Design and fabrication of Sensor Operated Electromagnetic Clutch and Braking System

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***Abstract* - It is evident that these days, the Pneumatic Operations Technology is associated with the work related to compressed air. It has become a pressing priority for the engineers to have sound knowledge in pneumatic systems. To accomplish maximum work done of the Pneumatic systems, it is principal to maintain low pressure drop between the generated and consumed compressed air. The Pneumatic clutches and brakes incorporate sensors along with IR Transmitter, Receiver and Control Unit. The Pneumatic braking electromagnet the clutch system is utilized for vehicle braking.**

***Index Terms* - Pneumatic System, Clutch, Brake**

I.INTRODUCTION

The reduction of speed and the halting the motion is an important factor to be considered while designing a vehicle. The widely used methodology is the mechanical braking system. The utilization of the friction mechanism between two contacting surfaces by rubbing against each other contributes a major share in converting of the kinetic state to the static state with the escalation of certain amount of heat. The mechanism used in this project involves the Pneumatic Braking coupled with an electromagnetic clutch. The renowned eddy current brake finds application in the magnetic fields in order to transform the dynamic energy into electric current inside the braking unit. The eddy current type of brakes yields better efficiency and consumes minimal amount of power. Brakes are not subjected to any particular surfaces. They find their usage in surfaces containing flowing fluids. In this project, the eddy current plays an important role to make the braking action effective.

II.LITERATURE REVIEW

The first reverse alert system was proposed by the Surveillance Guard Corporation. It is the initial aftermarket automatic braking system that was fitted to a vehicle. The process begins with a stream of supersonic sensors that was contoured at the rear part of the vehicle. These sensors sight the AN type objects, once a sign is been shipped to the magnet that is available at the front part of the vehicle. The co-ordination is connected to a super versatile cable that pipes its way through the firewall and is fitted to a universal pedal clamp. Once, the magnet is set in motion, this will immediately pull the pedal, causing the vehicle to stop instantly.

The reverse alert technology, that was discussed above was initially installed on the following vehicles.

- Two ford ranger light commercial vehicles (1 x1.6m and 1 x2.5m systems)
- Two hino trucks (both equipped with the 1.6m system)- EWP and line truck.

The popular Anti -Lock Braking System (ABS) supports the rider to experience a hassle -free ride in muddy and watery surfaces. The main reason behind this experience is the incorporation of the distributed braking technology. It prevents the skidding and protects the wheel. In 1998, BMW sold the electronic hydraulic motorcycles for the first time. The paramount merchandise of motorcycle with the Automatic Braking System was the Honda ST equipped optionally with an electro-hydro Automatic Braking System Moule back in 1992.

With feature of Automatic Braking System built, the vehicle rider in terms of rear or front wheel will tend to lock up if the respective brakes are being applied. Considering a Combined Braking System (CBS), it distributes the brake force uniformly in addition to the

non-braked wheel. This action helps to lower the likelihood of a lock-up, increases the speed and notch back the suspension pitch.
Volvo is all set to launch a new XC60 SUV, that can support optical braking, which can be capable of sensing a collision up to 50 mph and application of brakes mechanically.

III.DESIGN AND CALCULATIONS

Components used:

- Wheel: 30cm radius
- Pneumatic Cylinder: Double Acting Type
- Disk: 26cm diameter
- Solenoid valve:

Size- 5/2”
Pressure- 0 to 7kgf/cm2
Voltage: 12V A.C
Frequency:50Hz

- 555 IC timer circuit.
- IR Sensor Unit
- Electromagnet
- Relay Frame
- DC gear box motor
- 12V Drive Motor
- Sprocket

Selection of Sprocket:
Large sprocket = 4x
Small sprocket = x
Ratio of the sprocket = 1:4
Speed of the sprocket
N4 = 1.01 X 4
N4 = 4.04 rps

Design of Shaft:
The shaft may be designed on the basis of strength & rigidity
Shaft subjected to twisting moment or torque only
Where the shaft is subjected to poor twisting moment then
diameter of Shaft.
T/J = τ/R
T = Twisting moment or torque acting upon the shaft.
J = Polar moment of inertia of cross- sectional area about
the access of rotation in mm4
τ = Torsion shear stress NI mm2 or KNI mm2
R = Distance from neutral axis to the outer most layer mm
or M

For solid shaft required torque is,
T = ∏ /16 τ d3
D = diameter of the shaft for hollow shaft
T = ∏ /16 τ (d4 0 - d4 I)/ d0
D0 = outer diameter
Di= Inner diameter

