

DESIGN AND ANALYSIS OF LOCKING IN BOTH DIRECTIONS IN AUTOMOBILE.

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ABSTRACT

Automobiles are now becoming the most essential part of our day-to-day life. With increased parking difficulties and heavy traffic problems, equipping the forward and reverse system with more facilities is their major objective. In addition to that gliding of vehicles in gradients and mountain roads occurs often due to driver's carelessness. In this project, we made a simple and economical solution to the above mentioned problem. We used freewheel mechanism as our major capital and fabricated an equipment which can be attached to any automobile that it prevents unwanted reverse motion when it is at rest or in motion. The attachment is to be welded with the wheel rim and the pawl with a retraction spring or a lever mechanism is fabricated with the frame. Due to cost factors a small prototype of this project was done. Here we did a model with two metal wheels connected with a shaft. A rectangular frame is welded with the shaft and a lever attachment is provided in it to engage and disengage the pawl. The freewheel is welded with one of the wheels.

Key words: Freewheel mechanism, bevel gear, Lever mechanism.

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. Road transport safety is an important issue in the land transport sector. Driving mistakes made by drivers may be more serious because of the weight, size, shape, braking abilities, etc., of the vehicle.

The main types of transport accidents are:

- Vehicle crashes
- People falling from vehicles
- People struck by objects falling from vehicles, or vehicles overturning.

The analysis of European Statistics on Accidents at Work (ESAW) data reveals that 29% of fatal accidents at work are due to **loss of control** of means of transport or **handling equipment**. Thus, improper handling and loss of control over vehicles may cause a severe threat to both the drivers. Unexpected reverse motion of vehicles in gradients and mountain roads is one of those problems which may cause disastrous accidents. Even though modern vehicle has modern equipment like parking assistance system, hand brake, etc., driver's carelessness will cause serious damages.

The major objective of our project is to prevent these types of accidents with some simple and economical means. It has Freewheel as its major component. A freewheel is nothing but a mechanical device that allows continuous linear or rotary motion in only one direction while preventing motion in the opposite direction. Ratchets are widely used in machinery and tools. With this equipment we can prevent the unwanted reverse motion of a vehicle during all situations. A freewheel is to be welded with the wheel rim of the automobile and the pawl arrangement is connected to the chassis. The driver has control over this arrangement that it does not automatically

got engaged with the freewheel the vehicle is driving below certain speeds. This is our project description and due to cost considerations a small prototype describing this principle was done for this purpose.

Stopping safely is one of the most important functions a motor vehicle can performed. Failure of the brake system will almost invariably result in property damage, personal injury, or even death. Consequently, a great deal of consideration has been given to improving the brake system in trucks and passenger cars over the last nine decades. According to Mr. Willie D. Jones in the IEEE SPECTRUM magazine (September 2001), a person dies in a car crash every second... Automation of the driving control of vehicles is one of the most vital needs of the hour. Various system or methods have been developed and the improvement is still continuous for the safety of Driver, Passengers as well as vehicle.

2. LITERATURE REVIEW

The literature towards the design methodologies proposed by different authors is collected and presented in the subsequent paragraphs.

RAVI INGLE (2014)

The whole system works only while reversing the vehicle. When the sensor senses any obstacle behind the vehicle, it sends signal to the control unit (solenoid valve and flow control valve) which allows the passage of air from the compressor to the pneumatic cylinder which push the piston forward and results in stopping the running wheel. Thus we have developed an “**AUTOMATED PNEUMATIC BRAKING SYSTEM**” which helps in understanding, how to achieve low cost automation. The application of pneumatics produces smooth operation.

A.ARUNKUMAR (JAN, 2015)

In this work the mechanism has been developed to stop the vehicle from rolling backwards when the vehicle is moving in the hill roads. Ratchet and Pawl mechanism has been identified to arrest the motion to the front axle. Anti-Roll Back mechanism has been fabricated and tested on the front axle assembly. The mechanism works well.

