

DESIGN AND FABRICATION OF SEAT BELT ACTIVATED HAND BREAK

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ABSTRACT

Seat belt is implemented in car to ensure drivers safety. The increase in number of loss of life in accidents is due to driver's negligence to wear seat belt though it is strictly enforced by law. The aim of our paper is to make seat belt wearing compulsory for vehicle propulsion. We can achieve it by using pneumatic setup along with handbrake. The modification to be done ensures that the driver wears seat belt during driving. Here the seat belt of the car activates the hand brake (parking brake) through a pneumatic cylinder. When the seat belt activates the push button type DC valve an outward stroke is been obtained in the pneumatic cylinder through an air compressor which is used to release the hand brake. Similarly, during the retracing stroke of the piston the hand brake is been engaged.

Keywords: Seat belt, hand break, pneumatic setup, safety, sensor.

INTRODUCTION

The main purpose of this project is to ensure the drivers safety through a modified handbrake in car. A handbrake is an additional braking mechanism installed on all commercial vehicles that's completely separate from foot pedal-operated in cars the parking brake, also called hand brake, emergency brake, or brake, is a latching brake, usually used to keep the vehicle stationary. Most commonly used to prevent the vehicle from rolling when it is parked. Automobile hand brakes consist of a cable directly connected to the brake mechanism on one end and to a lever at the driver's position. The emergency brake is instead intended for use in case of mechanical failure, where the regular footbrake is inoperable or compromised, hopefully with opportunity to apply the brake in a controlled manner to bring the vehicle to a safe. Brakes are one of the most important safety systems in a motor vehicle.

The main function of brake system is to decelerate the vehicle, to maintain the vehicle's speed during downhill operation and finally to park the vehicle stationary either on a flat or slope road condition. The first two functions are related to the service brakes, while the last function is referred to the secondary or parking brakes.

Using your handbrake to stop a moving car can damage the brake system. Pneumatics is a section of technology that deals with the study and application of pressurized gas to produce mechanical motion.

Pneumatic systems that are used extensively in industry and factories are commonly plumbed with compressed air or compressed inert gases.

When the car ignition starts, then the hand brake is released automatically by the help of gear mechanism and the brakes are released from rear wheels and car can move easily. When the car ignition stops, then the hand brake is latched automatically by the help gear mechanism and the bakes lock the rear wheels and the car will be in station. We use gear mechanism and locking mechanism to operate the hand brake for latching and to release the hand brake. The hand brakes are interconnected to the rear wheel brake which locks the car to avoid rolling or slipping on the road. The hand brake lever is fixed to car chassis with the help of the fasteners or with the help of fabrication. Assembling the gear mechanism to the handbrake lever and the gear mechanism is engaged to dc gear motor. Control board is use to control the lift and down the handbrake lever to a certain degree of angle.

PROBLEM STATEMENT

- In conventional parking brake actuation involves the human interference. Without pulling or pushing the lever, the parking brake will not work. Also, sometimes due to negligence or in emergency conditions, we humans often forget to apply parking brakes. This may lead to rolling of vehicle in case of slopes and collision with other vehicles in parking area. Without pulling or pushing the lever, the parking brake will not work. Also, sometimes due to negligence or in emergency conditions, we humans often forget to apply parking brakes.
- This may lead to rolling of vehicle in case of slopes and collision with other vehicles in parking area. Sometimes if service brake fails parking brakes are used as a emergency brake to stop the vehicle

