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TIRE INFLATION USING SUSPENSION (TIS)

CH. Sai Phani Kumar
B.Tech (Mechanical Engineering)
Hyderabad Institute of Technology and Management,
Hyderabad, Telangana.

CH. Bhanu Sai Teja
B.Tech (Mechanical Engineering)
Hyderabad Institute of Technology and Management,
Hyderabad,Telangana.

G. Praveen Kumar
B.Tech (Mechanical Engineering)
Hyderabad Institute of Technology and Management,
Hyderabad,Telangana.

Singaiah.G
Assistant Professor
Hyderabad Institute of Technology and Management,
Hyderabad,
Telangana.

Abstract

In this project we are collecting compressed air from the vehicle shock absorber (which is a foot pump in this case) and storing the compressed air into the storage tank which holds the air without losing the pressure. This project combines the concepts of both conventional spring coil type suspension and air suspension, thereby introducing spring coil type suspension with the working fluid as air instead of oil as in the case of conventional one. This concept functions both as a shock absorber and produces compressed air output during the course of interaction with road noise. The stored air can be used for various applications such as to inflate the tires, cleaning auxiliary components of vehicle etc.., our project deals with the usage of compressed air energy to inflate the tires with required pressures.

INTRODUCTION

The Information Age is a period in history characterized by the shift from traditional industry that the Industrial Revolution brought through industrialization, to an economy based on information computerization. The onset of the Information Age is associated with the Digital Revolution, just as the Industrial Revolution marked the onset of the Industrial Age.

The modern era is normally defined as the 25 years preceding the current year. However, there are some technical and design aspects that differentiate modern cars from antiques. The modern era has been one of increasing standardization, platform sharing, and computer-aided design.Some particular contemporary developments are the proliferation of front- and all-wheel drive, the adoption of the diesel engine, and the ubiquity of fuel injection. Most modern passenger cars are front-wheel-drive monologue/uni-body designs, with transversely mounted engines.

Fig 1:Leaf spring, Coil spring, Air suspensions

Introduction to TIS

In addition to this technology, an advanced system is introduced into this phase called Tire Inflation using suspension (TIS). TIS are a system which is introduced to inflate the tires using vehicle suspension. The system increases tire life, fuel economy and safety by helping to compensate for pressure losses resulting from typical tire punctures and other slow leaks. Unlike equalization systems that merely distribute air from one tire to another, TIS uses compressed air from the air storage tank installed to the vehicle to inflate any tire that falls below a preset pressure.

There are multiple technologies based on tire inflating systems, which uses compressed air from the vehicles air system and inflate the tires that fall below present pressures whenever the vehicle is in operation.

Difference between normal suspension and TIS suspension

Suspension is the system of tires, tire air, springs, shock absorbers and linkages that connects a vehicle to its wheels and allows relative motion between the two.Suspension systems serve a dual purpose contributing to the vehicle's road holding /handling and breaking for good active safety and driving pleasure, and keeping vehicle occupants comfortable and a ride quality reasonably well isolated from road noise, bumps, vibrations, etc.These goals are generally at odds, so the tuning of suspensions involves finding the right compromise. It is important for the suspension to keep the road wheel in contact with the road surface as much as possible, because all the road or ground forces acting on the vehicle do so through the contact patches of the tires. The suspension also protects the vehicle itself and any cargo or luggage from damage and wear. The design of front and rear suspension of a car may be different.

History

An early form of suspension on ox-drawn carts had the platform swing on iron chains attached to the wheeled frame of the carriage. This system remained the basis for all suspension systems until the turn of the 19th century, although the iron chains were replaced with the use of leather straps by the 17th century. No modern automobiles use the 'strap suspension' system.

Springs and dampers

Most conventional suspensions use passive springs to absorb impacts and dampers (or shock absorbers) to control spring motions.

Some notable exceptions are the hydro pneumatic systems, which can be treated as an integrated unit of gas spring and damping components, used by the French manufacturer Citroen and the hydrolastic, hydra gas and rubber cone systems used by the British Motor Corporation, most notably on the Mini. A number of different types of each have been used:

Passive suspensions

Traditional springs and dampers are referred to as passive suspensions — most vehicles are suspended in this manner.