MRUNMAY RAUT(MARCH, 2016)

The “Automobile Reverse Locking Differential Mechanism” is a preferred embodiment provides systems and methods for preventing a vehicle from reverse movement on a slope. This system consists of a heavy commercial vehicle, ratchet and pawl device connected to at least one wheel of the vehicle and actuator which will control the movement of the pawl while engaging or disengaging the mechanism where in the system may be engaged using an engaging mechanism when reverse motion is undesirable or to be restricted, and may be disengaged when the reverse motion is desirable.

SOURABH SANTOSH JOSHI (APRIL, 2017)

In this project work the design and construction of a model of automatic braking system for vehicles in hill station is to be developed. The mechanism has been developed to stop the vehicle from rolling back word when the vehicle is moving in the hill roads. This construction made of two phases in a first deigns of ratchet and pawl mechanism, frame, shaft, etc. is done and in second sensor selection and interference is done. Ratchet and pawl mechanism has been fabricated and assembly with sensor interface is tested.Thus the mechanism can stop the vehicle from rolling back in hill roads.

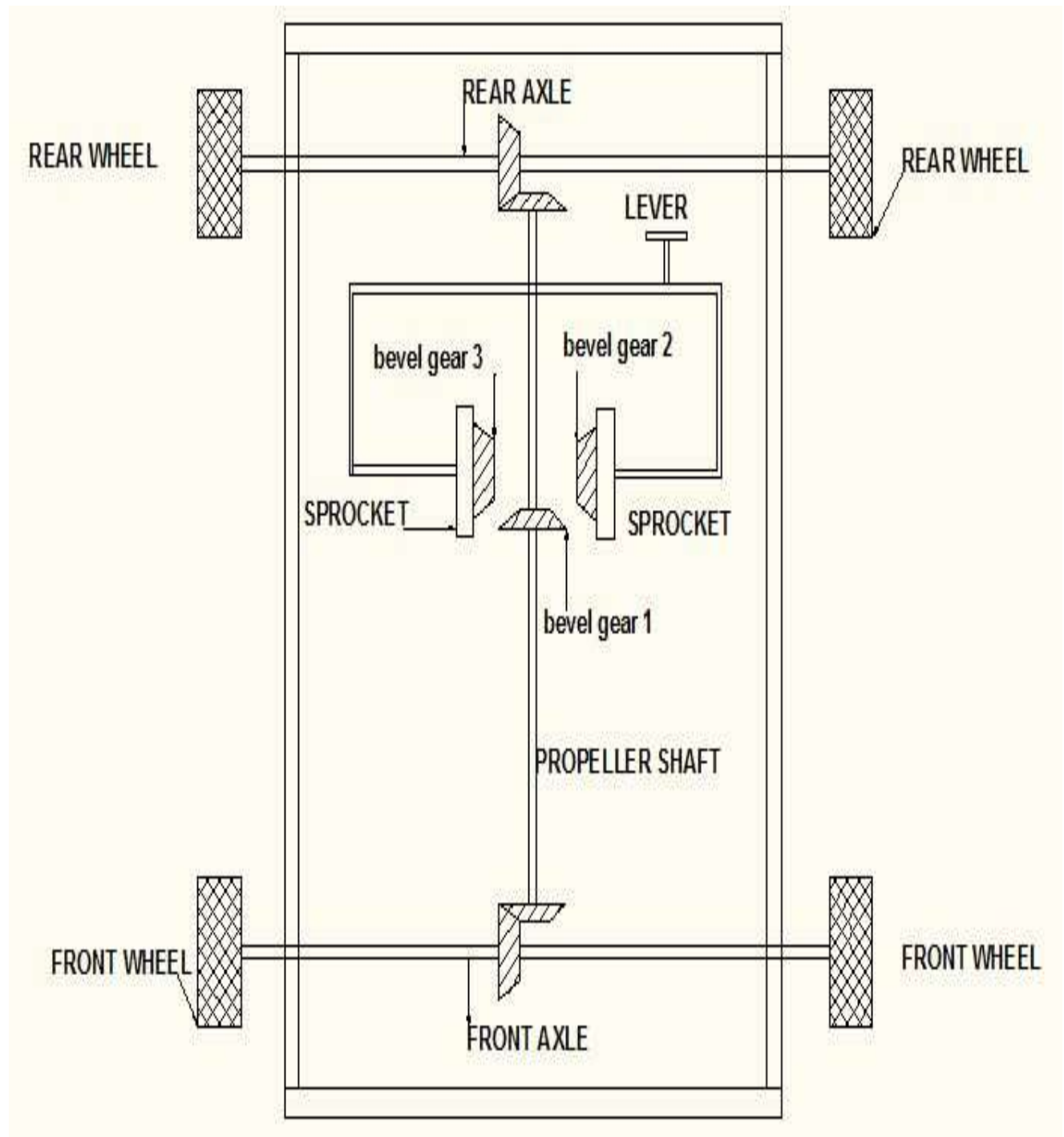
3. MATERIALS :

