Pneumatic Hand Brake System

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Abstract- *In this project we studied that in a ground vehicle, mechanical parking brake (Hand brake) unit is a mechanism that used to hold the vehicle motionless either on the even or gradient road. It consists of a directly linked to the brake mechanism on one end and to a mechanism that can be motivated by the driver on the other end. This actuating mechanism is often a hand operated lever on the base on either side of the driver, or a pull handle located below and close the steering wheel column or a (foot-operated) located far separately from the other pedals. In order to confirm that a vehicle remains stationary when it is parked at a certain road slope, the driver has to apply adequate dragging force on the handbrake lever. This could be achieved by using pneumatic setup along with handbrake The main benefit of this system is that traveler /driver safety, if we don't use seatbelt the vehicle handbrake dose not removes for safety.*

Keywords- Handbrake, Actuators, Solenoid Switch, Master Cylinder

I. INTRODUCTION

"Pneumatic breaking system" is nothing but one of the breaking systems in automobile at the time of vehicle is in running condition. In this breaking system motorized operated one. In this project, the control unit is received the signal from the switch. The switch is used to apply the break while vehicle is in running condition. The microcontroller controls the position of the solenoid valve. The main purpose of this project is to confirm drivers safety through a improved handbrake in car .`A handbrake is an added braking mechanism mounted on all commercial vehicles that's completely distinct from foot pedal -operated In cars the parking brake, also called hand brake, alternative brake, or brake, is a latching brake, usually used to keep the vehicle motionless. Most commonly used to avoid the vehicle from rolling when it is parked.

II. LITERARURE SURVEY

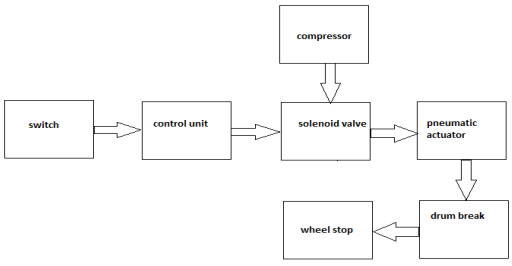
Sandeep Thorat[1]: Vehicle technology has increased rapidly in recent years, particularly in relation to braking systems and sensing systems. ASS (active safety systems) are being researched and developed to prevent accidents and target mitigation. Among many useful active safety systems, it has been reported that AEBS (Advanced Emergency Braking Systems) effectively prevents accidents and reduces casualties simultaneously. The project aims to distinguish between systems currently in production like traction control (TC), electronic brake force distribution (EBD), brake assist (BA) and electronic stability control (ESC) functions and future systems that are currently in development.

Sachin S. Dharia[2]: Now a day's automatic hand brake release mechanism has been replacing the manual hand brake release mechanism. This has taken up an additional use in control of the vehicle by no initiating a rear-wheel skid. The automatic hand brake release mechanism is one of the most effective hand braking system over the conventional systems. This type of mechanism provides totally lever-less operation which saves the effort as well as the space utilization of the vehicle. Generally the hand brake is manually operated whereas in our project work, we have developed an automatic handbrake release mechanism for safety purpose.

Ugale V. J.[3]: Mechanical parking brake (Hand brake) unit is a mechanism that used to hold the vehicle motionless either on the even or gradient road. It consists of a directly linked to the brake mechanism on one end and to a mechanism that can be motivated by the driver on the other end. This actuating mechanism is often a hand operated lever on the base on either side of the driver, or a pull handle located below and close the steering wheel column or a (foot-operated) located far separately from the other pedals.

III. SYSTEM DESCRIPTION

BLOCK DIAGRAM



Working -

Vehicle is in running condition.

When switch is ON it activate the electronics circuit will make the solenoid valve in ON condition.

Compressed air will be passed through the solenoid valve and pneumatic cylinder will activate and the piston will move in forward direction.

When piston will move in forward direction it act force on the drum break and break will apply to running vehicle and vehicle will stop.

Design calculation

1. Selection Of Actuator

From research it has been found that to hold vehicle stationary at 11 degree slope it requires about 200 N force.

So for selection of actuator for 200N force is by using 'Granta Chart'.

From standard chart bore dia. Is 32mm & stroke length is 100mm selected.

R = 16mm, $A_1 = 804.25$ mm sq.
R = 6mm, $A_2 = 113.04$ mm sq.
Hence A=A1-A2
=804.25 - 113.04
=691.21 mm sq.

Force =minimum pressure is 3 bar but we have to take 4 bar for test the pneumatic cylinder

F =0.4 * 691.21 mm sq. =276.484 N
Then the minimum pressure taken as 3 bar and the force is 207.363 N

Pneumatic cylinder is of 32 bore and 100 stroke.

