International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 11 | Nov -2016 www.irjet.net p-ISSN: 2395-0072

A Design and Fabrication of Overload Detection System in an Automobiles

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Abstract - *In this modern world, vehicle is fundamental need for everyone. So both the rich and poor need a vehicle (at least a bike) for their transportation. Buying a bike is not a difficult thing today. But the increasing in price of fuels made him difficult to manage the expenses. Hence a bike with good mileage will be a better choice. Even though the bike gives good mileage, the handling decides its mileage. One important factor which lowers the mileage is overload. When a bike is overloaded its mileage and performance will be decreased. Therefore an overload detector or indicator will be helpful in indicating in case a vehicle is loaded over its limit. This project mainly focuses on improving the mileage and performance with the help of overload indicator. This system needs no extra space as it is placed inside the shock absorber.*

Key Words: Fuel Economy, Over Load Detector.

1. INTRODUCTION

Overloading in vehicles decreases the mileage, performance and also difficult to handle them. When the vehicle is overloaded, the engine needs more power to pull the vehicle. So the fuel supply to the cylinder is increased than the normal loading case. Hence there will be a mileage drop in the vehicle thus decreasing the performance. Vehicles that are overloaded cause excessive wear and damage to roads, bridges, and pavements etc. Serious overloading can affect your safety by making the vehicle less stable, difficult to steer and take longer to stop when braking. As the fuel cannot be renewed and it is of high cost it becomes one of major problem in wasting them. This has to be controlled.

In order to control the mileage drop and therefore the performance there is a need of overload detector in the vehicle. These detector indicate whenever the vehicle is overloaded. When the vehicle is overloaded above the permissible level the spring get compressed and the rod inside the spring touches the bottom surface. Thus the circuit becomes closed circuit and rod begins to conduct making the LED indicator to glow.

2. DESIGN METHODOLOGY

2.1 Design Setup

The overloading detector setup consists of the following parts. They are spring, metallic rod, electric circuit, wooden board, etc.

2.2.1 Springs

A coil spring, also known as a helical spring, is a mechanical device which is typically used to store energy and subsequently release it, to absorb shock, or to maintain a force between contacting surfaces. They are made of an elastic material formed into the shape of a helix which returns to its natural length when unloaded.

Fig -1: Open Coil Spring

2.2.2 SPRING DIMENSIONS:

- Diameter of spring wire (d) = 3.5 mm
- Diameter of spring (D_1) = 41 mm
- Mean diameter (D= D_1-d) = 37.5 mm
- No. of turns (n) = 13
- Height of spring (h) = 155 mm
- Pitch (h/n) =11.95 mm
- tan a (pitch/D) = 0.318
- a = 17.6 deg.

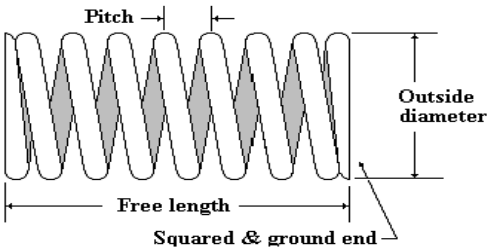

Fig -2: Spring Specification

2.2.3 SPRING CALCULATIONS:

- Applied Weight (w) = 50 N
- Max shear stress (Q) = (8wD)/ (3.14*d*d*d) (N/mm^2)

  = (8*50*37.5)/ (3.14*3.5*3.5*3.5) = 111.36 N/mm^2
- Stiffness of spring (k) = w/d (N/mm)

  = 50/31 =1.61 N/mm

$$\text{Deflection} = \frac{8wnD^3}{d^4 Cos\,a}\left(\frac{\cos 2a}{N} + \frac{2\sin 2a}{E}\right)$$