S.NO	MATERIALS	QUANTITY
1	Hollow mild steel shaft	3
2	Metal frame	As req.
3	Sprocket	2
4	Bevel gear	7

4. MATERIAL PROPERTIES:

SL.NO	PROPERTIES	CASE HARDENED STEEL	MILD STEEL
1	Tensile strength	530 Mpa	370 Mpa
2	Yield strength	385 Mpa	247 Mpa
3	Young's modulus	210 Gpa	200 Gpa
4	Shear modulus	80 Gpa	79.3 Gpa
5	Poisson's ratio	0.3	0.3
6	Density	$7.85 \frac{g}{cm^3}$	$7.85 \frac{g}{cm^3}$

5. SCHEMATIC DIAGRAM AND WORKING METHODOLOGY:

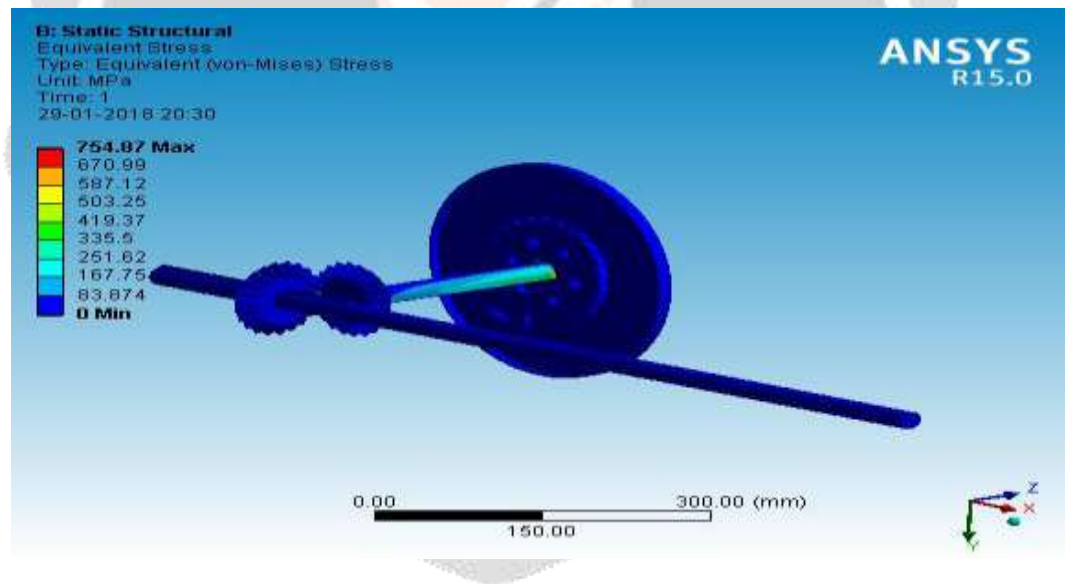


- When a normal vehicle is moving on an inclined path in a heavy traffic or if it is stopped on the slope and then suddenly started, it tends to move backwards.
- This can cause an accident with the vehicle just behind. In the normal running of a vehicle we have to perform three tasks at the same time i.e. disengaging the handbrake, releasing the clutch and at the same time accelerating the car. It can prove to be difficult for a novice driver.

