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COURSE NAME : AUTOMOTIVE TRANSMISSION SYSTEM

FACULTY NAME :**A.MANIKANDAN M.E**

DESIGNATION : GUEST FACULTY

TOPIC : **SUSPENSION SYSTEM**

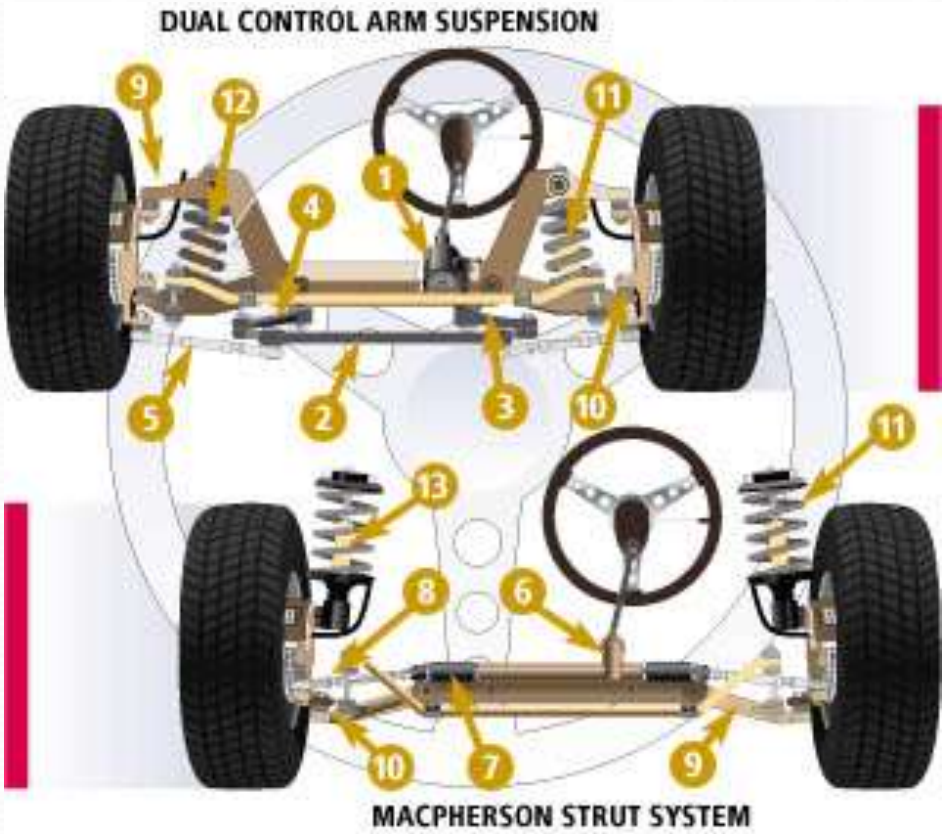
SUSPENSION SYSTEM

What is suspension system?

- Suspension is the term given to the system of springs, shock absorbers and linkages that connects a vehicle to its wheels
- Serve a dual purpose – contributing to the car's handling and braking.
- Protects the vehicle itself and any cargo or luggage from damage and wear

PURPOSE OF SUSPENSION SYSTEM

- Supports the weight.
- Provides a smooth ride.
- Allows rapid cornering without extreme body roll.
- Keeps tires in firm contact with the road.
- Allows front wheels to turn side-to-side for steering.

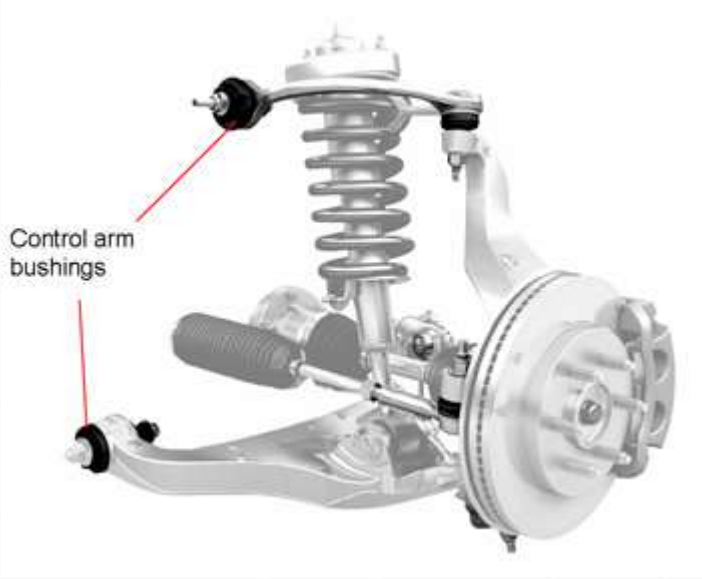


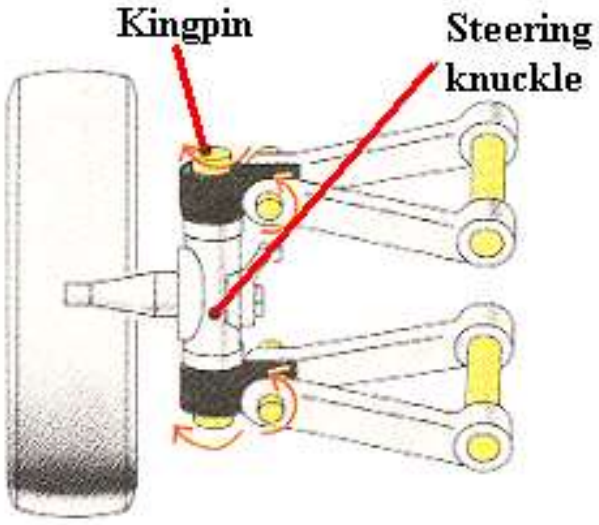
- Works with the steering system to keep the wheels in correct alignment.
- Isolate passenger and cargo from vibration and shock

Suspension System

Basic Parts:

Control Arm:- movable lever that fastens
the steering knuckle to the vehicle's
body or frame.



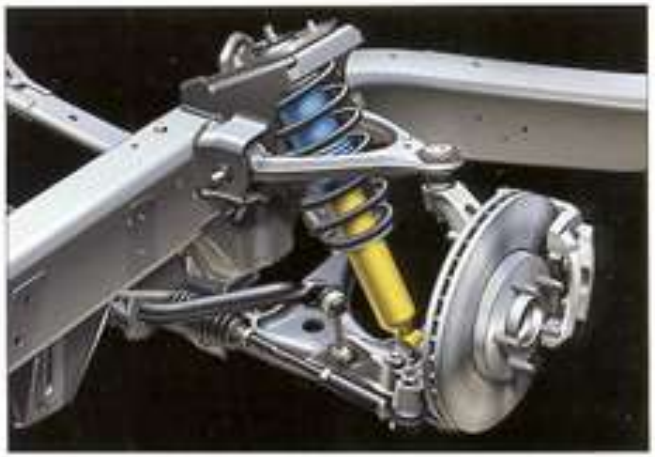


Steering Knuckle:– provides a spindle or bearing support for the wheel hub, bearings
and wheel assembly.

Suspension System

Basic Parts:

Ball Joints:– swivel joints that allow control arm and steering knuckle to move up and down and side to side.



Today's complex import suspension systems aren't tolerant of excessive wear.