Springs

Pneumatic spring on a semitrailer
The majority of land vehicles are suspended by steel springs, of these types:

- Leaf spring – AKA Hotchkiss, Cart, or semi-elliptical spring
- Torsion beam suspension
- Coil spring

Automakers are aware of the inherent limitations of steel springs that they tend to produce undesirable oscillations, and have developed other types of suspension materials and mechanisms in attempts to improve performance:

- Rubber bushing
- Gas under pressure - air spring
- Gas and hydraulic fluid under pressure - hydro pneumatic suspensionand oleo strut

Dampers or shock absorbers

The shock absorbers damp out the (otherwise simple harmonic) motions of a vehicle up and down on its springs. They also must damp out much of the wheel bounce when the unsprung weight of a wheel, hub, axle and sometimes brakes and differential bounces up and down on the springiness of a tire. Some have suggested that the regular bumps found on dirt roads (nicknamed "corduroy", but properly corrugations or wash boarding) are caused by this wheel bounce, though some evidence exists that it is unrelated to suspension at all.

Semi-active and active suspensions

If the suspension is externally controlled then it is a semi-active or active suspension — the suspension is reacting to signals from an electronic controller.

For example, a hydro pneumatic Citroen will "know" how far off the ground the car is supposed to be and constantly reset to achieve that level, regardless of load. It will notinstantly compensate for body roll due to cornering however. Citroën's system adds about 1% to the cost of the car versus passive steel springs.

TIS Suspension

Every vehicle which is equipped with the suspension system experiences some ambulation, tension and stress due to pressure on its body when it is in motion. On considering the wastage of energies from the suspension system, TIS is designed appropriately with the same basic terminology of hydraulic suspension, from which air cannot be taken out and stored as it works with the help of oils. To improvise the hydraulic suspension a new design is implemented in this

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automation, i.e., replacing oil with air as a medium in the place of shock absorber, which are almost same to that shock absorber but only the advantage is that it can extract the air from shock absorber in no load conditionas well as performs the function as that of conventional shock absorber.

TIS DESIGN SEGMENTATION

Suspension Unit

- Major spring
- support spring
- Foot pump (shock absorber)
- Spring caps
- Couplings
- Piston head

Air storage tank

- Inlet valve
- Outlet valve
- Pressure gauge
- Safety valve
- Drain valve

Various components used in TIS model

- ➢ Frame
- ➢ Air foot pump
- ➢ Springs
- ➢ Fasteners
- ➢ Tubed tires
- ➢ Pillow blocks
- ➢ Axle
- ➢ Receiver Tank
- ➢ Hose pipes
- ➢ Ply – wood
- ➢ G.I. Pipe bushes

Frame

A vehicle frame, also known as its chassis, is the main supporting structure of a motor vehicle to which all other components are attached, comparable to the skeleton of an organism.

Typically the material used to construct vehicle chassis and frames is carbon steel; or aluminum alloys to achieve a more light weight construction. In the case of a separate chassis, the frame is made up of structural elements called the rails or beams. These are ordinarily made of steel channel sections, made by folding, rolling or pressing steel plate.There are three main designs for these. "Boxed" frames contain chassis rails that are closed, either by somehow welding them up, or by using remanufactured metal tubing.

Spring

A spring is an elastic object used to store mechanical energy. Springs are usually made out of spring steel. There are a large number of spring designs; in everyday usage the term often refers to coil springs. Small springs can be wound from pre-hardened stock, while larger ones are made from annealed steel and hardened after fabrication. Some non-ferrous metals are also used including phosphor bronze and titanium for parts requiring corrosion resistance and beryllium copper for springs carrying electrical current (because of its low electrical resistance). When a coil spring is compressed or stretched slightly from rest, the force it exerts is approximately proportional to its change in length (this approximation breaks down for larger deflections).

