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STUDY OF ELIMINATION OF SPINNING MISSING IN THREE-WHEELER APPLICATIONS

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ABSTRACT

Three wheeler vehicles in India are commonly referred as a heavy load application. With harsh conditions of roads, three wheeler vehicles (TWV) are constantly subjected to various shocks which may bring discomfort to its riders. This is contradictory of its purpose of manufacturing. TWVs are hence provided with oil shock absorbers for its stability. Shock absorbers\ dampers thus plays vital role and hence any defect might turn into complete failure of said purpose. Even delicate parts such as spinning plays important role. This demands zero defects in its manufacturing and assembly. The study provides a detailed review of zero defect mechanism and its application in shock absorbers for avoiding spinning missing due to manual errors.. The aim of this project is to introduce a poke devices to self-eradicate the problem of missing spinning in damper assembly without disturbing its actual process. A detailed analysis of trial and error method used for various poka-yoke devices are also discussed.

I. INTRODUCTION

Three-Wheeled Vehicles form an essential part of public transport for the urban middle class population of India. Apart from India, TWVs are also being used world over for public transport and for carrying freight.

A shock absorber or damper is a mechanical device designed to smooth out or damp shock impulse, and dissipate kinetic energy. Shock absorbers are an important part of automobile and motorcycle suspensions, aircraft landing gear, and the supports for many industrial machines. Large shock absorbers have also been used in structural engineering to reduce the susceptibility of structures to earthquake damage and resonance. A transverse mounted shock absorber, called a yaw damper, helps keep railcars from swaying excessively from side to side and are important in passenger railroads, commuter rail and rapid transit systems because they prevent railcars from damaging station platforms. The success of passive damping technologies in suppressing vibration amplitudes could be ascertained with the fact that it has a market size of around $ 4.5 billion.In a vehicle, it reduces the effect of traveling over rough ground, leading to improved ride quality, and increase in comfort due to substantially reduced amplitude of disturbances. Without shock absorbers, the vehicle would have a bouncing ride, as energy is stored in the spring and then released to the vehicle, possibly exceeding the allowed range of suspension movement. Control of excessive suspension movement without shock absorption requires stiffer (higher rate) springs, which would in turn give a harsh ride. Shock absorbers allow the use of soft (lower rate) springs while controlling the rate of suspension movement in response to bumps. They also, along with hysteresis in the tire itself, damp the motion of the unspring weight up and down on the springiness of the tire. Since the tire is not as soft as the springs, effective wheel bounce damping may require stiffer shocks than

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would be ideal for the vehicle motion alone. Spring-based shock absorbers commonly use coil springs or leaf springs, though torsion bars can be used in tensional shocks as well. Ideal springs alone, however, are not shock absorbers as springs only store and do not dissipate or absorb energy. Vehicles typically employ springs and torsion bars as well as hydraulic shock absorbers. In this combination, "shock absorber" is reserved specifically for the hydraulic piston that absorbs and dissipates vibration. Vehicles without shock absorber give a bouncing ride and uncomfortable experience.

1.1 Problem Statement

Three-Wheeled Vehicles (referred as TWV) form an essential part of public transport for the urban middle class population of India. Apart from India, TWVs are also being used world over for public transport and for carrying freight. Such heavy duty vehicles require high quality shock absorber for its safe and unperturbed performance. This shock absorber is continuously subjected to variable loading conditions and hence their manufacturing need must precision and sharp awareness over any misalignment or missing parts. In such scenario it is evident that even smallest and simplest parts are needed to be accurately manufactured and more importantly perfectly assembled. It is found that spinning been small part could be easily overlooked while assembly either due to manual mistakes or faulty processing. Spinning is part that seal the cap which cover the cylinder filled with oil of shock absorber. In absence of the spinning the shock absorber will definitely fail which is contradictory to its purpose.

1.2 Objective

Detection and prevention of missing spinning in the damper assembly during entire process of production of shock absorber is a heavy challenge. This could only be resolved if a preintimation of occurrence of problem could be achieved or is forced to avoid mistake. Thus a device is need to be placed at that stage which will ensure that the spinning is mounted whenever it is needed to do.