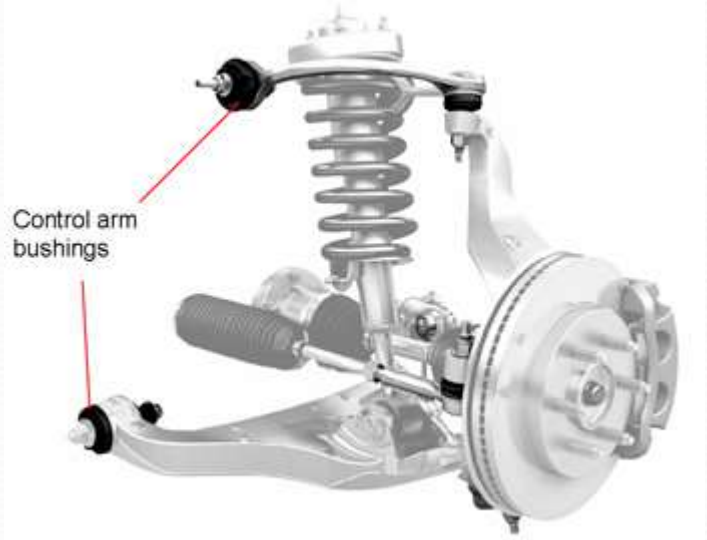
Springs:– supports the weight of the vehicle; permits the control arm and Wheel to move up and down.

Suspension System

Basic Parts:

Shock absorbers or dampeners:- keeps the suspension from continuing to bounce after spring compression and extension.

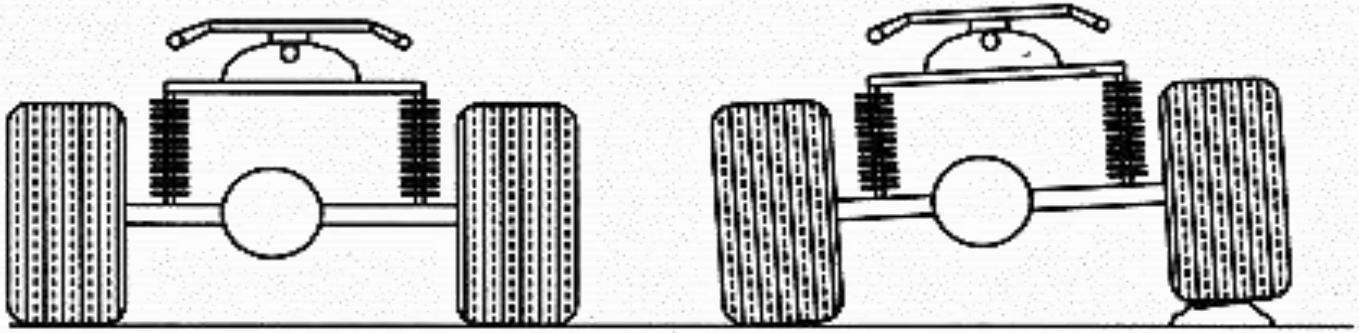
Control arm bushing :– sleeves that allows the control arm to swing
up and down on the frame.



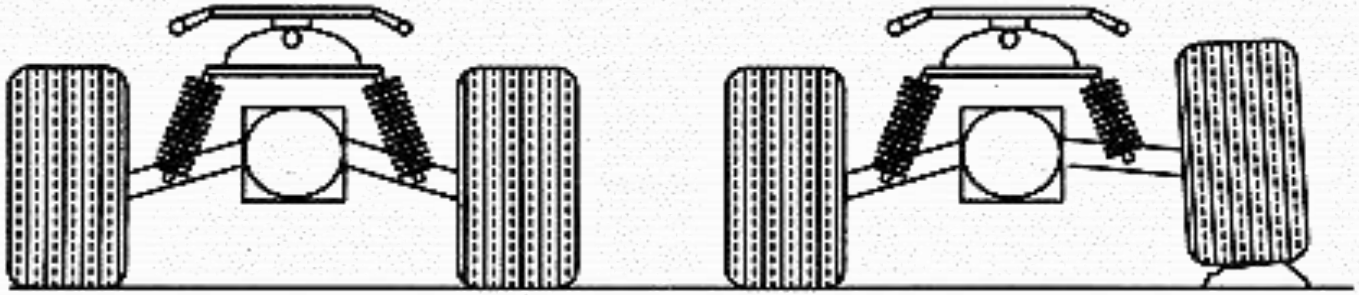
Non-independent suspension:- It has both right and left wheel attached to the same solid axle. When one wheel hits a bump in the road, its upward movement causes a slight tilt of the other wheel.

Independent suspension:- Independent suspension is a broad term for
any automobile suspension system that allows each wheel on the same axle to move vertically independently of each other

LOW SPEED BUMP WITH THE PATENTED LEHMAN "NO LEAN SUSPENSION"

