

**PASSIVE WEIGHT LIFT ASSISTIVE SYSTEM FOR  
HYDRAULIC TRUCKS**

**A PROJECT REPORT**

*Submitted by*

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*In partial fulfilment for the award of the degree*

*Of*

**BACHELOR OF ENGINEERING**

**IN**

**MECHANICAL ENGINEERING**

**CAPE INSTITUTE OF TECHNOLOGY, LEVENGIPURAM**

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**APRIL 2014**

## **BONAFIDE CERTIFICATE**

Certified that this project report **“PASSIVE WEIGHT LIFT ASSISTIVE SYSTEM FOR HYDRAULIC TRUCKS”** is a bonafide work of **“R. GOGUL and S. VENKATESH”** who carried out the project work under my supervision.

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Submitted for the B.E/B. Tech degree Anna University Practical Examination held at **Cape Institute of Technology** on \_\_\_\_\_ conducted by Anna University, Chennai.

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## ACKNOWLEDGEMENT

We team it a privilege to have been a student of MECHANICAL ENGINEERING in CAPE INSTITUTE OF TECHNOLOGY, Leve ngipuram. We express heartfelt gratitude to our beloved principal **Dr.N.AZHAGESAN** for the encouragement and his kind permission to do this project work.

We wish to mention our special thanks for the valuable ideas and plans given to us by **Mr. M. S. RAGAVAN** our beloved Head of the Department of Mechanical Engineering and **Dr. J. T. WINOWLIN JAPPES** for their timely advice and suggestions. We also wish to mention our sincere thanks to **Mr. A. LAKSHMANAN PILLAI** for the priceless support to figure out our ideas in to a project.

We wish to mention our sincere and heartfelt thanks to our project guide **Mr. G. ARUN RAJ** for his valuable guidance and his good support, encouragement which helped us in completing of the project work within the stipulated period of time and also thanks for the department staffs.

## **ABSTRACT**

Automobiles are now becoming the most essential part of our day-to-day life. This is the golden age for automobile companies, since they are attaining their peak selling rates in this 21<sup>st</sup> century. However with the increased production they are facing lots of problems like traffic, fuel efficiency, blends, exhaust gas analysis, etc., Among them providing a proper and efficient weight lifter system in an automobile is a major issue for them. With increased load carrying requirements equipping the lifting system with more facilities is their major objective. In addition to that efficiency of the hydraulic lifting system gets reduced due to the self weight of the tipper truck. The system will have to lift the load along with the trailer and it is a major limitation in this equipment.

In this project, we made a simple and economical solution to the above mentioned problem. We used pneumatic spring as our major capital and fabricated an equipment which can be attached to any automobile that it assists the conventional hydraulic system by means of the compressed air. The attachment is to be connected with the base of the trailer. Due to cost factors a small prototype of this project was done. Here we did a model with two metal frames hinged with each other. Two pneumatic springs are connected on either side of the frame with nuts and bolts. Self weight of the upper frame compresses the spring, then it can be easily lifted with less force due to the application of the compressed air inside the spring.

**Key words:** Hydraulic tipper truck, Pneumatic spring, Self weight

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# INTRODUCTION

## 1. INTRODUCTION

The land transport sector encompasses the commercial use of many different vehicles including lorries, light vans, taxis, buses, cars construction and agricultural machinery, emergency service vehicles, motorcycles, mopeds and bicycles. Among them tipper trucks found various applications in road transport sector, that it can carry heavy loads from one place to another efficiently.

The dumper in the tipper truck is actuated hydraulically in conventional trucks. It consists of Prime movers, pumps, directional control valves, accumulators for its operation to lift heavy loads. Due to these various components the efficiency of the automobile will reduced to a particular extent.

Here we provide a simple and economical solution for the above mentioned problem, that the trailer portion of the truck is lifted pneumatically without the aid of any external source. The hydraulic system will have to lift the load along with the self weight of the trailer. This increase in load is compensated by adding a pneumatic spring in the conventional system.

Pneumatic spring is a type of spring that operates using pressurized gas such as air or nitrogen. Automobile shock absorbers sometimes contain pneumatic springs.

We used two pneumatic springs of same kind for our project. It is joined with the base of the trailer on both sides and it gets compressed due to the self weight of the trailer. During lifting only less force is required than in the conventional hydraulic system due to the application of compressed air inside the pneumatic spring. This is the basic principle of our project, further fabrication processes are explained later in this report.



Source : [www.cshardware.com](http://www.cshardware.com)

The main objectives of our project are,

- To reduce the work done by hydraulic system in the weight lifting mechanism of tipper trucks, thereby increasing the efficiency of the vehicle.
- To utilise the application of compressed air in weight lifting applications to make it more simple and economical.
- To eliminate the limitations of hydraulic system by assisting it with a pneumatic spring in tipper trucks and to make the weight lifting operation more effective.

