are set up during operation. The material selected should with stand it. Another criterion for selection of metal depends upon the type of load because a machine part resist load more easily than a live load and live load more easily than a shock load.

Selection of the material depends upon factor of safety, which in turn depends upon the following factors

1. Reliabilities of properties
2. Reliability of applied load
3. The certainty as to exact mode of failure
4. The extent of simplifying assumptions
5. The extent of localized
6. The extent of initial stresses set up during manufacturing
7. The extent loss of life if failure occurs
8. The extent of loss of property if failure occurs

#### IV. DESIGN

##### 1. Design of cylinder- VESSEL:

A container or structural envelope in which materials are processed, treated, or stored; for example, pressure vessel, reactor vessel, agitator vessel, and storage vessels (tanks).

##### PRESSURE VESSEL:

A metal container generally cylindrical or spheroid, capable of withstanding various loadings. **STRAIN:**

Any forced change in the dimensions of a body. A stretch is a tensile strain; a shortening is a compressive strain; an angular distortion is a shear strain. The word strain is commonly used to connote unit strain.

##### STRESS:

Internal force exerted by either of two adjacent parts of a body upon the other across an imagined plane of separation. When the forces are parallel to the plane, the stress is called shear stress; when the forces are normal to the plane the stress is called normal stress; when the normal stress is directed toward the part on which it acts is called compressive stress; when it is directed away from the part on which it acts it is called tensile stress.



#### STRESSES IN PRESSURE VESSEL:

Longitudinal S1 stress. Circumferential (hoop) S2 stress.

S1 and S2 called membrane (diaphragm) stress

For vessel having a figure of revolution bending stress shear stress discontinuity stress at an abrupt change in thickness or Shape of the vessel.

#### THERMAL STRESS:

There are many variables concerning the operation and construction of net gun. These factors include reservoir volume, the air pressure in the reservoir, and the ambient temperature. We will not be able to control the ambient temperature, but we will measure it. The main issue presented by the net gun is whether to manipulate the air pressure or the volume of the cylinder. However, due to the constraints of glue, pressure is much easier to manipulate than building different reservoir cylinders. Reference standard suggests higher barrel ratios of 4:1 or 5:1 reservoir volume to barrel length.

So we select the pvc scheduled 40 pipe.

Types of  
cylinder-

Thin

cylinder

( $d_i/t > 20$ )

Thick cylinder ( $d_i/t \leq 20$ )

1. Internal diameter  
( $d_i$ )=50.8mm  
Thickness (t)  
=3.9116mm

$$d_i/t = 12.98 < 20$$

So the cylinder is thick.

1. Difference in analysis of thin and thick cylinders:

The analyses of thick cylinders are differs from that of thin cylinders in following ways:

In thin cylinders it is assumed that, the circumferential stress is uniformly distributed over the cylinder wall thickness.

In thick cylinders, the circumferential stress is not uniformly distributed over the cylinder wall thickness.

In thin cylinders, the radial stress is very small, and hence is neglected. In thick cylinders, the radial stress is of significant magnitude, and hence cannot be neglected.

Stresses in thick cylinders subjected to internal and external pressures Circumferential stress/tangential stress,  $\sigma_t$