Fig 2: Types of springs

The rate or spring constant of a spring is the change in the force it exerts, divided by the change in deflection of the spring. That is, it is the gradient of the force versus deflection curve. An extension or compression spring has units of force divided by distance, for example lbf/in or N/m. Torsion springs have units of torque divided by angle, such as N·m/rad or ft·lbf/degree. The inverse of spring rate is compliance, that is: if a spring has a rate of 10 N/mm, it has a compliance of 0.1 mm/N. The stiffness (or rate) of springs in parallel is additive, as is the compliance of springs in series.

Depending on the design and required operating environment, any material can be used to construct a spring, so long as the material has the required combination of rigidity and elasticity: technically, a wooden bow is a form of spring.

Fasteners

Nut

A nut is a type of fastener with a threaded hole. Nuts are almost always used opposite a mating bolt to fasten a stack of parts together. The two partners are kept together by a combination of their threads' friction, a slight stretch of the bolt, and compression of the parts. In applications where vibration or rotation may work a nut loose, various locking mechanisms may be employed: Adhesives, safety pins or lock wire, nylon inserts, or slightly oval-shaped threads. The most common shape is hexagonal, for similar reasons as the bolt head - 6 sides give a good granularity of angles for a tool to approach from (good in tight spots), but more (and smaller) corners would be vulnerable to being rounded off. It takes only 1/6th of a rotation to obtain the next side of the hexagon and grip is optimal. However polygons with more than 6 sides do not give the requisite grip and polygons with less than 6 sides take more time to be given a complete rotation. Other specialized shapes exist for certain needs, such as wing nuts for finger adjustment and captive nuts for inaccessible areas.

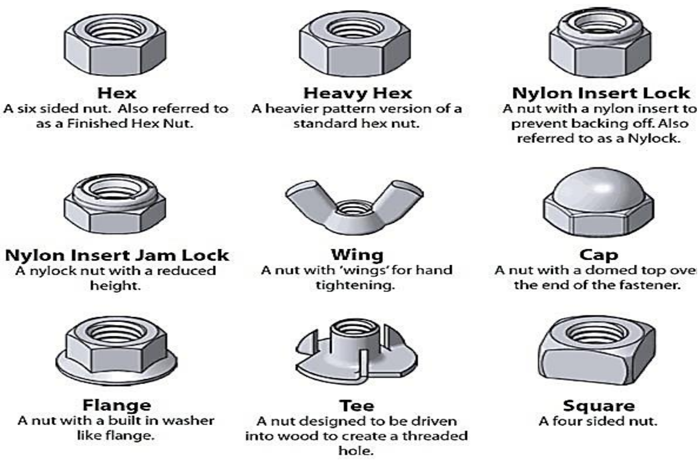

Fig 3: Types of nuts

Tubed Tire / Wheel Rim

Tubed tire

A tire (American English) or tire (British English) is a ring-shaped vehicle component that covers the wheel's rim to protect it and enable better vehicle performance. Most tires, such as those for automobiles and bicycles, provide traction between the vehicle and the road while providing a flexible cushion that absorbs shock.

The materials of modern pneumatic tires are synthetic rubber, natural rubber, fabric and wire, along with carbon black and other chemical compounds. They consist of a tread and a body. The tread provides traction while the body provides containment for a quantity of compressed air. Before rubber was developed, the first versions of tires were simply bands of metal fitted around wooden wheels to prevent wear and tear. Early rubber tires were solid (not pneumatic). Today, the majority of tires is pneumatic inflatable structures, comprising a doughnut-shaped body of cords and wires encased in rubber and generally filled with compressed air to form an inflatable cushion.

Fig 4: Front, Rear tires

Wheel Rim

The rim is the "outer edge of a wheel, holding the tire". It makes up the outer circular design of the wheel on which the inside edge of the tire is mounted on vehicles such as automobiles. For example, on a bicycle wheel the rim is a large hoop attached to the outer ends of the spokes of the wheel that holds the tire and tube. The term "rim" is often incorrectly used instead of wheel.