1.3 Methodology

Trial and Error method is implemented for achieving most appropriate poka- device thus ensuring zero defect. Step by step analysis of production process is been understood. Each part of shock absorber is studied to get familiar with the problem. Plotting of graph for presenting the curve for complete elimination of defect is done.

1.4 Defination and Parts of Shock Absorber

A shock absorber or damper is a mechanical device designed to smooth out or damp shock impulse, and dissipate kinetic energy. It is a velocity sensitive device, which resists and /or limits movement by converting kinetic energy into heat energy, which in turn is absorbed by oil and subsequently, dissipated to atmosphere. A shock absorber controls unwanted motion. Following are main parts of shock absorber:

II. TYPES OF VEHICLE SHOCK ABSORBER

Most of the vehicular shock absorbers are either mono tube or twin tube types with some variations on these themes.

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Fig: various shock absorbers

2.1 Mono-Tube

Fig. types of mono-tube shock absorber

The principal design alternative to the twin tube form has been the mono-tube shock absorber which was considered a revolutionary advancement when it appeared in the 1950s. as its name implies, the mono-tube shock, which is also a gas-pressurized shock and also comes in a coilover format, consists of onlyone tube, the pressure tube, though it has two pistons. These pistons are called the working piston and the dividing or synchrony inside the pressure tube in response to changes in road smoothness. The two pistons also completely separate the shock's fluid and gas components. The mono-tube shock absorber is consistently a much longer overall design than the twin-tubes, making it difficult to mount in passanger car designed for twin-tube shocks. However, unlike the twin-tubes the mono-tube shock can be mounted either way. It also does not have a compression valve, whose role has been taken up by the dividing piston, and although it contains nitrogen gas, the gas in a mono-tube shock is under high pressure.

III. MANUFACTURING OF SHOCK ABSORBER

Outer tube is selected as per the requirement demanded by the costumer. For three wheeler the outer tube bore is larger as compared to that of used for two wheeler vehicles. This outer tube is selected from the suppliers catalogues

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Welding line for Monoshocks


Fig. inner tubes received by suppliers **Fig. spring seat luk welding**

3.1 Spring Seat Welding

Valve Seat is provided for resting of spring valve. This valve seat is welded to the outer tube through seam welding on valve seat welding machine. The hollow tube is fixed into jaw and locked through fixtures. Then the valve seat which in the form of a ring is inserted on the tube. The tube is rotated at slow speed rate at about 0.2 rpm. The tube and the seat is seam welded together fixing them tightly together.

3.2 Seal Cap Pressing and Spot Welding

The seal cap of the shock absorber is a cup shape structure with groove for guiding oil from inner tube to outer reservoir. The seal cap is press fitted at one end by press fitter machine and then tested on seal cap testing machine. After approval, the tested pressed tube is spot welded over the rim to seal one end completely.

3.3 Eye Ring Projection welding

Eye Ring is a round ring type structure for hooking of damper to the chassis. This ring is welded to cap by projection welding method. Through this method precise and point welding is possible. This process is carried out on Eye Ring Projection Welding machine. The work piece i.e. the outer tube is fixed in fixture vertically. The point nozzle for welding is placed horizontal or in some sensitive cases at a particular angle for better welding. only the site were the ring is to be fitted is heated and then immediately ring is placed over it joining by precise amount of welding fluid which hardens on cooling giving a neat and clean joint. Thus after the above three welding processes the worked piece is called as the outer tube sub assembly. This part is the stored in trays and then tested for final approval on testing machine. Then is send to assembly line

3.4 .Bottom Seal cap seam Welding

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Seal caps are used for sealing the inner tube to use is as a cylinder to fill in oil. Caps are of generally hemispherical shape and hence are joint through seam welding. The joints are subjected to high temperature flame and a third material is used as connector of two parts. This material melts and seals this parts when quenched in cold water. Some times Mike welding is used for better results.