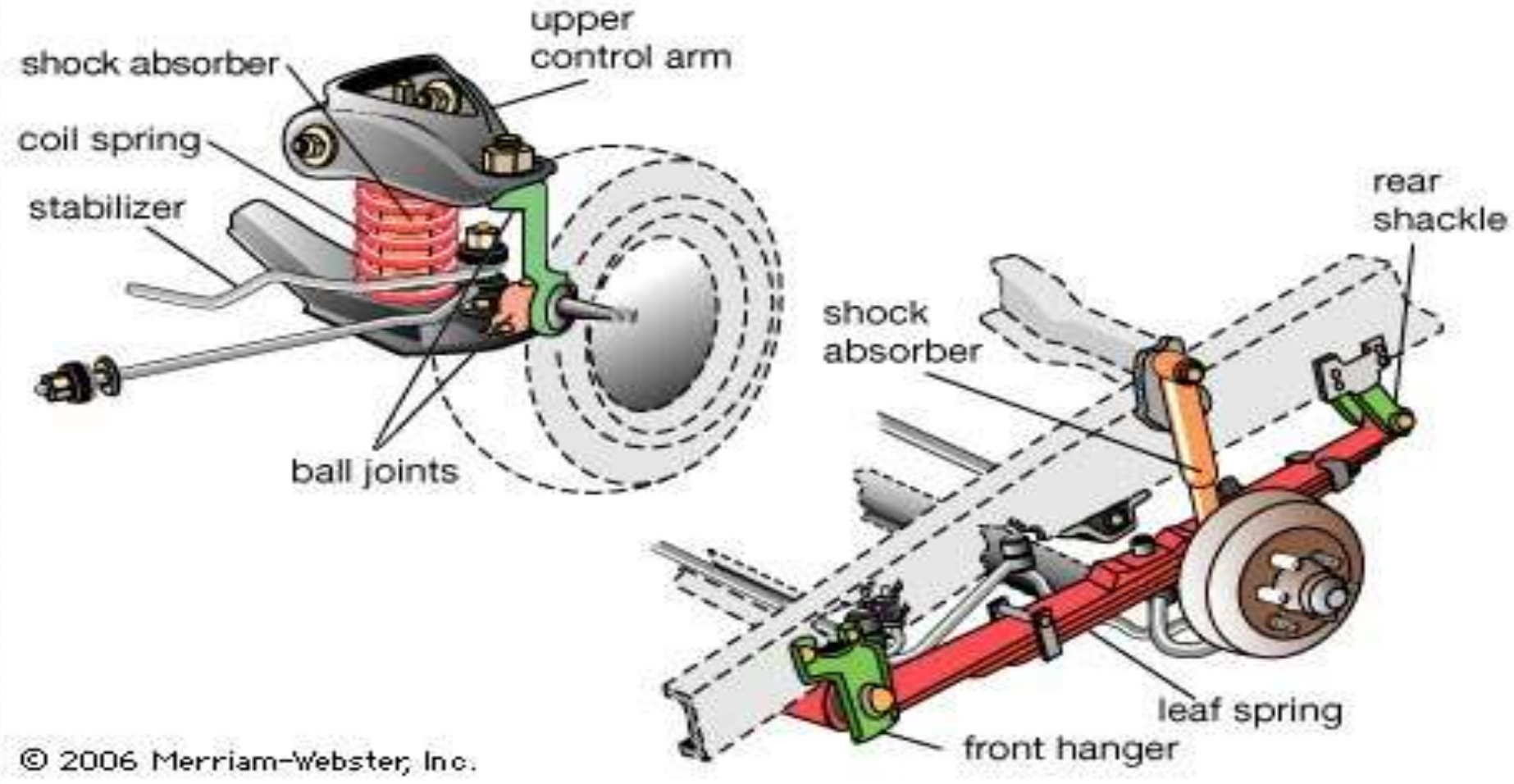


LOW SPEED BUMP WITH INDEPENDENT SUSPENSION



- Non-Independent suspension
- Independent Suspension

Suspension System



COIL SPRING AND LEAF SPRING

LEAF SPRING

- Used in many early applications
- Internal friction provides damping
- Provide Lateral location for the axle
- Heavy
- Prone to weaken over time
- Leaf springs are now limited to the rear of some cars

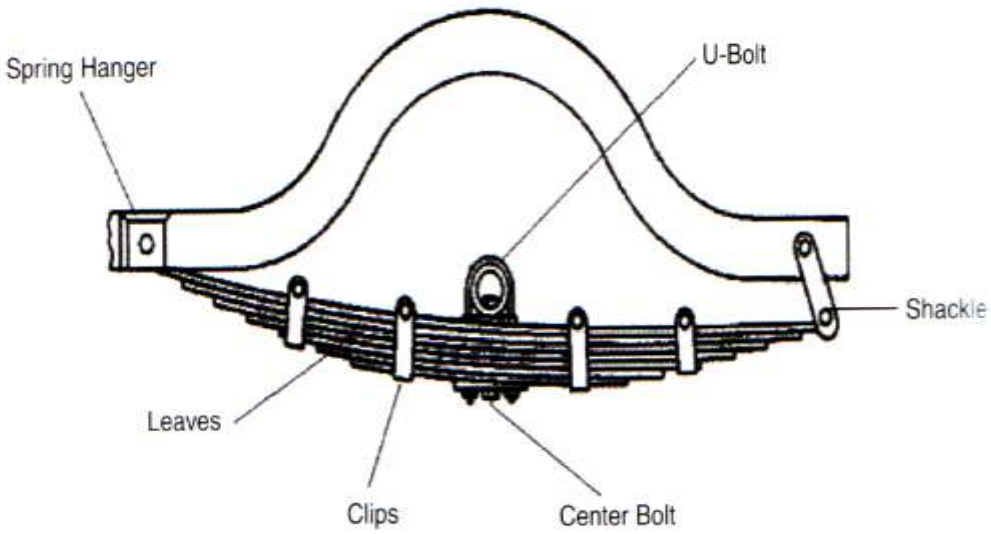


Figure 8.17. *A multi-leaf spring. Adapted from TM 9-8000 (1985).*

COIL SPRING

- Little to no internal damping
- Low cost
- Compact Size
- Used in many Suspension types
- Coil spring is the most common type of spring found on modern vehicles

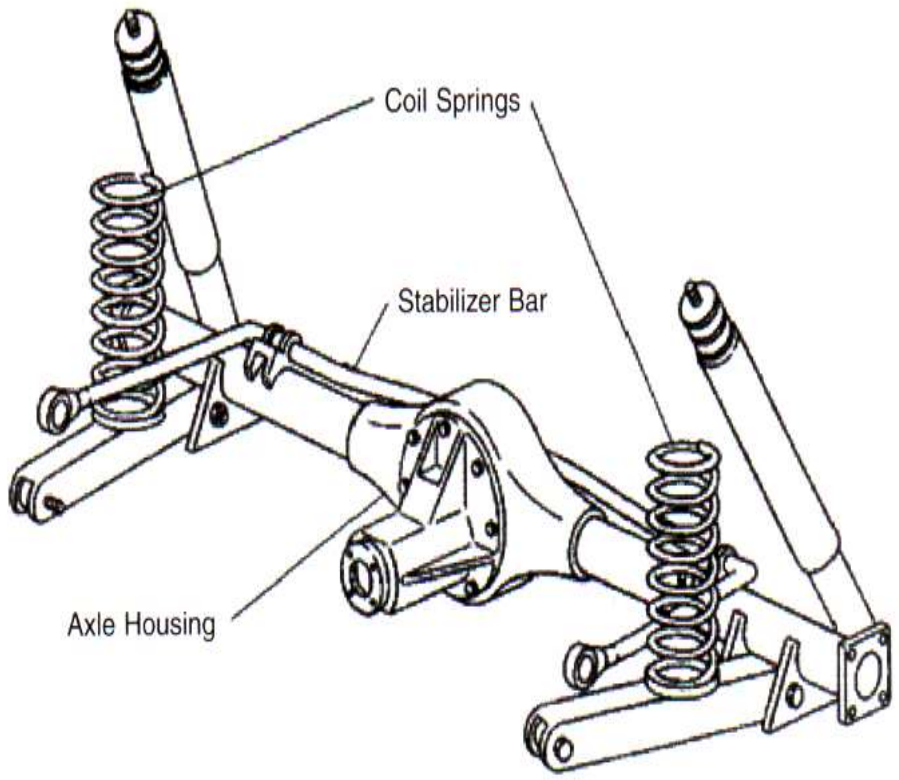
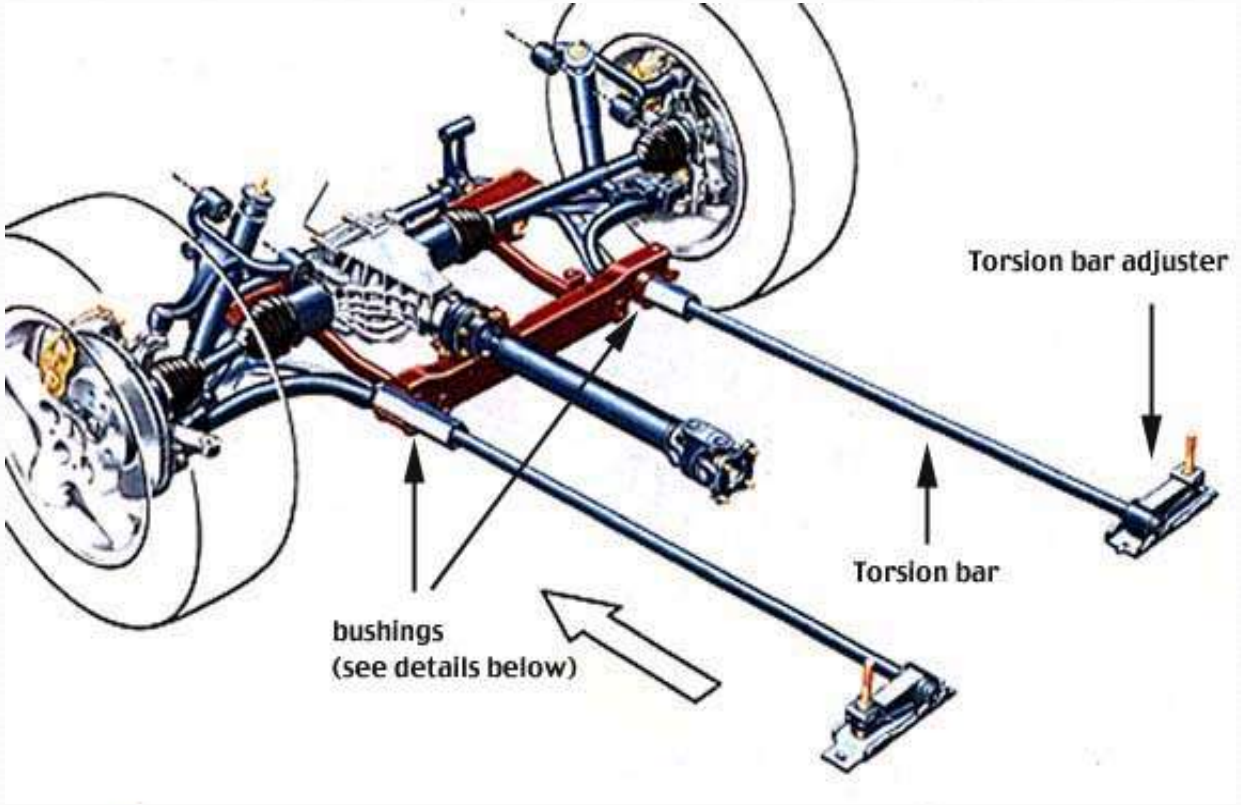


