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Animal Net Gun Using Pneumatics

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Abstract*: The below research on product development and manufacturing of the animal net gun involves analysis of the product and testing of its power for particular air pressures. The successful completion of project aims towards a cost effective and safe measure to rehabilitate animals, as well as it helps law reinforcement and agriculturists to safeguard their interest without harming the user.*

Keywords*: Animal net gun, capturing animals, net gun analysis, hoop stress analysis*

1. Introduction

In modern world the severity of population has directly affected the wild life. The adverse effect of deforestation is affecting the whole population of the country such as. Frequent attacks on civilians by wild creatures are reported every day in large numbers. We cannot stop these attacks until we stop crouching up their lands, that's a far long case, but we can safely is rehabilitate them , globally we use tranquilizers and other inefficient traps to capture animals. But the over dose of tranquilizers can kill them and the dizziness might cause them to drown in a river or fall of from the cliff.

Trapping of animals may hurt those fuzzy, furry, cuddly creatures, birds and wild animals. In some cases live trapping may cause worse than killing an animal.

In trapping we are using conventional live traps such as steel and snap traps, Leg snares, Box traps, Corral Traps, and the modern traps such as Oral drugs or by using a tranquilizer gun. The above methods may cause the death of animal due to over dose of the medicines or tranquilizing agents[1]

This project mainly aims towards proper management of wildlife. Here the method of launching of the net is done pneumatically. Hence it is cleaner, safer and cost efficient compared to the other capturing equipment. It can also be used by agriculturalists and law reinforcement to capture their culprits without harming them.

2. Methodology

2.1 General Idea:

This four barreled pneumatically powered Net-gun is very simple in its design and operation. This air-charged Net-gun is an equipment having air as the working fluid. The successful completion of this project fulfills a gap both domestically and internationally for the Shooting of Net with air as the driving power.

The working of the net-gun is explained by simple physics. Each of the barrels is adapted to receive a projectile; simple kinematics involved will be explained in this chapter. The other components used are pic-microcontroller for accurate actuation of gun, a solenoid valve is used which is powered by a battery, a net holder is another important part and a pneumatic compressor. In this chapter, part Specifications, various assumptions made and various tools used with their specification in detail will be explained.

2.2 Physics Involved:

The launching of the net is better explained by two-dimensional motion in a plane or a projectile. In the projectile motion, the body is launched obliquely i.e. at a certain angle with horizontal. It is given certain initial velocity and it moves in a curved path. Its motion is studied by implying equations of motion in two dimensions. The only acceleration involved in the projectile motion is acceleration due to gravity (g) which acts vertically downwards. It is very interesting when we observe the nature of acceleration as during first half of the motion it decreases the vertical velocity and increases in remaining half and if the point of projection and termination of the projectile are on the same horizontal line then the initial and final velocities are same in magnitude. The important assumptions made in this case are body remains closer to the surface of earth; air resistance is negligible and the value of acceleration due to gravity(g) equals to (g=9.81m/sec2) and remains constant throughout the

motion. It is important to note that the horizontal component of initial velocity remains constant during the motion because there is no horizontal acceleration[2].

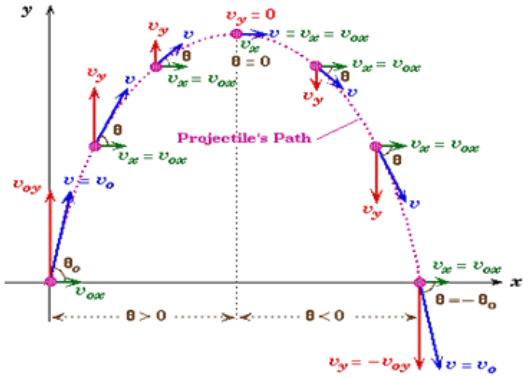

Fig1-Projectile Motion[

2.3 Working Principle:

In this project we are using a compressor and an actuator connected to the microcontroller as shown in the block diagram below. When the user presses the trigger, the micro controller will read the data and then will activate the relay and the same will be displayed on the LCD. The relay actuates the solenoid valve and the burst of pressure gets into the Net Gun. The pressurized air then enters into the manifold where air is divided into 4 ways and passed to the barrels in which the counter weights are placed. Due to this action the weights are ejected in the prescribed path which in turn opens the net. This will then net target to be trapped at that moment.

The lightweight net is made from durable nylon that flies farther, faster than any other material. Each of the net's four corners are carried by a nylon weights which when fired opens the net to a parachute-like trap.

The recoil is moderate to heavy depending on the load or application. These Net-Guns are modified to prevent the loading of a normal, bulleted cartridge.