Radial stress, or Longitudinal/axial stress,  $\sigma_l$



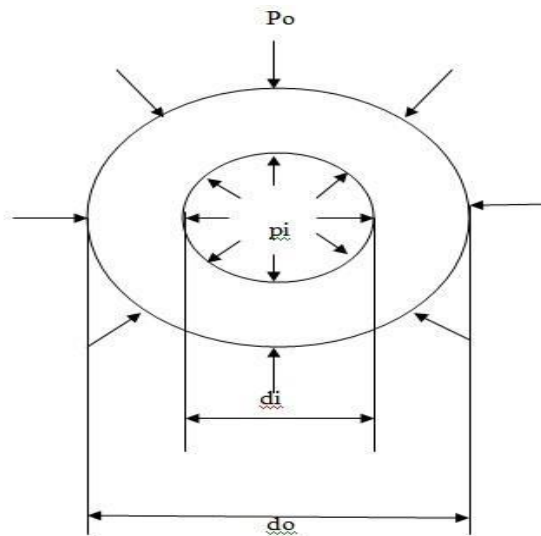


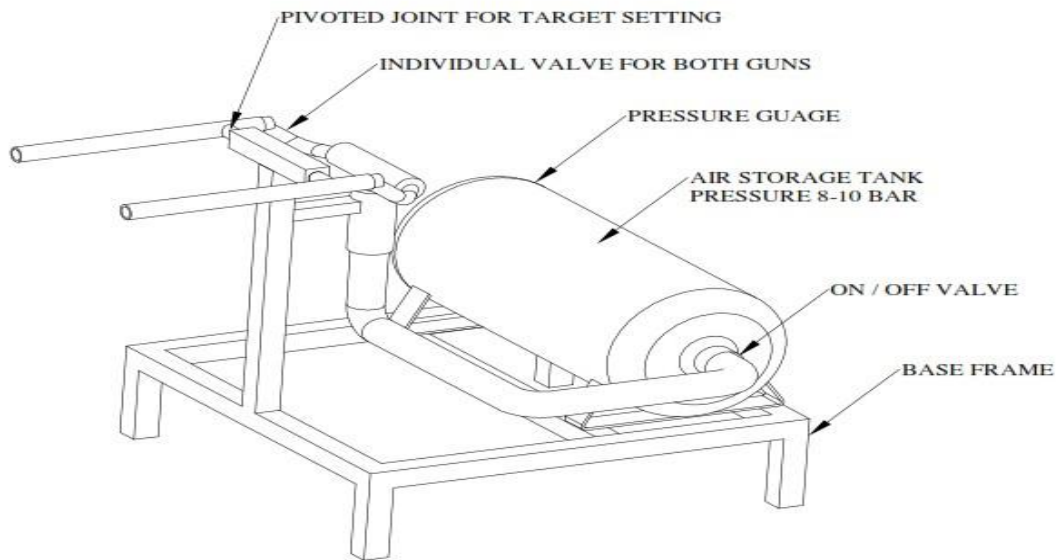
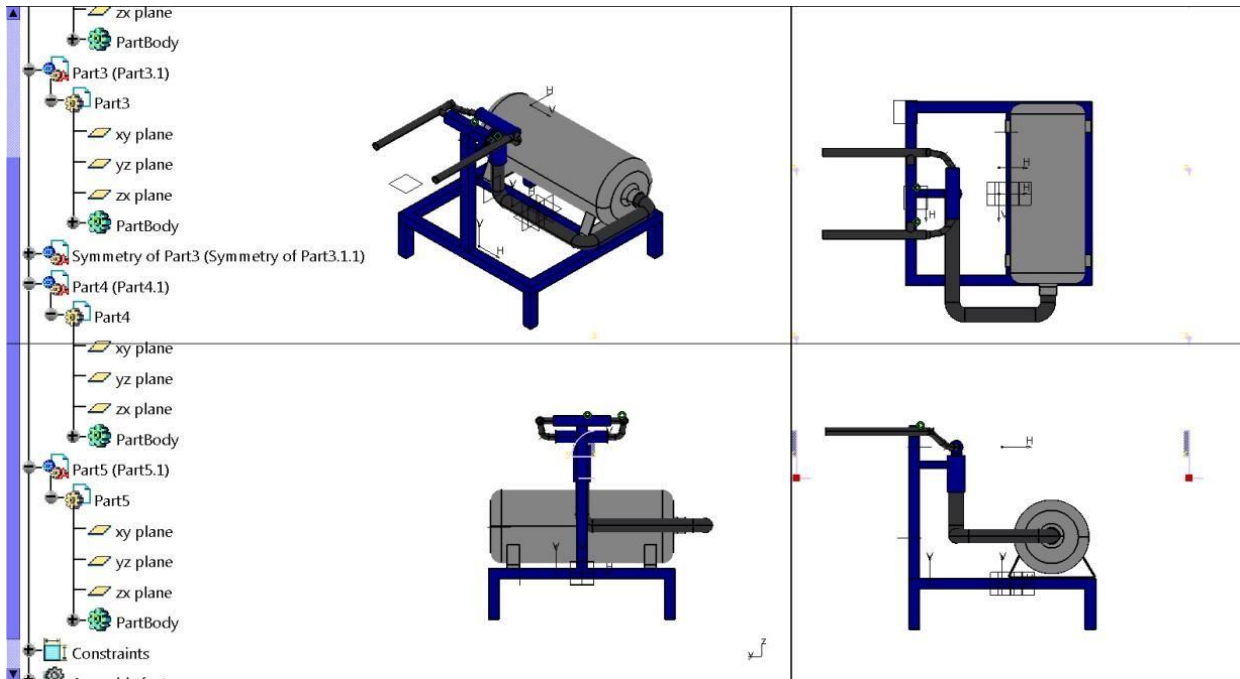
Figure 1-Stresses acting on cylinder

Sr no.	Principal Stress	At inner surface(Mpa)
1	Tangential stress	4.11
2	Radial stress	-0.7
3	Longitudinal stress	1.7066

**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.

**CAD DESIGN :**



**Schematic Block Diagram :**

**V. RESULTS AND DISCUSSION**

The Solar Powered Air Gun is an innovative weapon which can be a good replacement for the guns and missiles used just for warning the enemy from entering in our territory. This gun can also be used by forest department for capturing animals as this can be safe than using rifles or other methods. This is very simple and easy to use and can be carried from one place to other easily. This gun has zero negative chemical impact on human or animals.



## VI. CONCLUSION

It's the best and safest way to capture an animal without causing any harm to it or to the capturer handling the gun. The idea was to investigate the three proposed realms of legitimacy as they relate to drone killings across international borders, a design that does not necessarily point in the direction of policy solutions. By peering through the lenses of legality, morality, and efficacy a series of worthwhile views into the legitimacy of drones could be offered to enhance the public understanding of an issue that is only growing in importance. This indebted editor believes that the contributing authors have done precisely this. Unexpectedly, this book project also advanced in a manner that has produced a keen policy proposal meant to integrate these three basic tenants of legitimacy.

## VII. FUTURE SCOPE

- The use of muffler may reduce the sound intensity of air gun.
- By reducing the sound intensity the animal can easily capture.
- The use of sensors will increase the accuracy of capturing pray.
- By use of motion sensors it is easy to capture animal.
- Attaching some locking mechanism for trigger.
- By attaching locking mechanism, the misuse of air gun can be avoided.
- Use of multi-cylinder.
- Currently air gun is designed for only one shot. The shot can be increased by using multi-cylinder attachment. The same mechanism use for air holder.

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