Rim Profile

Fig 5: Rim profiles

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Axle

An axle is a central shaft for a rotating wheel or gear. On wheeled vehicles, the axle may be fixed to the wheels, rotating with them, or fixed to the vehicle, with the wheels rotating around the axle. In the former case, bearings or bushings are provided at the mounting points where the axle is supported. In the latter case, a bearing or bushing sits inside a central hole in the wheel to allow the wheel or gear to rotate around the axle. Sometimes, especially on bicycles, the latter type axle is referred to as a spindle.

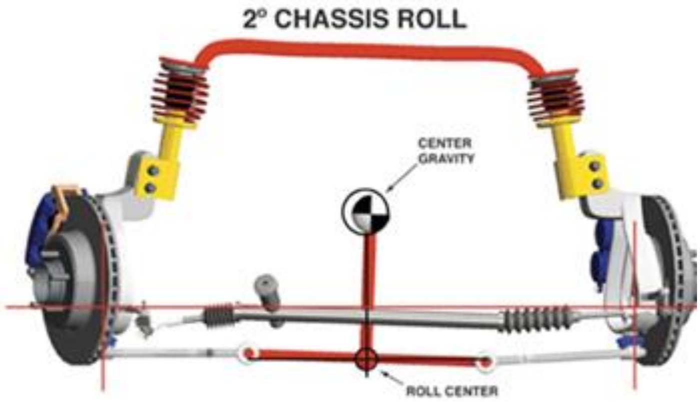

Fig 6: Axle rod

Terminology

On cars and trucks, several senses of the word "axle" occur in casual usage, referring to the shaft itself, it's housing, or simply any transverse pair of wheels. Strictly speaking, a shaft which rotates with the wheel, being either bolted or splined in fixed relation to it, is called an "axle" or "axle shaft".

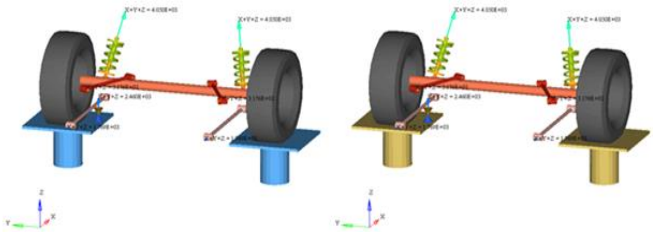

Fig 7: Terminology of axle shaft

However, in looser usage an entire assembly including the surrounding "axle housing" (typically a casting) is also called an "axle". An even broader sense of the word refers to every pair of parallel wheels on opposite sides of the vehicle, regardless of their mechanical connection to each other and to the vehicle frame or body. Thus, transverse pairs of wheels in an independent suspension may be called "an axle" in some contexts. This very loose definition of "axle" is often used in assessing toll roads or vehicle taxes, and is taken as a rough proxy for the overall weight-bearing capacity of a vehicle, and its potential for causing wear or damage to roadway surfaces.

Vehicle axles

Axles are an integral component of most practical wheeled vehicles. In a live-axle suspension system, the axles serve to transmit driving torque to the wheel, as well as to maintain the position of the wheels relative to each other and to the vehicle body. The axles in this system must also bear the weight of the vehicle plus any cargo. A non-driving axle, such as the front beam axle in heavy duty trucks and some 2-wheel drive light trucks and vans, will have no shaft, and serves only as a suspension and steering component. Conversely, many front wheel drive cars have a solid rear beam axle.

Drive axle

Modern front wheel drive cars typically combine the transmission (i.e. gearbox and differential) and front axle into a single unit called as transaxle. The drive axle is a split axle with a differential and universal joints between the two half axles. Each half axle connects to the wheel by use of a constant velocity (CV) joint which allows the wheel assembly to move freely vertically as well as to pivot when making turns.