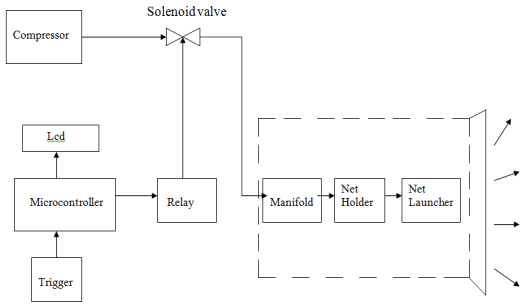

Figure 2: Flow chart for the simple working procedure

3. Result Analysis

3.1 Calculation Of Hoop Stress In the Barrels For 10 bar Pressure:

Ri = 0.01855 m (inner radius)
Ro= 0.0212 m (outer radius)
Px = 106 N/m2 (maximum pressure)

$P = (b \div x^2) - a$ (1)

Here in (1) P denotes the pressure at inner or outer surface of the barrel. x represents the inner or outer radius for different boundary conditions. a and b are constants to require to find hoop stress.

Considering Boundary Condition;

1. for inner surface

$P = (b \div x^2) - a$
At x=Ri = 0.01855 m Px =Po=106N/m2
$106 = (b/0.018552) - a$ (2)

2. for outer surface
At X= Ro = 0.0212 m Px = 0;

$0 = (b/0.02122) - a$ (3)
Subtracting (2) By (1)
$106 = (b/0.018552) - (b/0.02122)$
b = 1468.17 N
Substitute the Value of b in (2)
a =(1468.17/0.02122)
a = 32.67*105 N/m²

maximum and minimum hoop stress (σ)
$\sigma = (b \div x^2) + a$ (4)
At x = 0.01855,
$\sigma max = (1468.17/0.018552) + 32.67*105$
$\sigma max = 7.53$ MN/m2
At x =0.0212
$\sigma min = (1468.17/0.02122) + 32.67*105$
$\sigma min = 6.53$ MN/m2
Yield Stress of Mild Stress = 250 MN/m2.

Supposition:-The above calculation shows the minimum and maximum hoop stress generated in the barrels of the animal net gun. The material used in the net gun barrel is mild steel with a yield stress of 250 MN/m², which is much higher than the hoop stress generated in it(6.53 to 7.53 MN/m2)so the system is safe.

3.2 Power Calculation for given pressure:

F=P*A (5)

Here in (5) F represents the force on the bush which is calculated by multiplying pressure(P) with the area of the bush(A)

W=F*S (6)

Here in (6) W represents the work done by the net gun which is calculated by multiplying Force(F) and distance traveled by the net(S)

P°=W/T (7)

Here in (7) P° represents the power generated by the net gun which is calculated based on the work done(W) against the time take for that work(T)

Area of the Bush=A= π*(0.01855)²;
A=1.081*10-3m²
Radius=0.01855m

SL NO	DESCRIPTION	FORCE	WORK	POWER
1	At P=2*10^5 N/m² S=3.5m	F=P*A F=[2*10^5(1.081*10^{-3})] **F=216.2 N**	W=F*S W= [(216.2)*(3.5)] **W=756.7 Nm**	P°=W/T P°=(756.7÷2) **P°=378.35 W**
2	At P=3*10^5 N/m² S=5m	F=P*A F=[3*10^5(1.081*10^{-3})] F=324.3 N	W=F*S W= [(324.3)*(5)] **W=1621.5 Nm**	P°=W/T P°=(1621.5 ÷2) **P°=810.75 W**
3	At P=4*10^5 N/m² S=6.5m	F=P*A F=[4*10^5(1.081*10^{-3})] **F=432.4 N**	W=F*S W= [(432.4)*(6.5)] **W=2810.6 Nm**	P°=W/T P°=(2810.6 ÷2) **P°=1405.3 W**

Table. contains power calculation for given pressure

4. Conclusion

There is a need of effective equipment for the safe capture and rehabilitation of the endangered species which is an at most important aspect in the conservation of environment. Our project's objective is to full fill the defects of earlier used equipment like snares, tranquillizers etc. at an economical and safer rate.

In this equipment pneumatic technology is used for its silent operation and for its faster response. A solenoid control value controlled by a pic micro controller allows compressed air to flow towards ¼ manifolds from a pneumatic compressor. That air is then passed to four barrels through manifold by which the net is launched.

For the safety of animals and human beings there should be profound and safe trapping equipment, which should have wide range of application. By considering all the characteristics of net gun it satisfies the required conditions.

From the result analysis it is known that the net can travel up to 8m which gives an advantage to the shooter to catch the prey from safer distance.

Pic1:Complete set up of animal net gun

Nomenclature

F : Force on the bush (counter weight)
P : Pressure at which the gun is activated
A : Area of the bush (counter weight)
D : Diameter of a bush (counter weight)
S : Distance travelled by net for given pressure
T : Time taken
W: WORK done by the gun
P°:power of the gun for given pressure
R_i: Inner radius of the barrel
R_o: Outer radius of the barrel
Px: maximum pressure inside the barrel surface
σ: Hoop stress
σ_{max}: Maximum Hoop stress
σ_{min}: Minimum Hoop stress

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