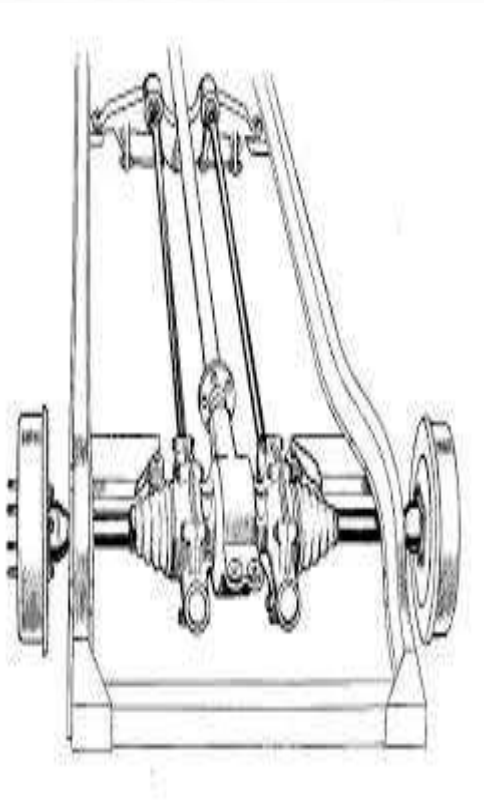
Figure 8.19. *A coil spring suspension. Adapted from TM 9-8000 (1985).*

Torsion bar *(large spring rod)*

- One end is attached to the frame and the other to the end of a wheel arm.
- Up and down of the suspension system twists the torsion bar
- When the wheel strikes a bump, it begin to vibrate up and down.

Torsion bar


Torsion bar adjuster
Torsion bar
bushings
(see details below)

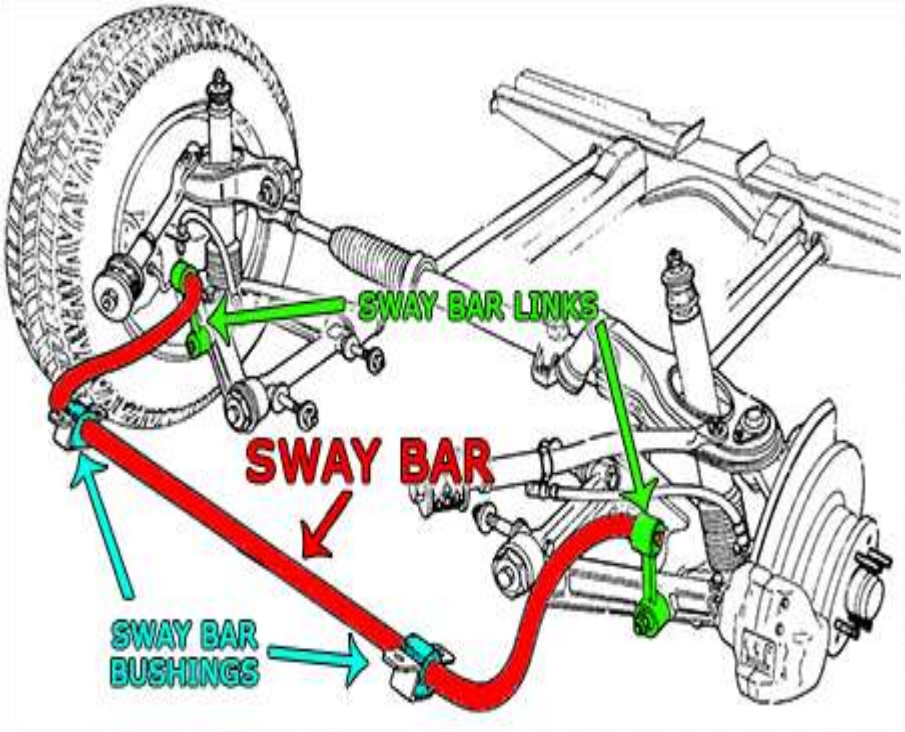


Sway Bar *(Stabilizer Bar)*

- Used to keep the body from leaning excessively in sharp turns.
- Fastened to lower control arms.
- During cornering, centrifugal force makes the outside of body drop and inside raise.

Their purpose in life is to try to keep the car's body from "rolling" in a sharp turn.