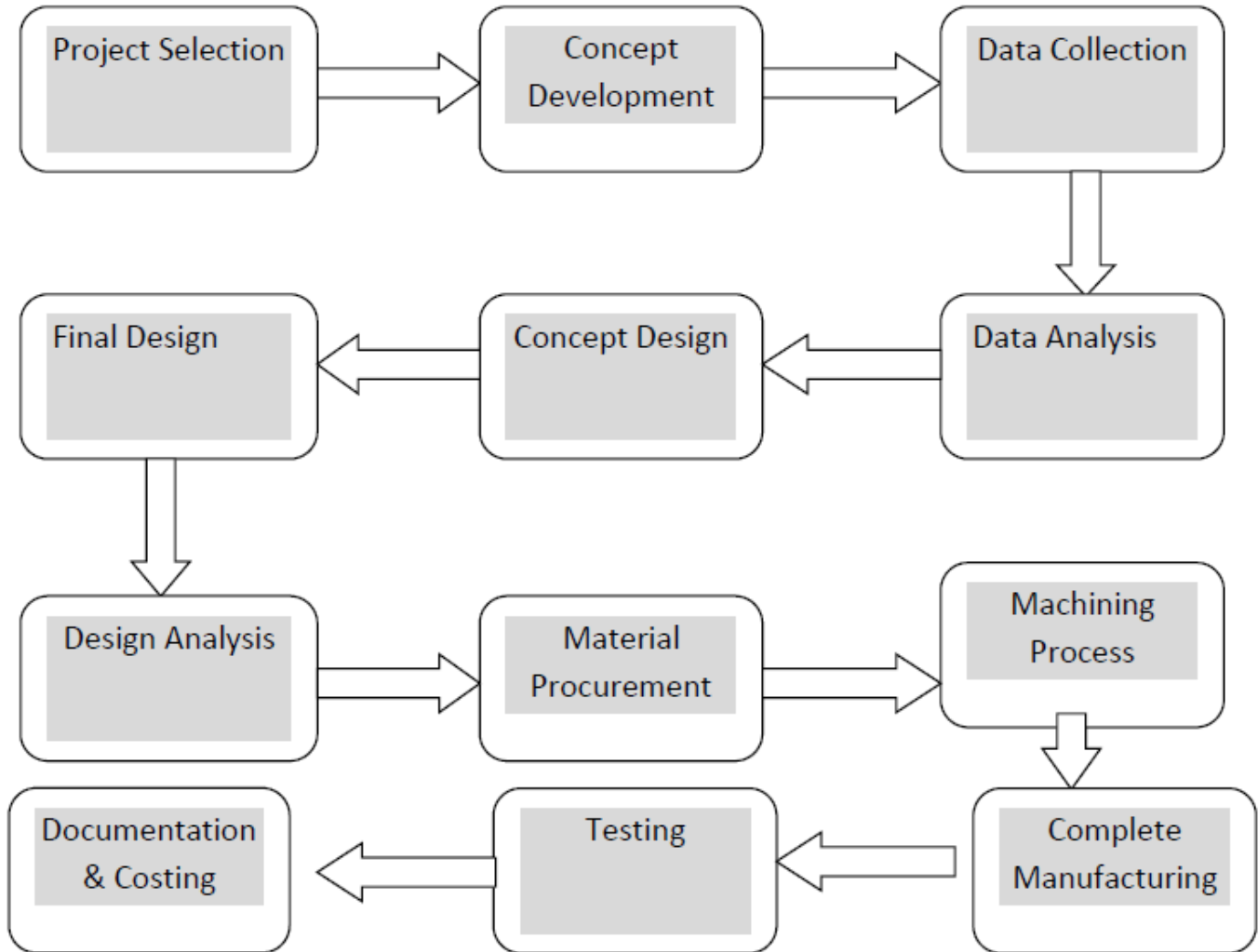
OBJECTIVE

- 1) To reduce the extra efforts during operation of handbrake at the time of starting of vehicle braking system.
- 2) To maintain the accuracy in hand brake operation in case of hand brake is not completely remove or lock in case of emergency braking system operation.
- 3) To develop automation unit in automobile emergency braking system, so that m/c can easily be adopted in today's automated braking system in vehicle.
- 4) This type of braking system provides work practically at low cost, low maintenance, low capital investment in less space in same system in place of conventional handbrake.
- 5) To perform the most rigid operation with safe braking system at the time of starting & stopping of vehicle.
- 6) The main benefit of this system is that passenger/driver safety, if you don't use seatbelt the vehicle handbrake dose not remove for safety.