Shaft Subjected to Bending Moment:
Maximum stress is given in bending equation M/I = fb / Y
M = Bending moment in N-M or N-mm
T = Moment of inertia of cross -sectional area about its axis
of rotation in mm
f b` = Bending stress in N/mm2 or KN/mm2
Y = Distance from neutral axis to the outer most layer

For solid shaft (M) = ∏ / 32 x fb x d3
d = diameter of the shaft
For hollow shaft (M) = ∏ / 32 x fb x (1-k4) x
Do = outer diameter
K = ratio of diameter = d1/d0

The following two theories are important from the subject point of view.

- Maximum shear stress theory:

τ (max) = 1 /2 (f h 2+4fs 2).5
T0 = (M2+T2= ∏ /16x τ d3).5

- Maximum normal stress theory:

Me=l/2(M + VM2+T2)
Me =n/32xfbxd3
Shaft subjected to axial load in addition to combined to torsion and bending loads:
Me =∏/32 x fb x (l-k4) x do3

Design of Shafts on The Basis of Rigidity:

- Torsional Rigidity:

The torsional deflection may be obtained by using the
T/J = G9 /L.
Ø = TL/JG
Ø = Torsional deflection or angle of twist in radians
T = twisting moment or torque on the shaft
J = polar moment of inertia of the cross- sectional area

about the Axis of rotation.
= ∏/32d4 for solid shaft.
= ∏ /32(d40 -d4) for hollow shaft.
G = Modulus of rigidity for the shaft material.

• Lateral Rigidity:
d2y/dx2= M/ EI.

IV.ANALYSIS

Design model of the system

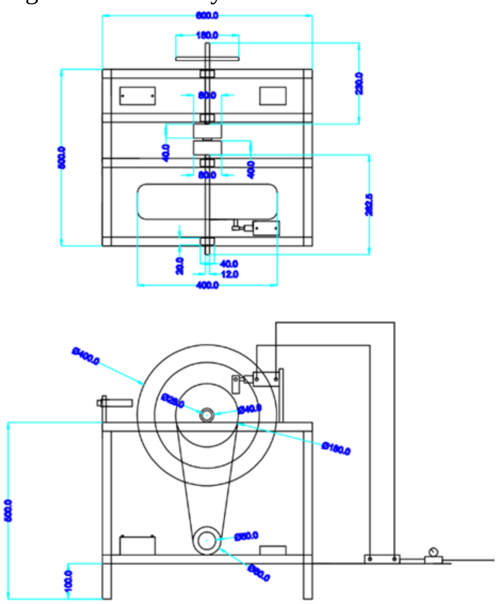

Fig 1. Design Model

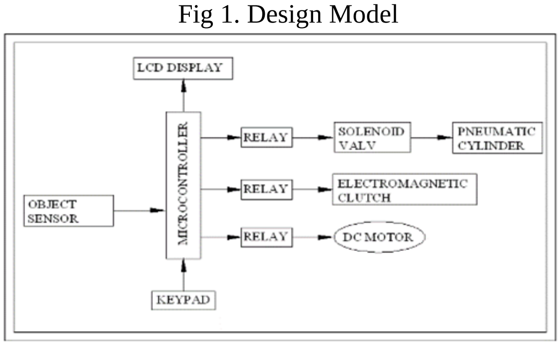

Fig 2. Controller setup

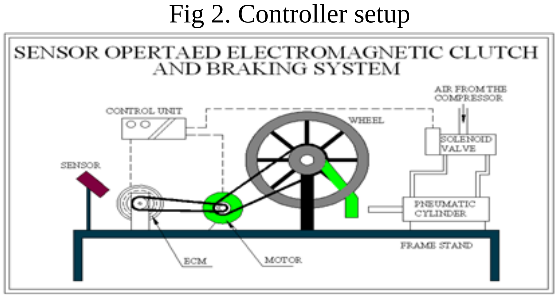

Fig.3 Structure of the Project

Fig.4 Fabricated Model

V.CONCLUSION

The Electromagnetic brakes are widely utilized as a subsidiary retardation equipment besides the regular friction of the brakes. This extraordinary braking system assists in effective braking and drastically reducing the accidents rate. Moreover, the electromagnetic brakes intercept the danger that make an appearance from the continual usage of brake beyond their capability to dissipate heat. These brakes can be incorporated in wet weather conditions to eliminate the circumstances like skidding.

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