- To solve this problem, we make use of a freewheel, which is attached to the bevel gear1 to the propeller shaft.
- This freewheel is engaged with the help of lever and is coupled with the bevel gear of the propeller shaft.
- The motion of freewheel is restricted in reverse direction. So, when the vehicle is moving in the forward direction then freewheel also moves in the forward direction.
- But when the vehicle is moving in reverse direction then the freewheel restricts the reverse motion.
- At the same procedure bevel gear2 directly attached to the freewheel. The vehicle moves only reverse direction, but not move in forward.
- Hence, the accidents can be avoided. Bevel gear1 is directly attached with transmission shaft.
- Bevel gear2 is weld with sprocket which is connected to the lever by link.
- When the vehicle moves in slopes the lever is operated to engage the bevel gear 2 with bevel gear1.
- Due to bevel gear2 weld with the sprocket the vehicle moves only in forward direction. Vehicle doesn't move backward.
- At the same procedure bevel gear 1 and bevel gear 3 are engaged the vehicle move only in reverse direction, but not move in the forward.
- When we pull the lever backward, the bevel gears are disengaged, now the vehicle moves in both directions.

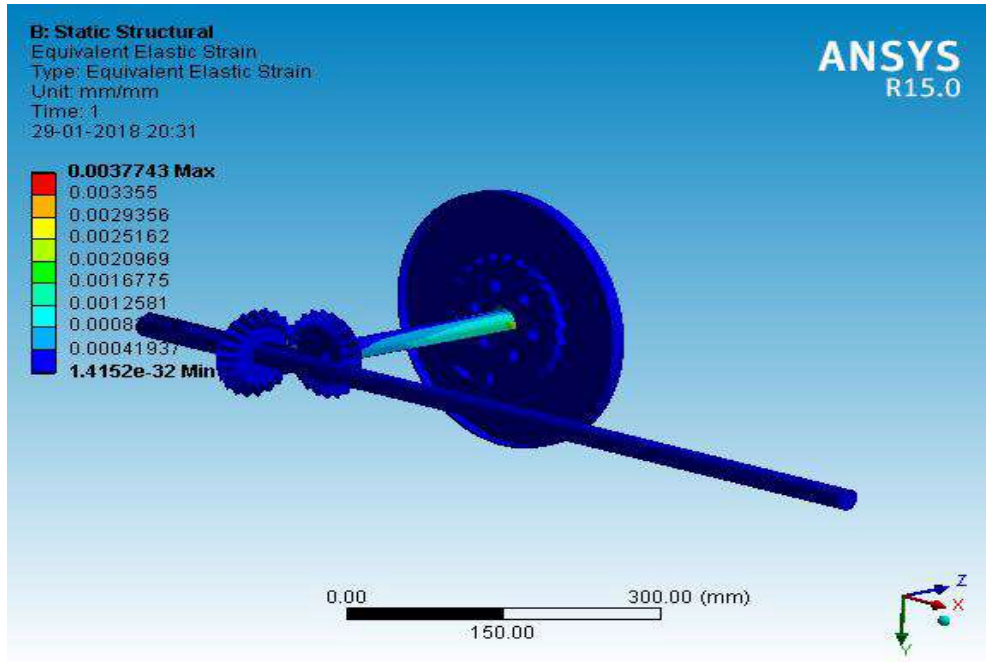
6.RESULT DISCUSSION:

6.1 EQUIVALENT STRESS RESULT



- In the above result the maximum stress for the material is $754.87 \frac{N}{mm^2}$ which are indicated as red color but the stress obtained in our project is $419.37 \frac{N}{mm^2}$ which is less than the indicated value so we conclude that the design is safe for stress condition.