SCOPE

We developed just a model of the pneumatic hand brake. In this we have used piston-cylinders and pneumatic control with required specifications. But if we want to develop a actual brake that is to be used in the car, we can use the piston-cylinders and pneumatic controls with higher stroke and capacity to increase the efficiency of the braking system.

METHODOLOGY



CONSTRUCTION

- 1) **Frame:** The frame is of MS material. The frame of our machine is mainly used to support the pneumatic components fixed on it.
- 2) **Double acting cylinders:** Cylinders are linear actuators which transform fluid power into mechanical power.



- 3) **Pneumatic pipe fittings :** Pneumatic tubing is also available in a number of other materials both with and without reinforcement for use in standard .



Fig.3.2. Pneumatic hoses and fittings.

4) Hand Brake Set



Fig.3.3. Hand brake set.

5) Seat Belt and Clamp Lock



Fig.3.4. Seat & belt lock.

6) Solenoid type 5/2 dc valve: A valve is a device that controls the flow of fluid (gases, liquids, fluidized solids or slurries) by opening and closing or partly obstructing passage ways

7) Timer with relay board: The repeat cycle timer was recognized to control solenoid valves or other modules that require intervallic energization.

WORKING

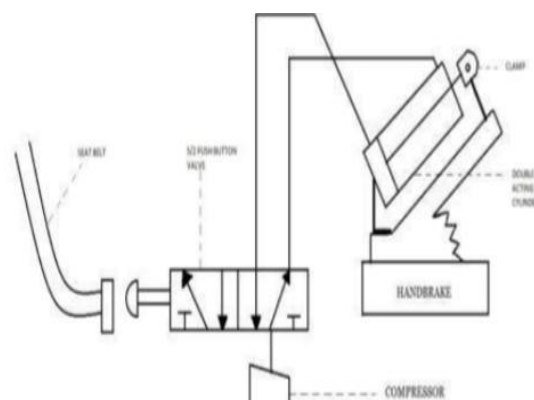


Fig4. General Layout of seatbelt activated hand brake.

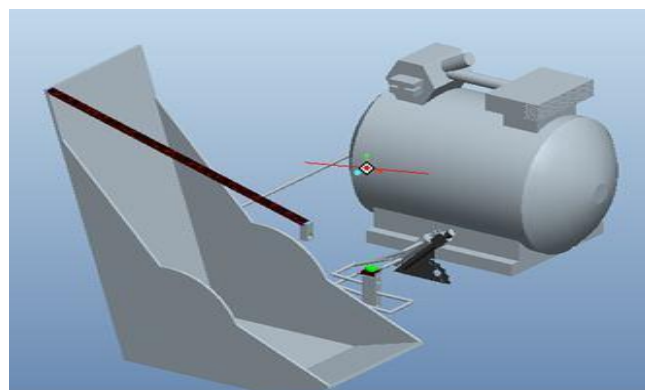
The inlet port of the 5/2 pneumatic Solenoid valve is been connected to the compressor, The 5/2 valve is been integrated within the seat belt locket in such a way that the seat belt end activates the push button, Double acting cylinder is been clamped along the body of the hand brake. The end of the piston rod is bolted with the clamp connecting with the hand brake A Solenoid valve type pneumatic valve is being integrated

within a seat belt locket. When the seat belt is been locked it activates the Solenoid valve. By this pneumatic cylinder is been activated. The pneumatic cylinder is been welded with the clamp connected with the hand brake lever. During the forward stroke of the piston the lever of hand brake is been pushed down and the brake is released. On return stroke the lever is brought to its initial position and the brake is engaged.