Anti-sway bars or Anti-roll bars



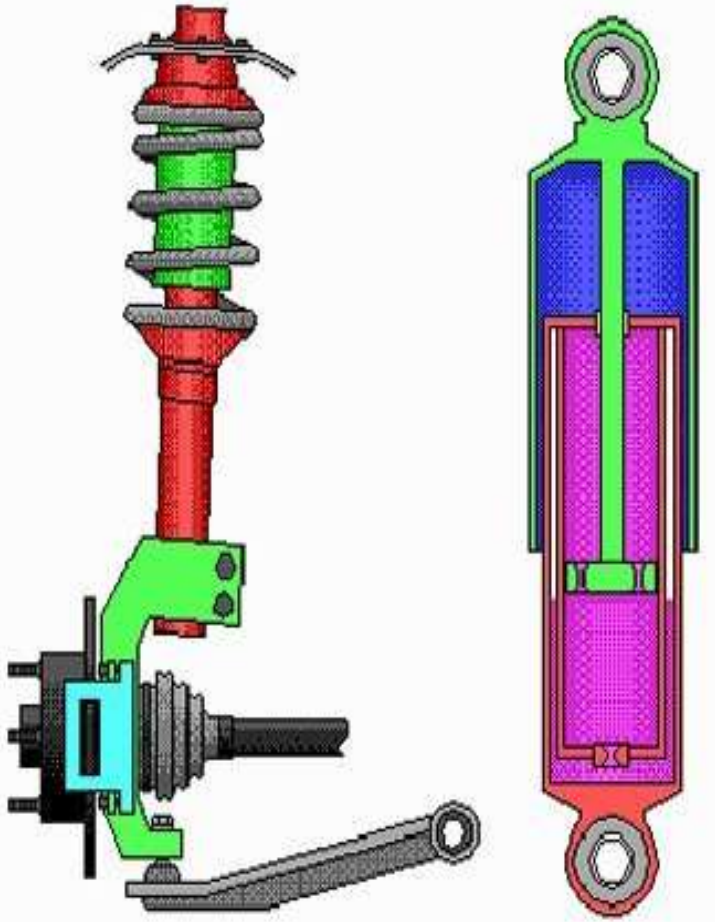
Example

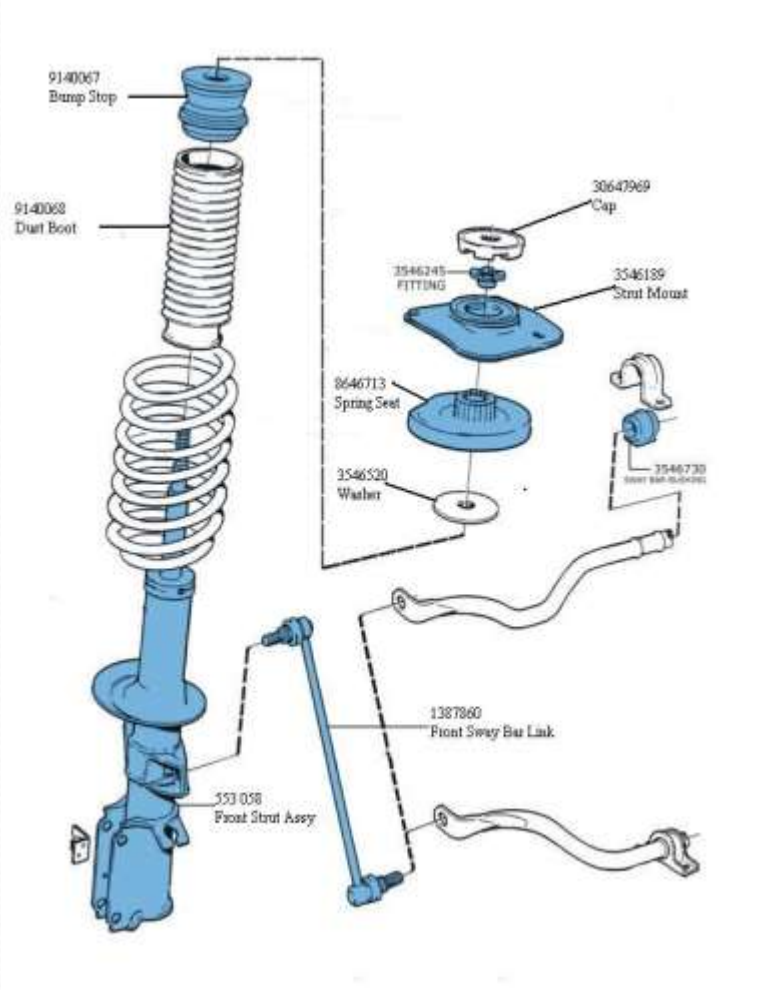
Think about what happens to a car in a sharp turn. If you are inside the car, you know that your body gets pulled toward the outside of the turn. The same thing is happening to all the parts of the car. So the part of the car on the outside of the turn gets pushed down toward the road and the part of the car on the inside of the turn rises up. In other words, the body of the car "rolls" 10 or 20 or 30 degrees toward the outside of the turn. If you take a turn fast enough, the tires on the inside of the turn actually rise off the road and the car flips over.

Shock absorbers

- A shock absorber is a mechanical device designed to smooth out or damp shock impulse, and dissipate kinetic energy.
- Limits spring compression-extension movements to smooth the vehicle's ride.
- Without shock absorbers, the vehicle would continue to bounce up and down long after striking dip or hump in the road.

Strut assembly *(MacPherson struts)*





Strut Assembly

- Its is a independent suspension system
- Consists of a shock absorber, a coil spring, and an upper damper unit.
- Strut assembly often replaces the upper control arm.
- The steering gear is either connected directly to the lower shock absorber housing, or to an arm from the front or back of the spindle.
- When you steer, it physically twists the strut and shock absorber housing (and consequently the spring) to turn the wheel.

Advantages:-

- Low production costs
  - Stamped construction
- Preassembled
  - Strut body carries spring assembly
- Compact
  - Simple mounting and no need for an upper control arm
- Simplicity
  - Reduction in fasteners and alignment of vehicle suspension components.

Air Suspension

Air suspension:- Air Suspension is a type of vehicle suspension powered by an electric or engine driven air pump or compressor. This compressor pumps the air into a flexible bellows, usually made from textile-reinforced rubber. This in turn inflates the bellows, and raises the chassis from the axle.

Pneumatic Spring On Semitrailer

Advantages:-

- These maintain a constant frequency of vibration whether the vehicle is laden or unladen.
- Constant frame height is maintained.
- It helps to reduce the load while the vehicle in motion i.e. the dynamic loading as the spring rate variation between laden and unladen weight is much less.
- It gives smooth and comfort ride of the vehicle.
- The stiffness of the system increases with the increase of the deflection.

Common Air Suspension Problems:-

- Air bag or air strut failure

  - due to old age, or moisture within the air system that damages them from the inside.

- Compressor failure

  - Primarily due to leaking air springs or air struts

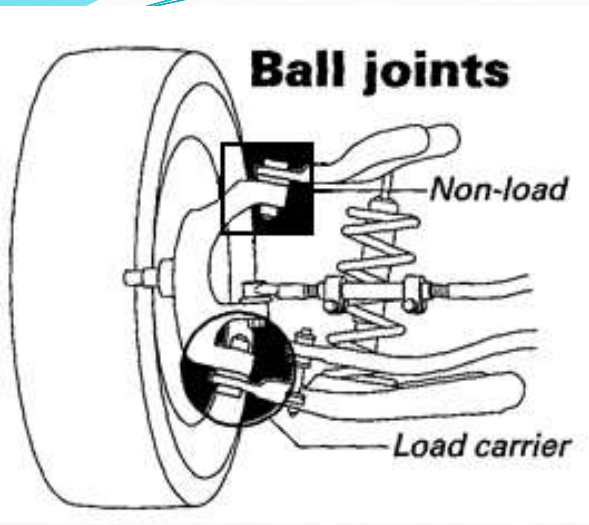
  - Compressor burnout may also be caused by moisture from within the air system coming into contact with its electronic parts.

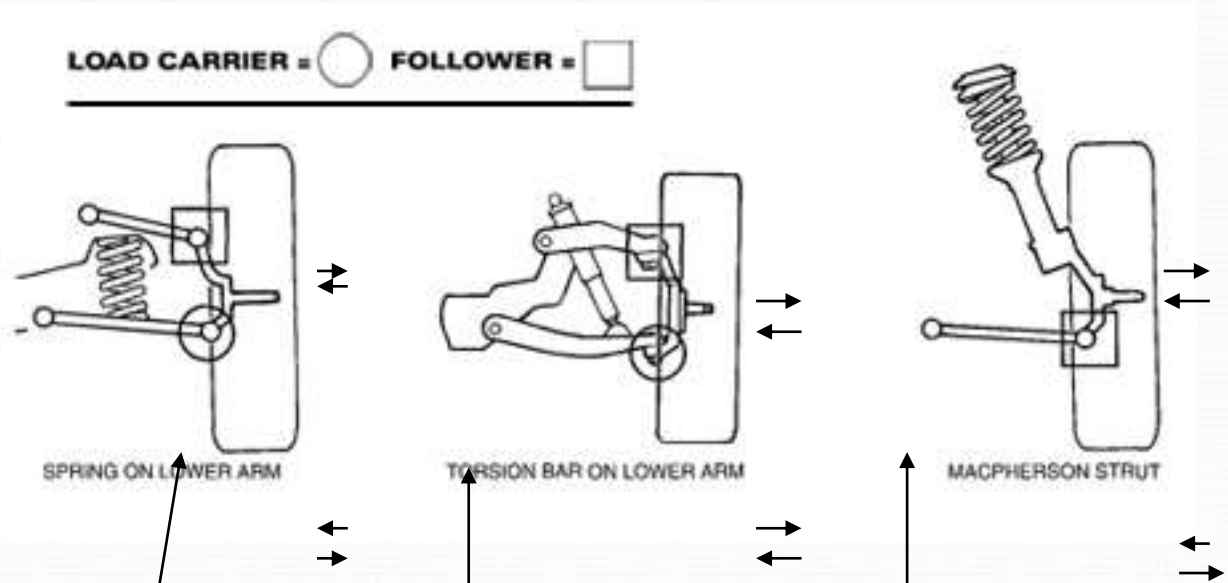
- Dryer failure

  - which functions to remove moisture from the air system eventually becomes saturated and unable to perform that function

