Hydraulic Spring Testing Machine

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Abstract- *In Industries they purchase the springs for their hydraulic valves but they are facing the problem of checking the spring stiffness. After understanding the Industries problems for spring testing we designed and developed hydraulic spring stiffness testing machine. Only considering the two parameters load and deflection we can calculate spring stiffness. The machine is based on the requirement of the company which manufacture different valve. So according to the requirement of company, hydraulic spring testing machine is developed. Springs isolate the driver from road imperfections by allowing the tyre to move over a bump without drastically disturbing the chassis. If the chassis remains fairly steady then the tyres are better able to follow road contours automatically. While springs do an excellent job of smoothing over bumps, they will keep bouncing once started. In other words, the chassis continues swaying and the tyres keep hopping long after the vehicle strikes a bump. Left uncontrolled, springs give an uncomfortable ride with very poor tyre to road contact. To control this undesirable behavior, a shock absorber keeps the spring from over reacting to every bump or dips and not only prevents but also balances excess movement of the tyre and chassis. Springs are durable items and are easily inspected. If the ride height of a vehicle has decreased excessively or a coil/ leaf has broken it is advisable to replace the springs in axle sets. Consumers also often change springs to alter their vehicle's ride and handling characteristics. Spring problems are generally easy to identify.*

Keywords- Hydraulic Jack, Pneumatic Cylinder, Pressure, Scale, Spring.

I. INTRODUCTION

An engineer is always focused towards challenges of bringing ideas and concepts to life. Therefore, sophisticated machines and modern techniques have to be constantly developed and implemented for economical manufacturing of products. At the same time, quality and accuracy factor is considered. A spring is defined as an elastic machine element, which deflect under the action off the load and returns to its original shape when the load is removed. Stiffness and spring index are the main parameters of spring design. Spring stiffness is the force per unit deflection1. These parameters are considered for defining the spring. In designing and developing the spring testing machine, these parameter is considered. Hydraulic principle considered while designing and developing the stiffness machine.

The most common method for checking the performance of shock absorbers is for the owner or mechanic to jump up and down on the car bumper and observe whether or not the car motion appears to be adequately damped. When the shocks are completely worn out, it is clear that the damping is inadequate, however by the time the wear is readily observable, the car owner has been driving for an extended period of time with bad shocks. By then the owner has learned to hate his vehicle, the tyres have been abnormally worn, and the road ability has deteriorated to the point that he or she has been driving dangerously all over the road. Main reason for replacement of shock absorber (spring) is physical damage. Spring stiffness must be checked before replacement. This test rig will give the force applied on spring. With the help of force and deflection produced, we can calculate stiffness of spring. By varying the force, we can obtain corresponding deflections. We are going to study the suspension characteristics of spring by graphical method.

Now the project mainly concentrates on designing a suitable operating system. To maintain simplicity and economy in the design the locally fabricated unit has been used.

Our project achieves higher safety, reduces human effort, increases the efficiency, reduces the work load, reduces the fatigue of workers and reduces maintenance cost.

Many companies manufacture valves and they required the springs for installing in their products (hydraulic valves).Depending upon the valve size there is variations in sizes and shapes of springs, hence company are facing problem of checking stiffness of spring. Understanding the Industry problems, we have designed and developed a hydraulic spring stiffness testing machine.To fabricate a model of spring stiffness testing machine which calculate the stiffness (k) of spring.

II. CAD MODEL

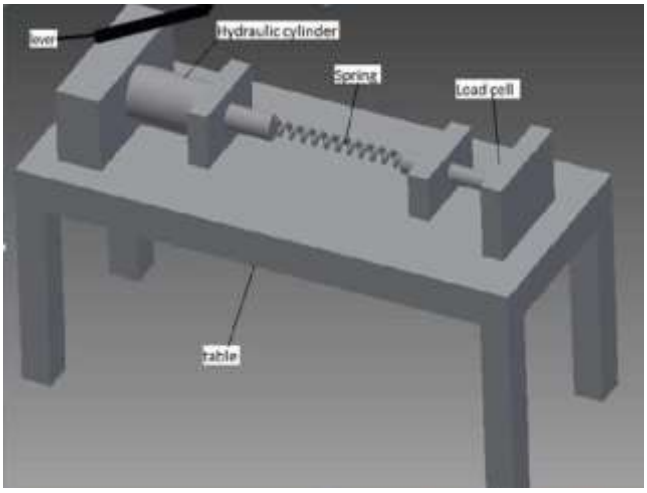

Fig. 1. CAD model of Spring Stiffness Testing machine.

Fig. 2 Working model of Spring Stiffness Testing machine.

III. WORKING

There are two cylinder of different diameter, which is interconnected by same liquid. The pressure is transmitted from larger cylinder to smaller cylinder by application of a lever. The smaller cylinder is having plunger and larger cylinder is having ram (piston and piston rod). Larger cylinder is having a lever mounted over it. When force is applied by lever it gets multiplied to many times and that multiplied force acts on the plunger. Due to this force the plunger compresses the liquid. The liquid will be pressurized as it is confined between plunger and piston. This pressure in liquid is transmitted by liquid to piston. As the piston is having larger area then plunger, the force delivered by piston and piston rod is much larger then force acting on the plunger. The piston rod moves outwards and presses the hardened ball through dent pipe supported between the two pillars and dent is removed to required size. When the release knob is opened the pressurized liquid gets escaped into the reservoir and due to the spring action of retracting spring the piston is brought backward.

IV. CONSTRUCTION

It consists of square bars, hydraulic jack, hydraulic cylinder spring, scale, pressure gauge which is placed on hydraulic cylinder which measures the pressure. Hydraulic jack is mounted on base frame which acts a force on spring and compress it. The deflection in spring is measured by scale.

Components:

1. Hydraulic cylinder
2. Hydraulic jack
3. Scale
4. Spring
5. Load gauge or pressure gauge
6. Supporting Frame

V. CALCULATION

Pipe Hight:- 27 inch
Pipe Width:- 12inch
Pipe Length :- 12inch
Spring Length:-8inch
Hydraulic Cylinder Weight :-4000 ton
Hydraulic cylinder:- 32 dia & 60 mm dia
Pressure gauge :-o-100 bar
Pressure gauge reading in bar=5
1 bar = 10N/m2
28 bar = 280N/m2
a = annular area of cylinder in m
a = 67858.4mm
$A=2\pi rh+2\pi r2$
r=60,h=120
A=0.06785m2
Load= P×A
Load= 280×0.6785=19N
Deflection= 11.16cm= 111.6mm
Stifness (k)=load/deflection
K=19/111.6
Stiffness =0.1702N/mm

VI . CONCLUSION

1. The spring stiffness testing machine is designed and developed by using hydraulic principle.

2. This model will act maximum load of 19 newton and calculate stiffness of spring up to =0.1702N/mm.

3. The result have been varified with the calibrated degital stiffness testing machine.

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