Table -1: OBSERVATIONS ON OPEN COIL SPRINGS

S.NO	LOAD(W)	INITIAL READING (IR)	DEFLECTION FOR INCREASING LOAD		DEFLECTION FOR DECREASING LOAD		AVERAGE DEFLECTION
	N	*Cm*	*FR*	*FR-IR*	*FR*	*FR-IR*	*mm*
1	2	35.5	36.1	0.6	36.1	0.6	6
2	4	35.5	36.5	1	36.5	1	10
3	6	35.5	36.6	1.1	36.6	1.1	11
4	8	35.5	36.6	1.1	36.6	1.1	11
5	10	35.5	36.9	1.4	36.9	1.4	14
6	12	35.5	37	1.5	37	1.5	15
7	14	35.5	37.15	1.65	37.15	1.65	16.5
8	18	35.5	37.2	1.7	37.2	1.7	17
9	20	35.5	37.3	1.8	37.3	1.8	18
10	24	35.5	37.6	2.1	37.6	2.1	21
11	28	35.5	37.7	2.2	37.7	2.2	22
12	30	35.5	37.9	2.4	37.9	2.4	24
13	34	35.5	38	2.5	38	2.5	25
14	38	35.5	38.1	2.6	38.1	2.6	26
15	40	35.5	38.3	2.8	38.3	2.8	28
16	46	35.5	38.55	3.05	38.55	3.05	30.5
17	50	35.5	38.6	3.1	38.6	3.1	31

2.3 Wooden Board:

Wooden board is used to hold the springs in a fixed position so that they do not move during environmental vibrations. It is also used to hold the springs with smaller diameter inside the in the middle of the springs with large diameter in a fixed position. Wooden board is used to hold the spring at both the top surface and the bottom Surface. A small hole is half drilled at the wooden board whose thickness is half of the wooden board Thickness and its diameter of the hole is exactly same as the external diameter of the spring. The springs and metallic rod are being fixed to the wooden board as shown in Figure 3.

Fig -3: Spring with wooden board

Another hole is drilled in the center of the half drilled wooden board whose diameter is as same as the diameter of the metallic rod which is on the top wooden surface. In the bottom wooden surface a hole is drilled straight to the metallic rod and a bolt is fixed through the hole and a nut is used to tight the bolt.

3. Working Methodology

The overload detector is used for indicating the overload in two wheelers. This mainly depends on the compression of the spring. Two wooden boards are used. Two springs are fixed in between the two wooden boards. The springs with smaller diameter is inserted within the two springs which are fixed to the top wooden board. The length of the spring with smaller diameter is lesser than that of the spring and it also depends on the tension of the spring. The two rods are connected by a metallic connecting wire and is connected to the positive terminal of the LED. The negative terminal of LED is connected to the positive terminal of battery. The two screws in the lower wooden board are connected to negative terminal of the battery.

When load goes beyond its permissible limit the spring gets compressed and the smaller springs inside the spring touches the bottom screw which is attached to the lower board. Thus the model becomes a short circuit leaving the electron flow from positive to negative of the battery.

Thus circuit is capable of conducting current which leads the LED to glow. Thus the overload in the vehicle is indicated using this model.

Fig -3: Model of Overload detectors

When implementing in two wheelers the springs are replaced by the shock observers in them. The smaller springs is inserted within the shock observers. The length of small spring is smaller than that of the shock observer. Depending upon the tension of the spring the small spring length can be adjusted. The two small springs are connected by a metallic connecting wire and is connected to the positive terminal of the LED. The negative terminal of LED is connected to the positive terminal of battery. The two wheeler battery is used in original care but in the model a battery holder with two batteries is used.

The over load detector does not require a separate space in the vehicle as the rod is placed inside the shock absorber which act as the spring in our model.

4. Demerits of Overloading

- Vehicles that are overloaded cause excessive wear and damage to roads, bridges, and pavements etc.
- Serious overloading can affect your safety by making the vehicle less stable, difficult to steer and take longer to stop when braking
- Overloaded vehicles are in unfair competition with other hauliers. In the long term, keeping within weight limits may keep you employed and your firm in business
- Overloaded vehicles are illegal - this may affect the insurance cover for the vehicle
- Overloading vehicles leads to decrease in mileage and performance

5. CONCLUSIONS

- By using overload detector we can detect overload in bikes easily. Also it improves the mileage and performance of the bikes
- No extra space is needed as we can place this setup in the shock absorber itself
- Also the cost of the setup is very cheap. So this is essential for safe loading of every vehicle
- Simple circuit connections only

6. FUTURE WORK:

The setup which we shown above is just a model of this project and how it will work in practice. Actually we will place this setup under the seating position. In that case four springs of high tension and less no of turns will be used along with a load cell. A load cell is a transducer which will converts a force into electrical signal. Depending upon the maximum load capacity of vehicles, the tension of the spring can be chosen.

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