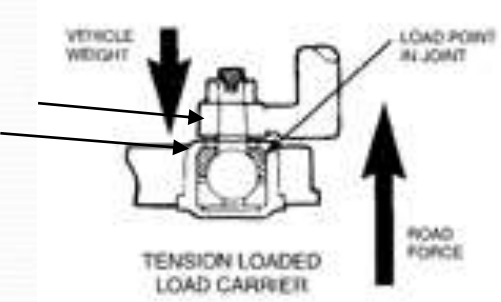
- Normally find on the rear suspension
- Combines independent double wishbone suspension with a leaf spring.
- It involves one leaf spring mounted *across* the vehicle, connected at each end to the lower wishbone.
- The centre of the spring is connected to the front subframe in the middle of the car.
- There are still two shock absorbers, mounted one to each side on the lower wishbones.

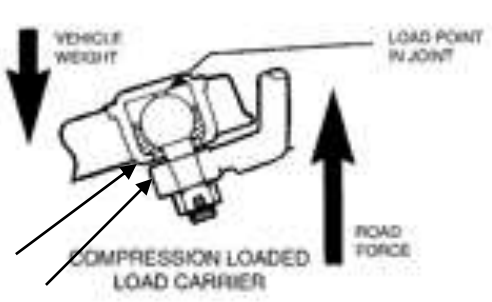
Checking Ball Joints





- If spring on lower control arm, jack stand goes under the control arm.
- If spring on upper control arm, jack stand goes under frame.





If any play found, replace it.

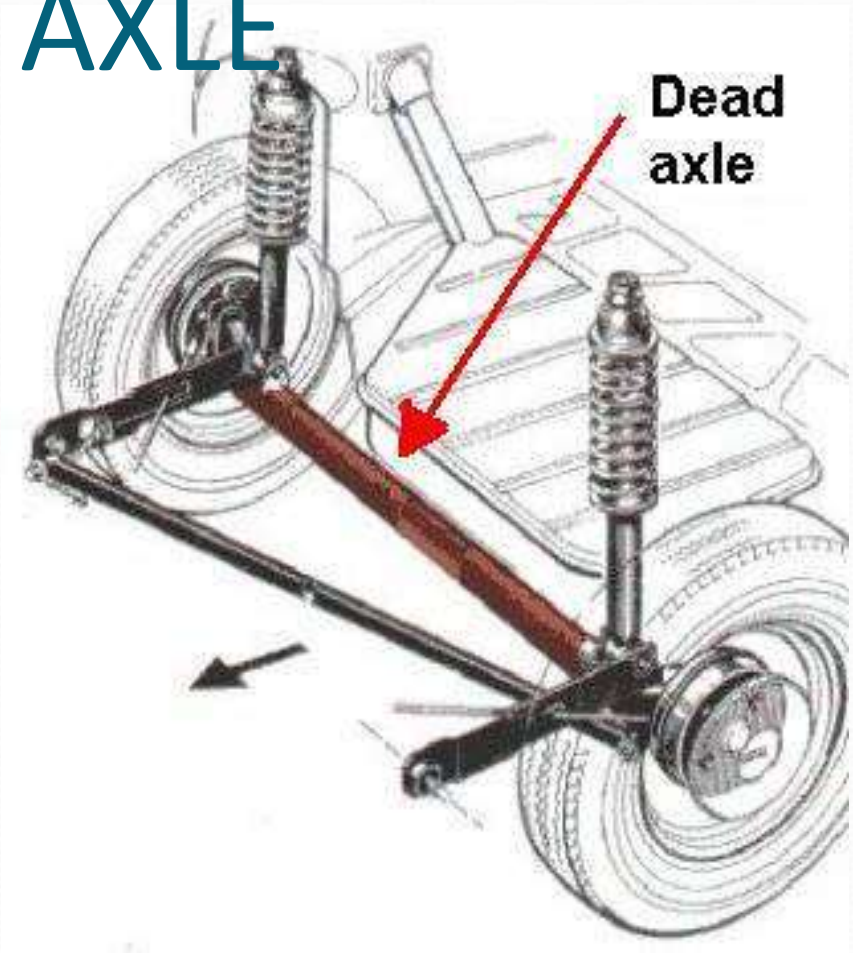
FRONT AXLES

Front wheels of the vehicle are mounted on front axles .

- It supports the weight of front part of the vehicle.
- It facilitates steering.
- It absorbs shocks which are transmitted due to road surface irregularities.
- It absorbs torque applied on it due to braking of vehicle.

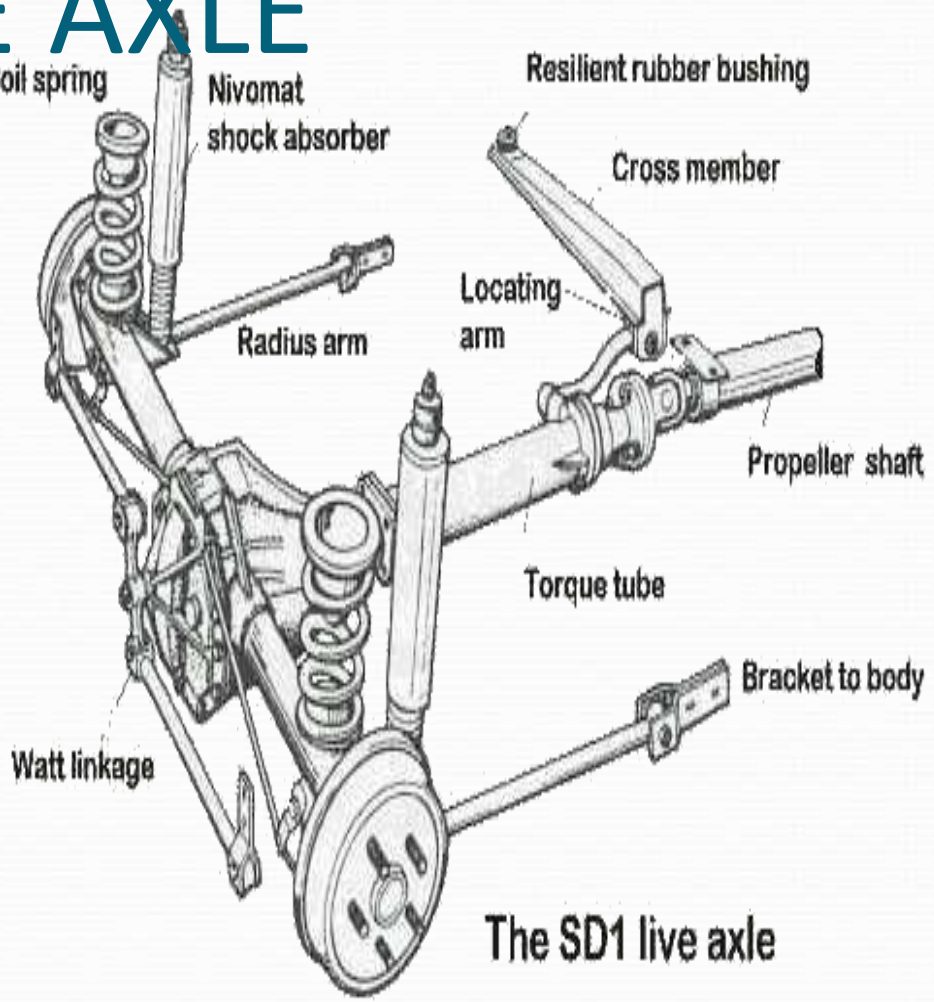
DEAD AXLE

- Dead axles are those axles, which do not rotate.
- These axles have sufficient rigidity and strength to take the weight.
- The ends of front axle are suitably designed to accommodate stub axles.