Dead axle (lazy axle)

A dead axle, also called lazy axle, is not part of the drivetrain but is instead free-rotating. The rear axle of a front-wheel drive car is usually a dead axle. Many trucks and trailers use dead axles for strictly load-bearing purposes. A dead axle located immediately in front of a drive axle is called a pusher axle. A tag axle is a dead axle situated behind a drive axle. Dead axles are also found on semi-trailers, farm equipment, and certain heavy construction machinery serving the same function. On some vehicles (such asmotorcoaches), the tag axle may be steerable. In some designs the wheels on a lazy axle only come into contact with ground when the load is significant, thus saving unnecessary tire wear.

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Air Storage Tank

Air receiver tank is also called as pressure vessel, pressure vessel is a container designed to hold gases or liquids at a pressure substantially different from the ambient pressure.

Principle

Air receiver acts as a reservoir for the storage of compressed air and absorbs pulsations in the discharge line from the compressor. A steady flow of air is thus provided to the service line. Any moisture or oil present in the air as it carries over from after-coolers to the air receiver will be separated out in there. Air receiver should therefore be placed in a clean and well-ventilated location, and be set off the ground, on concrete blocks or on a suitable foundation, as the dampness on the ground causes excessive rusting and corrosion around the bottom. The bottom seams should be kept clean and well painted at all times

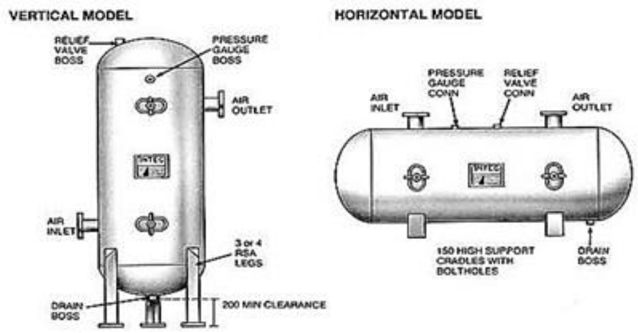

Fig 8: Vertical and Horizontal air receiver tank

Sufficient access to allow visual inspection must always be provided all around the body of the receiver.The air receiver must be of sufficient capacity or the differential pressure switch setting must be wide enough to avoid short cycling of an air compressor i.e. frequent start and stop. The pressures and frequency at which the compressor unit starts and stops on load have to be monitored within the limits recommended by the manufacturer. The air receiver must be drained regularly to remove the condensate accumulated in order to avoid water being carried over to the down-stream air supply line and prevent corrosion. Whenever the air compressor or receiver is to be taken out of service for long period of time, the receiver should be drained and stored in a dry sheltered location. It is recommended that air receiver be dried out after draining, inspected before storage and re-inspected before putting back into commission.

DESIGN CALCULATIONS

Component Measurements

- Major Springs
- Minor springs
- Foot pumps
- Fasteners
- Air storage tank
- Pillow block

Major Springs

Major springs are illustrated as large springs, which are used at four different places for the cylinder of the foot pump, to form a suspension system.

Internal Diameter (ID): 81mm
Outer Diameter (OD): 98mm
Mean diameter: 89.5mm (D)
Wire diameter: 8mm (d)
Full length (free length): 300mm
Pitch: 36mm
Gap: 26mm
No. of coils: 10
No. of active coils: 8

Minor Springs

Minor springs are illustrated as small springs, which are used at four different places for the piston of the foot pump, to give it some support and to form a suspension system.

Internal diameter (ID): 20mm
Outer diameter (OD): 25mm
Mean diameter (D): 22.5mm
Wire diameter (d): 2.3mm
Free length: 152mm
Pitch: 9mm
Gap: 7mm
No. of coils: 18
No. of active coils: 16

Frame

Material: Mild steel
Shape: square
Size: 50x50 mm
Material section: Hollow
Material thickness: 3mm

Foot Pump

Piston diameter: 11mm
Cylinder diameter: 730mm
Piston length: 150mm
Cylinder length: 132mm

Fasteners

Nut:

Inter diameter: 11mm
Threading: $\frac{1''}{4}$ BSW

Bolt:

Diameter: 12mm
Length: 70mm
Threading: $\frac{1''}{2}$ BSW

Air Storage Tank

Total length: 550mm
Cylindrical length: 460mm
Diameter: 170mm
Spherical length: 80mm

CALCULATIONS

Frame:

Material: Mild steel
Shape: square
Material section: Hollow
Material thickness: 3mm
Density of M.S: 7850 kg/m^3

Weight

Weight in kg = WxWx0.00000785xlength in mm
Width of solid section (W_1) – Width of hollow section (W_2)
W_1 = 50x50x0.00000785x4800= 94.2 kg/m
W_2 = 44x44x0.00000785x4800=72.94 kg/m

W= W_1 – W_2 = 94.2-72.94 = 21.26 kg/m (theoretical value)

Spring caps:

Spring caps are used to hold the spring foot pumps setup stable and to lock them to the frame member and the axel members.

Major:

Inter diameter (ID) = 104mm
Outer diameter (OD) = 113mm
Thickness: 5mm

Upper disk:

Diameter: 111mm
Thickness: 6mm

Bushes

Outer diameter: 18mm
Internal diameter: 12mm
Length: 55mm

Major spring calculation:

Major springs are illustrated as large springs, which are used at four different places for the cylinder of the foot pump, to form a suspension system.

Formula: $K = \frac{Gd^4}{8D^3 N}$

Where

G – Shear modulus offspring steel= 11.25x10^6 PSI
d – Wire diameter (inches)
D – Mean coil meter (inches)
N – No. of active coils
K – Spring rate

$K= \frac{11.25X\ 10^6 X(0.315)^4}{8X(3.52)^3\ X8}$ = 39.68 pounds/inch

(1kg = 9.81N)

K = 6949.032 N/m = 708 kg/m = 0.7 kg/mm

Minor spring calculation:

Minor springs are illustrated as small springs, which are used at four different places for the piston of the foot pump, to give it some strength and to form a suspension system.

Formula: $K = \frac{Gd^4}{8D^3 N}$

Where

G – Shear modulus offspring steel= 11.25x10^6 PSI
d – Wire diameter (inches)
D – Mean coil meter (inches)
N – No. of active coils
K – Spring rate

We have d = 0.09 inches
D = 0.91 inches
N = 16
$K= \frac{11.25X\ 10^6 X(0.09)^4}{8X(0.91)^3\ X16}$ = 7.65 pounds/ inches
K = 1339.72 N/m
K = 136.5 kg/m
K = 0.136 kg/mm

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Foot pumps calculation:

Volume of Cylinder = Volume of Air

$V = \pi r^2 h$

$V = \pi \times 365 \times 365 \times 132$

$V_{air} = 0.05524\ m^3$

V_{air} for one stroke length of 115mm

115mm = $0.05524\ m^3$

1 cm = $V_{air} = 0.0008\ m^3$

SUSPENSION SYSTEM

Objectives:

To provide good ride and handling performance

- Vertical compliance providing chassis isolation
- Ensuring that the wheels follow the road profile
- Very little tire load fluctuation

To ensure that steering control is maintained during maneuvering

- Wheels to be maintained in the proper position with respect to road surface

To ensure that the vehicle responds favorably to control forces produced by the tires during

- longitudinal braking
- Accelerating forces,
- lateral cornering forces and
- Braking and accelerating torques
- This requires the suspension geometry to be designed to resist squat, dive and roll of the vehicle body

To provide isolation from high frequency vibration from tire excitation

- Requires appropriate isolation in the suspension joints
- Prevent transmission of 'road noise' to the vehicle body

Vehicle Axis systems

Un-sprung mass

- Right-hand orthogonal axis system fixed in a vehicle
- X-axis is substantially horizontal, points forward, and is in the longitudinal plane of symmetry.
- Y-axis points to driver's right and
- Z-axis points downward.