Handbrakes are purely mechanical braking tools, relying on a series of levers, cables and screws to activate a car's wheel brakes. When the handbrake is applied, the brake cable passes through an intermediate lever, to increase the force of your pull; this force is then split evenly between your brakes by an equalizer. A mechanical lever is added to the existing disc or drum brakes on the car. In drum brakes, the handbrake cable runs directly to a lever on the brake shoes. In disc brakes an additional lever and corkscrew is added to the existing caliper piston. When the handbrake is pulled, the lever forces the corkscrew against the piston, which would normally be activated by the hydraulic foot pedal system. So when the pneumatic cylinder setup is been integrated with the hand brake, a driver should activate the 5/2 Solenoid valve by using the seat belt otherwise the arm of handbrake will not be lowered if he tries to apply the hand brake without wearing the seat belt the force of the pneumatic cylinder prevents it.

Solenoid is DC Valves stands for Directional-Control Valves. Directional control valves are one of the most fundamental parts in hydraulic machinery as well and pneumatic machinery. Fig represents the sectional view of a pneumatic cylinder. They allow fluid flow into different paths from one or more sources. They usually consist of a spool inside a cylinder which is mechanically or electrically controlled. The movement of the spool restricts or permits the flow, thus it controls the fluid flow. In our project we use a Solenoid valve 5/2 valve. A 5/2 directional control valve would have five ports and two spool positions. Fig shows the working of 5/2 Solenoid valve on electric signals & 12 volt battery supply.

Hand brakes have a ratchet locking mechanism that will keep them engaged until a release button is pressed. This is used to prevent the lever of hand brake from falling down when it is been engaged. In our project the pneumatic cylinder itself holds the hand lever through a clamp welded over it so the release button is been disengaged from the hand brake. A clamp is being welded to the body of the handbrake to couple with the cylinder. Fig.4.2. shows the assembled view of the setup.



DESIGN

- if we increase the pressure of air as per formula pressure is directly proportional to the force
 If, $P \uparrow F \uparrow$

- Design of Pneumatic Cylinder:

Clavarino's equation for closed end cylinder at both ends. For ductile material use to determine the thickness of cylinder.

Let,

Material of the cylinder is Aluminum

$$t = r_i \left[\frac{\sqrt{\sigma t + (1 - 2\mu)p}}{\sqrt{\sigma t - (1 + \mu)p}} \right]$$

ADVANTAGE

- 1) The safety of driver is ensured.
- 2) Manual effort in engaging the hand brake is reduced.
- 3) Both seat belt wearing and brake release is done in single operation.

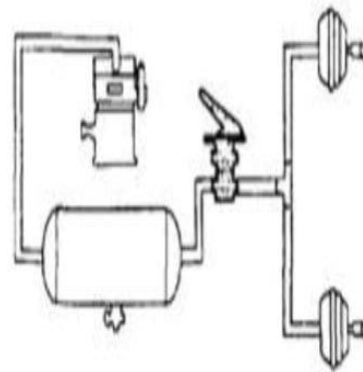
- 4) The cost of brake modification is low.
- 5) The operation of the new system is well controlled.
- 6) Well balanced system.
- 7) It approximately having higher efficiency that of old handbrake in low cost application brakes.
- 8) It minimizes misalignment & less floor space is required.
- 9) Only simple support structures are required Design & fabrication is easy.
- 10) It increases the safety and working condition.

DISADVANTAGE

1. Pneumatic actuators are suitable for only low payload capacity machine.
2. Pneumatic actuators have low power to weight ratio.
3. The operation of actuators & motor clean but noisy.
4. Constant monitoring is required to avoid the air leakages.

APPLICATION

It is used for handbrake of commercial vehicles like Car, Buses & Trucks automation system



CONCLUSION

While concluding this report, we feel quite fulfill in having completed the project assignment well on time, we had enormous practical experience on fulfillment of the manufacturing schedules of the working project model. We are therefore, happy to state that the in calculation of mechanical aptitude proved to be a very useful purpose.

Although the design criterions imposed challenging problems which, however were overcome by us due to availability of good reference books. The selection of choice raw materials helped us in machining of the various components to very close tolerance and thereby minimizing the level of balancing problem. Needless to emphasis here that we had lift no stone unturned in our potential efforts during machining, fabrication and assembly work of the project model to our entire satisfaction.

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