LIVE AXLE

- Live axles are used to transmit power from gear box to front wheels.
- Live front axles although, resemble rear axles but they are different at the ends where wheels are mounted. Maruti-800 has line front axle.



STUB AXLE

- Stub axles are connected to the front axle by king pins. Front wheels are mounted on stub axles arrangement for steering. Stub axle turns on king pins. King pins is fitted in the front axle beam eye and is located and locked there by a taper cotter pin. Stub axles are of four types:

- Elliot
- Reversed Elliot
- Lamoine
- Reversed Lamoine

TYPES OF STUB AXLES

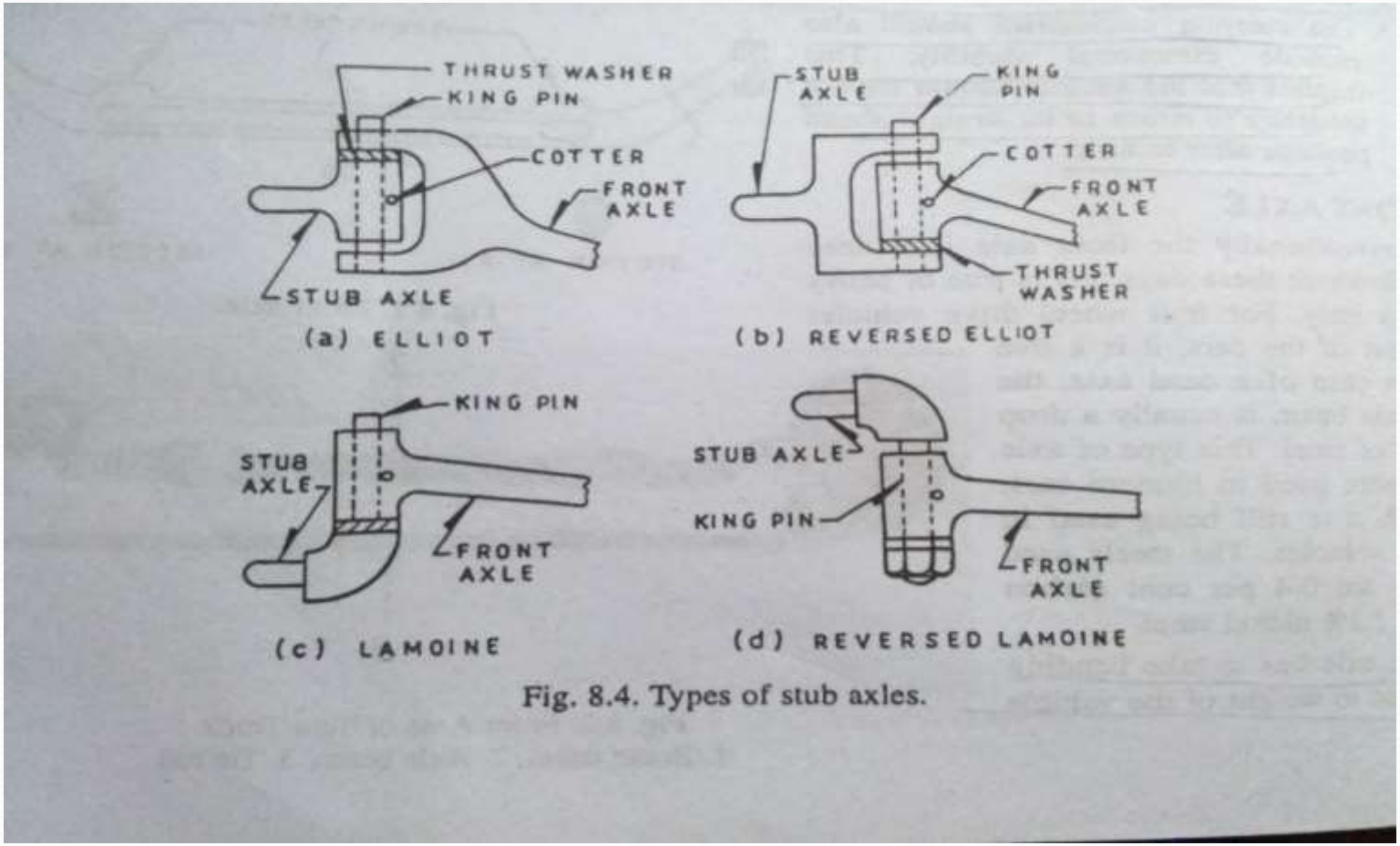


Fig. 8.4. Types of stub axles.

STUB AXLES

FRONT AXLE

INTRODUCTION :

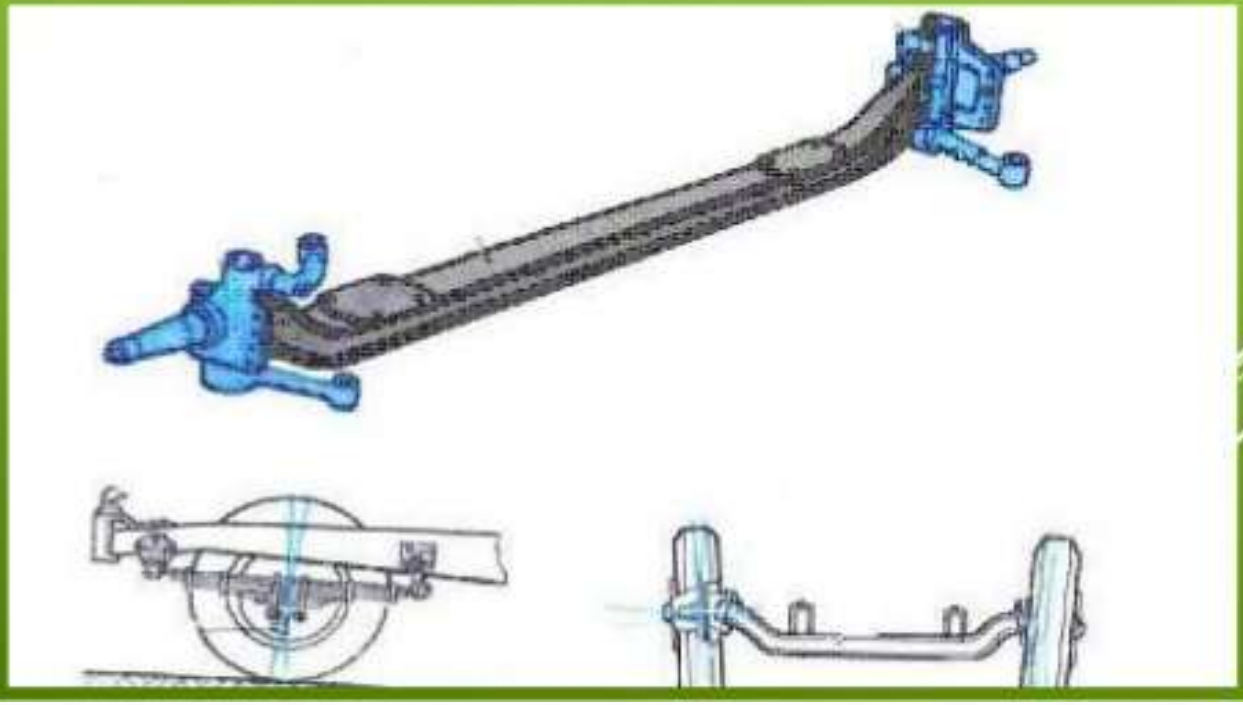
- Front axle is used to carry the weight of the front part of the vehicle .
- It facilitates the stearing mechanism.
- It absorb shocks due to the road surface variations.
- It must be right and robust in construction.
- It is made of "I" section in the centre portion , while the ends are made either circular or elliptical.
- Different components of the front axle are the axle beam , stab axle , king pin , tie rod.