2. Base frame design

WE design a basic frame for a prototype by mild steel channel (L beam),

L Channel- MS Angles are L-shaped structural steel represented by dimension of sides & thickness. For e.g. 25x25x3 means, both the sides of angles are 25mm & thickness is of 3mm. There are various sizes of angles which are as follows :-(there are also equal & unequal angles). Equal angles: - They are angles having both the sides of equal dimensions. For e.g. refer below given diagram, in which both the sides are of dimensions "a"

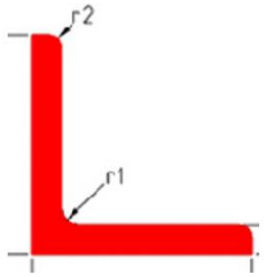
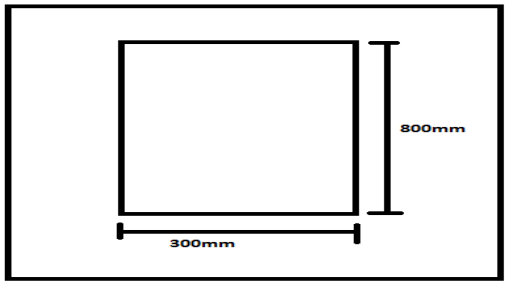


Fig.16 L-angle bar dimensions



$\frac{M}{I} = \frac{\sigma b}{y}$ ……(1)

Bending moment(M)=force *perpendicular distance

M=4*400*9.81

Bending moment(M)=19620 N-mm

$I = \frac{(b(h^3))}{12}$

$I = \frac{(25(25^3))}{12}$

I=32552.08 mm^4

$Y = \frac{25}{2}$

Y=12.5

Therefore above value use in equation no(1)

$\frac{19620}{32552.08} = \frac{\sigma_b}{12.5}$

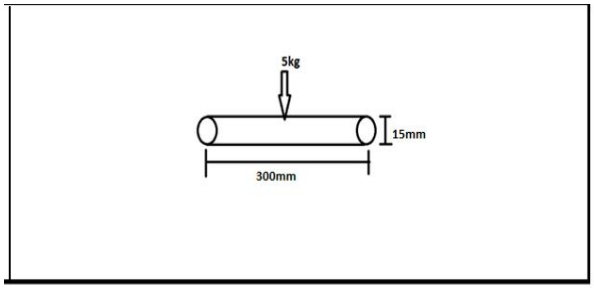
Therefore,

σ_b=7.53 N-mm

7.53<105

Hence design is safe.

3. Design of shaft:



$$\frac{M}{I} = \frac{\sigma_b}{y} \quad \text{.....(1)}$$

Bending moment=force*perpendicular distance

$$I = \frac{\pi}{64} * d^4$$

Bending moment=5*9.81*300/2

M=7357.5 N-mm

For diameter 15mm,

$$I = \frac{\pi}{64} * d^4$$

$$I = \frac{\pi}{64} * 15^4$$

I=2485.7 mm^4

Therefore,

$$\frac{11036.25}{2485.7} = \frac{\sigma_b}{7.5}$$

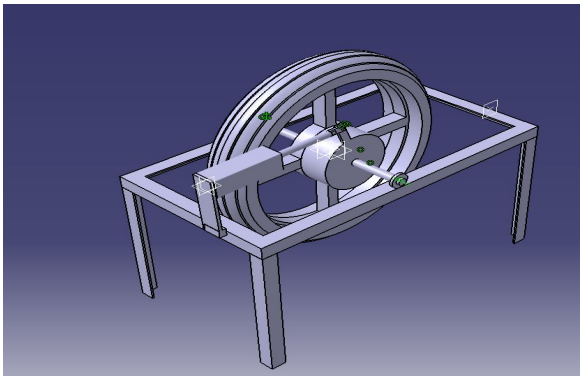
σ_b =8.87*7.5

σ_b =22.2N-mm

22.2<105 N-mm

Therefore, design is safe

Software design:



IV. ADVANTAGES AND APPLICATION

ADVANTGES

- Free from wear adjustment.
- Reduce the manual work.
- Less skill technicians is sufficient to operate.
- Installation is simplified very much.

APPLICATION

It is used for hand brake of commercial vehicles like Car, Buses & Trucks automation system.

V. CONCLUSION AND FUTURE WORK

Automatic hand brake release mechanism using pneumatic system is beneficial for operator's safety by reducing accident chances.

This system can also be used in commercial cars for ease of operating as well for reducing cost purpose.

The working is quite simple and doesn't require any extra effort to operator or driver.

It can be used to automate overall braking system in an automobile and can be developed to operate these brakes remotely using a remote key or a smart phone.

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