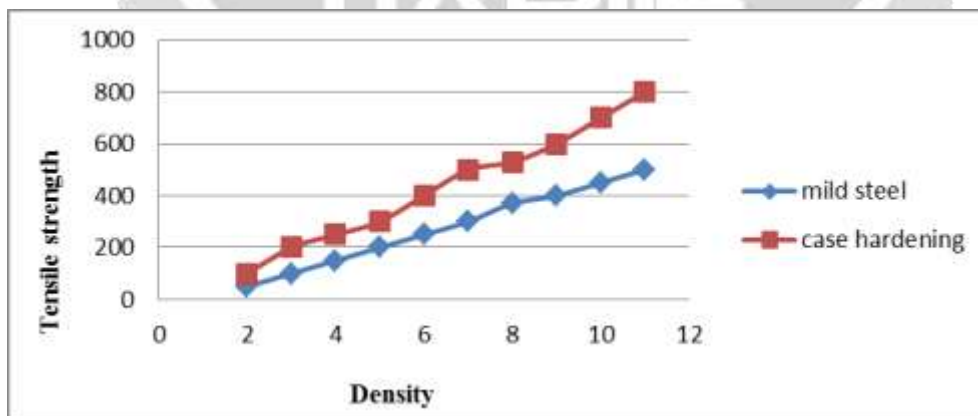
6.2 EQUIVALENT STRAIN RESULT



- In the above result the maximum strain for the material is 0.0037743 which are indicated as red color but the strain obtained in our project is 0.0025162 which is less than the indicated value so we conclude that the design is safe for strain condition.

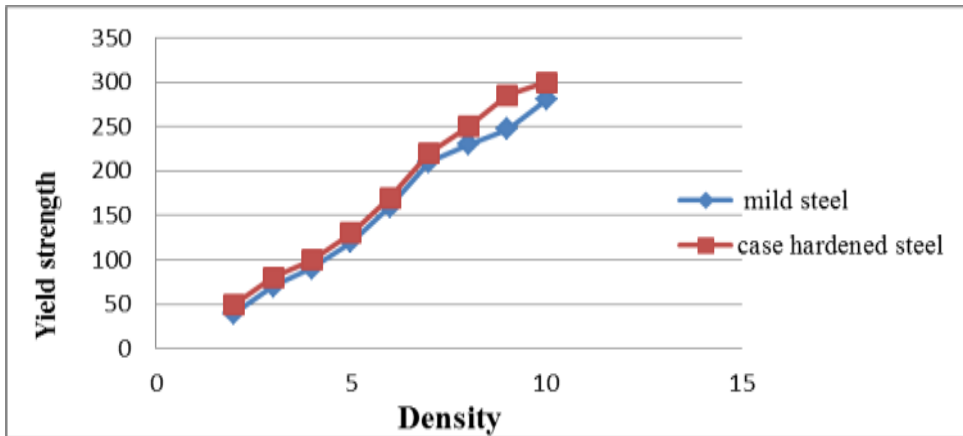
7. GRAPH RESULTS:

7.1 Density vs Tensile strength



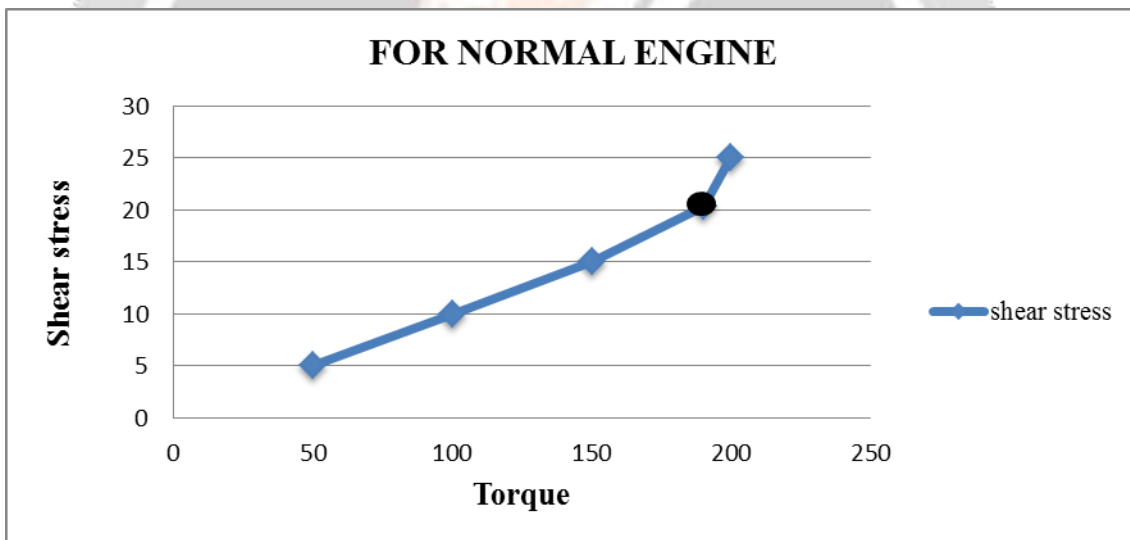
- Tensile strength is the capacity of the material to resist the breaking when the load applied. Here the tensile strength for case hardening steel is higher than the mild steel so this case hardening steel is used for the manufacturing of bevel gears and sprocket.