Types of Front Axles

Usually there are two main types of front axles

1) Live axle 2) Dead front axle

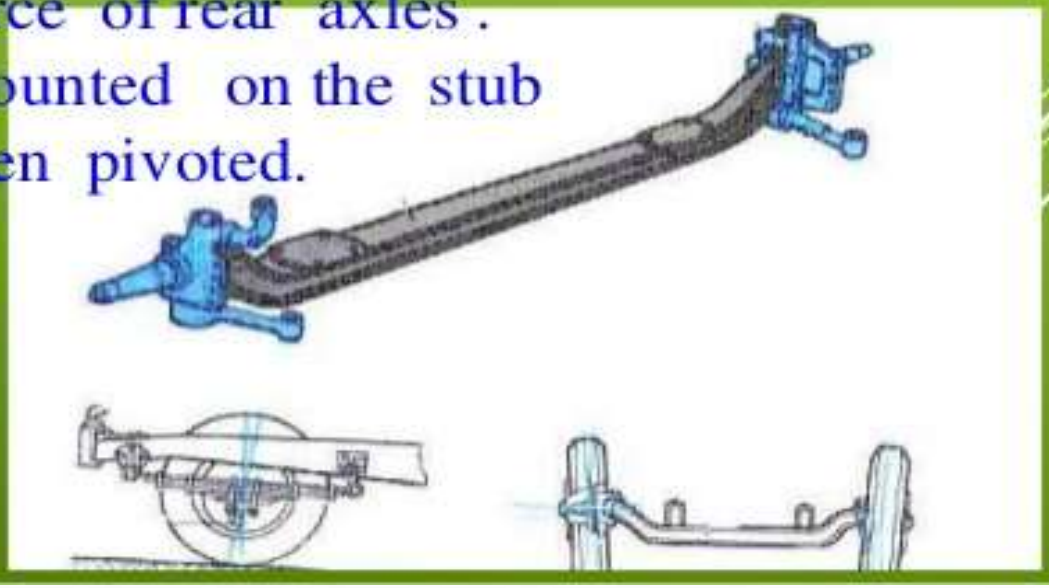
1) - Front axles are usually dead axles because they do not rotate



Types of Front Axles

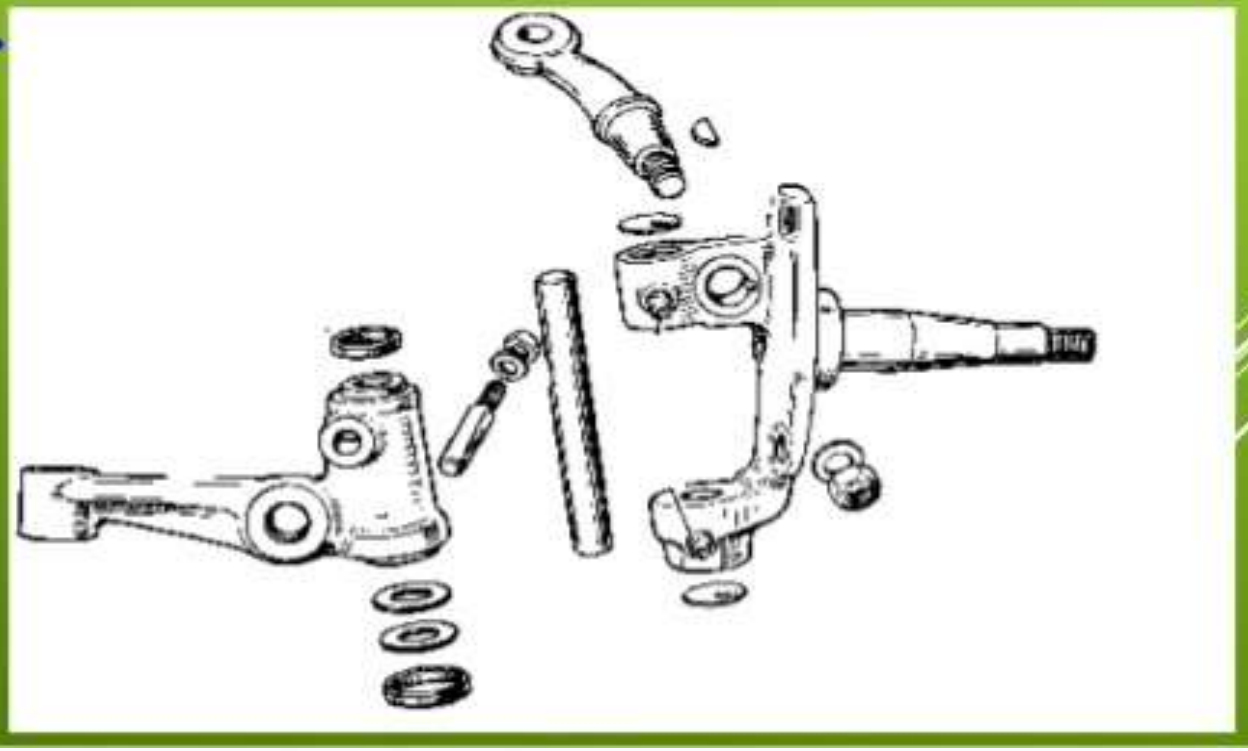
- A live front axle receives additional power from the gear box transfer case
- Live axle receives the power of the engine

2) Dead axle do not receive the power of engine but moves with the help of the driving force of rear axles. The wheels are mounted on the stub axles which are often pivoted.



STUB AXLE

- The stub axle turns on the king pin which is a light drive fit in the axle beam eye located and locked by a taper cotter pin.



Types of Stub Axles

There are four types of stub axles

1. Elliot
2. Reverse Elliot
3. Lamoine
4. Reverse Lamoine

STUB AXLE

-Bronze buses are fitted in to the forked ends of the axle to the axle to provide a bearing surface for the king pin.

- Vertical load are taken by thrust bearing` located either on the top fork of the stub axle are between the lower fork and the underside of the beam.

ELLIOT TYPE

In elliot stub axle is attached to the front axle by placing it in the yoke end with a king pin and cotter pin to poin two together

REVERSE ELLIOT

In reverse Elliot type stub axle the arrangement is reversed. It is widely used in current auto mobiles used in trucks

LEMOINE

In lemoine type stub axle instead of yoke type hinge a L- shaped spindle is used as shown in fig used in tractors

REVERSE LEMOINE

It is the reverse position of lemoine but not used in modern automobiles.