Rotations:

- A yaw rotation about z-axis.
- A pitch rotation about y-axis.
- A roll rotation about x-axis

Tire basic Terminology:

Camber angle

- angle between the wheel plane and the vertical
- taken to be positive when the wheel leans outwards from the vehicle

Swivel pin (kingpin) inclination

- angle between the swivel pin axis and the vertical

Swivel pin (kingpin) offset

- distance between the center of the tire contact patch and
- intersection of the swivel pin axis and the ground plane

WORKING OF TIS

Description

TIS is an advanced system which is introduced into this phase called Tire Inflation using suspension (TIS). TIS is a system which is introduced to inflate the tires using vehicle suspension. The system increases tire life, fuel economy and safety by helping to compensate for pressure losses resulting from typical tire punctures and other slow leaks. Unlike equalization systems that merely distribute air from one tire to another, TIS uses compressed air from the air storage tank installed to the vehicle to inflate any tire that falls below a preset pressure.

There are multiple technologies based on tire inflating systems, which uses compressed air from the vehicles air system and inflate the tires that fall below present pressures whenever the vehicle is in operation.

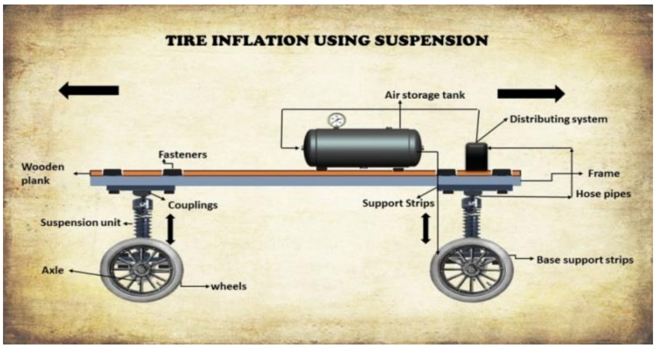

Fig 9: TIS system

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Operation

Every vehicle which is equipped with the suspension system experiences some ambulation, tension and stress due to pressure on its body when it is in motion. On considering the wastage of energies from the suspension system, TIS is designed appropriately with the same basic terminology of hydraulic suspension, from which air cannot be taken out and stored as it works with the help of oils. To improvise the hydraulic suspension a new design is implemented in this automation, i.e., replacing oil with air as a medium in the place of shock absorber, which are almost same to that shock absorber but only the advantage is that it can extract the air from shock absorber in no load condition as well as performs the function as that of conventional shock absorber.

The air extracted out of the shock absorber is transported through the hose pipes setup to air receiver tank which stores the air at a certain pressure which is required to inflate the tire. The tank size will be proportional to the vehicle tire inflating pressure requirements and varying dimensions shock absorber setup.

Working of TIS

When TIS vehicle is in running condition the stability and traction control of the vehicle may distract due to road noise, bumps, vibration. In order to stabilize the vehicle from vibrations, the suspension units are designed to reduce the vibrations transmitting from the road to vehicle and also producing compressed air at no load condition by storing it in the air receiver tank.

Tire Inflation basics

According to TIS, about 80 percent of the cars on the road are driving with one or more tires under inflated. Tires lose air through normal driving (especially after hitting pot holes or curbs), permeation and seasonal changes in temperature. They can lose one or two psi (pounds per square inch) each month in the winter and even more in the summer. And, you can't tell if they're properly inflated just by looking at them. You have to use a tire pressure gauge. Not only is under inflation bad for your tires but it is also bad for your fuel mileage, affects the way your car handles and is generally unsafe. When tires are under inflated, the tread wears more quickly. According to Goodyear, this equates to 15 percent fewer miles you can drive on them for every 20 percent that they're under inflated. Under inflated tires also overheat more quickly than properly inflated tires, which cause more tire damage. The faded areas below indicate areas of excessive tread wear.