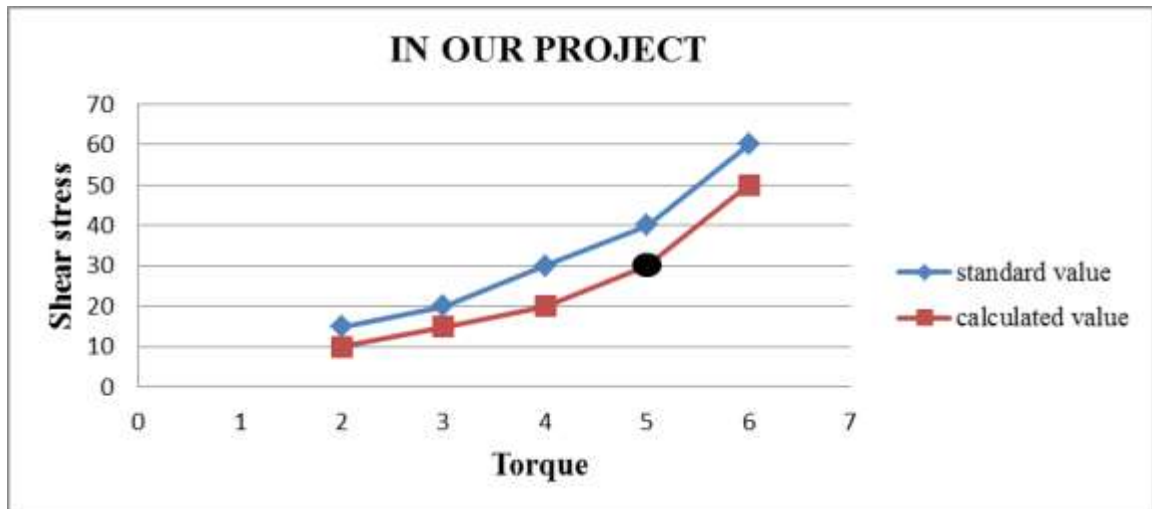
7.2 Density vs Yield strength



- Yield strength or yield stress is the material property defined as the stress at which a material begins to deform plastically. Here the yield strength for case hardened steel is slightly greater than mild steel. So both materials are used for the purpose.

7.3 Torque vs Shear stress





- Shear stress arises from shear forces, which are pairs of equal and opposing forces acting on opposite sides of an object. *Shear stress*, force tending to cause deformation of a material by slippage along a plane or planes parallel to the imposed stress. In both cases such as in normal engine and in our project the calculated shear stress values is less than the standard value of $40 \frac{N}{mm^2}$
- Therefore the design is safe and it has the capacity to withstand the load to resist the braking so it is possible to employ this mechanism in vehicles.

8. CONCLUSION:

All the design and fabrication works is very simple and we can understand easily and less skilled drivers can be sufficient to operate this machine. We hope that this project will better make our future career development. Thus the mechanism can stop the vehicle from rolling backward and forward in hill roads. This would be more helpful for the drivers to drive their cars comfortably in hilly roads and he can take off the car in the hill without rolling the car. The project locking system for hill station vehicle using lever has been successfully designed and tested. It has been developed by integrating features of all the components used. Presence of every component has been reasoned out and placed carefully thus contributing to the best working of the unit.

9. REFERENCE:

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