# LITERATURE SURVEY

## 2. LITERATURE SURVEY

[1] Albert F Rockwell (1910) <sup>1</sup>

### PNEUMATIC SPRING:

1. A vehicle spring comprising a plurality of independently mounted cylinders and valves for maintaining a uniform pressure in the cylinders and the source of fluid pressure supply, substantially as described.
2. A vehicle spring comprising a plurality of independent mounted cylinders and pistons arranged for reverse operation one of said cylinders and pistons operating in one direction being of greater power than the combined cylinders and pistons operating in the opposite direction, substantially as described.
3. A vehicle spring comprising a central vertically disposed cylinder, piston, and piston rod, and two cylinders, pistons, and piston rods one upon each side of the central cylinder, piston and piston rod and inclined with relation thereto, substantially as described.
4. A vehicle spring comprising a central vertically disposed cylinder, piston and piston rod, and two cylinders, pistons and piston rods one upon each side of the central cylinder, piston and piston rod, the piston rods of the pistons of the side cylinders being connected to a support in line with each other upon one side of a plane cutting the axis of the central cylinder, piston and piston-rod and the side cylinders being connected to a support in line with each other upon the opposite side of said plane, substantially as described.
5. Vehicle spring comprising a plurality of reversely arranged cylinders, pistons and piston rods and joints connecting the cylinders and piston rods to their supports, one of said piston rods and joints having a communicative passage with

the interior of one of the cylinders } through which fluid pressure may be introduced into said cylinder.

6. A vehicle spring comprising a weight lifting and porting element, a plurality of independently mounted and oppositely operating resisting elements, the combined power of the latter elements being less than the former element, means for operating said elements by fluid pressure and means for maintaining a uniform pressure in said elements and in the source of fluid pressure supply, substantially as described.

[2] Randall G Falk (2003) 2

#### MOTOR CYCLE FRONT WHEEL SUSPENSION SYSTEM WITH PNEUMATIC SPRINGS:

A motorcycle front wheel suspension includes a pair of suspension struts mounted in parallel with a pair of fork struts. Each fork strut and suspension strut pair are connected at a bottom end by a link. The two fork struts are connected together by a pair of crossbeams.

The top ends of the suspension struts are connected by arms to a crosshead. The crosshead is mounted to the top crossbeam through a pair of pneumatic springs. An axle is mounted to the lower ends of the suspension struts. A pressure air source is installed on the motorcycle to provide pressure air to the pneumatic springs.

# PROBLEM DEFINITION

### **3. PROBLEM DEFINITION**

- The problem which we taken under consideration in this project was the reduction in efficiency of hydraulic weight lifting system in tipper trucks due to the self weight of the trailer.
- This reduction in efficiency occurs due to the need of a hydraulic motor with high capacity to lift heavy loads. A motor with low capacity can be used when assisting it with a pneumatic spring.
- Thus reduction in efficiency of the automobile is compensated with the help of a pneumatic spring.
- Pneumatic spring is a type of spring that operates using pressurized gas such as air or nitrogen. Automobile shock absorbers sometimes contain pneumatic springs.
- The self weight of the truck trailer is sufficient enough to compress the pneumatic spring and the spring at its compressed form can be easily lifted with less force.
- Thus work done to lift the entire load by conventional hydraulic mechanism gets reduced. This was the background of our project.
- Due to cost considerations, we did a small miniature representing the whole project with two rectangular frames hinged with each other. The outer frame represents the vehicle chassis, while the inner frame represents the trailer.

DESIGN  
AND  
FABRICATION

## 4. DESIGN AND FABRICATION

### 4.1. MATERIALS REQUIRED

SL.NO.	MATERIAL	QUANTITY
1.	Pneumatic Springs	2
2.	Steel bars	8
3.	Hinged Joints	2
4.	Nuts and bolts	Required

### 4.2. EQUIPMENTS USED

- Arc welding equipment
- Portable Grinding Machine
- Drilling machine
- Hacksaw Blade
- Ball peen hammer
- Spanner
- Chipping hammer, etc.,

### **4.3. FABRICATION PROCESS**

- Materials required to do the project are purchased.
- Then a reconnaissance was carried out about the methods through which the project was to be done.
- Finally a most efficient and economical method was selected for the experimentation.
- As Pneumatic spring is our major capital it is essential to have a study over the equipment.
- A vehicle spring comprising a plurality of independently mounted cylinders and valves for maintaining a uniform pressure in the cylinders and the source of fluid pressure supply, substantially as described.
- It comprising of a plurality of independent mounted cylinders and pistons arranged for reverse operation one of said cylinders and pistons operating in one direction being of greater power than the combined cylinders and pistons operating in the opposite direction, substantially as described.
- A vehicle spring comprising a central vertically disposed cylinder, piston, and piston rod, and two cylinders, pistons, and piston rods one upon each side of the central cylinder, piston and piston rod and inclined with relation thereto, substantially as described.

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