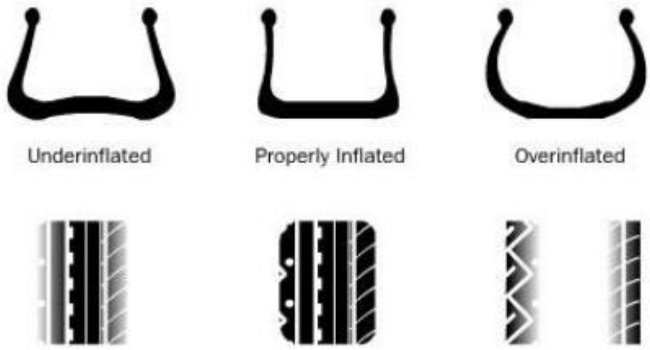

Fig 10: Underinflated, properly inflated tires and Overinflated tires

Because tires are flexible, they flatten at the bottom when they roll. This contact patch rebounds to its original shape once it is no longer in contact with the ground. This rebound creates a wave of motion along with some friction. When there is less air in the tire, that wave is larger and the friction created is greater -- and friction creates heat. If enough heat is generated, the rubber that holds the tire’s cords together begin to melt and the tire fails. See how tire works to learn more. Because of the extra resistance an under inflated tire has when it rolls, your car's engine has to work harder. AAA statistics show that tires that are under inflated by as little as 2 psi reduce fuel efficiency by 10 percent. Over a year of driving, that can amount to several hundred dollars in extra gas purchases.

Advantages / Disadvantages

Advantages

The tire inflation using suspension system would be capable of succeeding as a new product in the automotive supplier industry. It specifically addresses the needs of the consumers by maintaining appropriate tire pressure conditions for:

- Reduced tire wear
- Increased fuel economy
- Increased overall vehicle safety

Because such a product does not currently exist for the majority of passenger vehicles, the market conditions would be favorable for the introduction of a self-inflating tire system. Through extensive engineering analysis, it has also been determined that the self-inflating tire system would actually function as desired. In particular, the product would be capable of:

- Compressed air is produced at no load condition and utilizing it at peak loads
- Providing sufficient airflow to the tire with minimal leakage
- Withstanding the static and dynamic loading exerted on the rotary joints.

This system would not produce any negative dynamic effectson surrounding systems. Most significantly, the TIS would be a successful product because of its economic benefits to investors.

Break-even on the capital investment in just under three years for further development of this product, we recommend increasing the capability of the system by adding the following features:

- Pressure adjustment based on increasing vehicle speed
- Pressure adjustment based on increasing vehicle load
- Adaptability for recreational use (inflating rafts, sports balls, etc.)
- Implementation of interactive display.
- Creation of universal design for aftermarket use.

Disadvantages

- It is not self-inflating type
- No sensors are used
- It is expensive

CONCLUSION

This paper presents the Tire Inflation using Suspension (TIS), it is designed for an upcoming technology. Experimental work has been carried out carefully. The result shows that good amount of efficiency is indeed achieved using TIS in a vehicle. The proposed method is verified to be highly beneficial domestic purpose.Thus it can be concluded that the design implemented in the present work provides ease of use and perfect handling of tires. Replacing the conventional shock absorber unit (with oil as a medium) with TIS system in which air is used as a medium. If the dimensions are varied according to the vehicles specifications and requirements more output can be attained.

Future Scope

Despite an initial investment in the technology, they will experience a reduction in tire wear and an increase in fuel economy; both of which will result in saving money in the long run. TIS system works more effectively with the assistance of sensors. The reduction in tire disposal in landfills and decrease the rate of consumption of natural resources will truly benefit society. Also, the improvement in vehicle safety will benefit all people who drive a vehicle on the roadways.

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Author Details

CH. Sai Phani Kumar
B.Tech (Mechanical Engineering)
Hyderabad Institute of Technology and Management, Hyderabad,
Telangana, INDIA

CH. Bhanu Sai Teja
B.Tech (Mechanical Engineering)
Hyderabad Institute of Technology and Management, Hyderabad,
Telangana, INDIA

G. Praveen Kumar
B.Tech (Mechanical Engineering)
Hyderabad Institute of Technology and Management, Hyderabad,
Telangana, INDIA

Singaiah.G
Assistant Professor
Hyderabad Institute of Technology and Management, Hyderabad,
Telangana, INDIA