3.5 Rod Line

The piston rod has diameter less than the inner tube and are threaded on both ends. The piston is inserted on piston rod above the pressure rings. Between this rings rubber pads are provided. This helps in holding the piston in place. The lower end is sealed by a nut and other end is fitted with piston seat assembly last with upper perforated ring for releasing pressure during partial loads. The entire part is called as piston sub assembly. This is then send to the assembly line inventory.

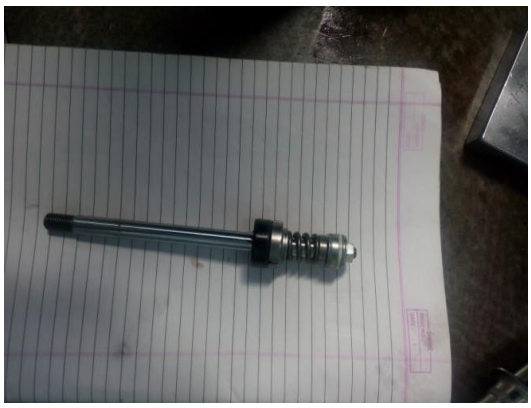
3.6 Base Valve Line

It is fitted with a perforated cap valve and pressed and then tested for precise alignment. This is carried out on pressing machine and tested on rod testing machine. This is called as inner tube sub-assembly. This is compiled in inventory and then turned to assembly line.

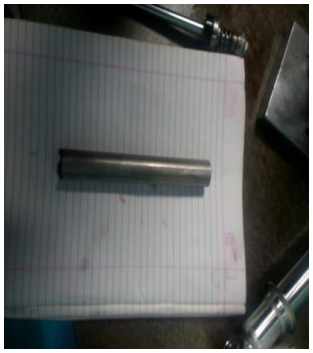
3.7 Assembly Line

There are following main parts in damper assembly;

OUTER TUBE SUB ASSEMBLY

- PISTON ROD ASSEMBLYINNER TUBE SUB ASSEMBLY

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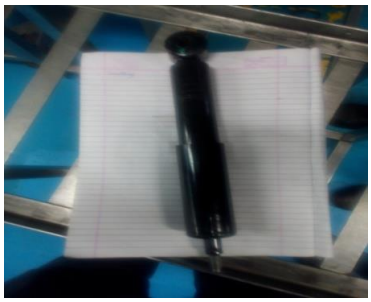
- COMPLETE ASSEMBLY

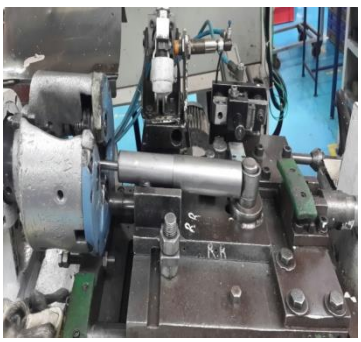
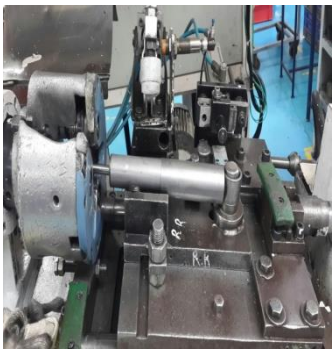
IV. IN THE DAMPER ASSEMBLY

A piston is assembled on the piston head of the piston rod.

- A compression valve is assembled on the one one end of the inner tube.
- Piston rod is then inserted into the inner tube.
- Inner tube is further inserted into the outer tube and the shox oil is filled into the system.
- Inner Car/Van support valve is then assembled in the outer tube which supports the piston rod inside it. Rod seal is also used to avoid oil leakage.
- Body nut car/van is then assembled on the outer tube to avoid dust from outside, avoiding the movement of inner tube outside the outer tube. The bumper is then assembled at last above the outer tube body nut to avoid the metal to metal contact during the sudden loads. The whole assembly now is called as DAMPER:
- Then, the damper is tested for torqing and resistance checking on Torqing machine and Resistance checking machine with load indicator respectively.
- The resistance checking machine works on the principle that when the cyclic loads(tensile and compressive) applied on the damper ,accordingly LVDT gives the analog signal to PLC, thus the output of PLC is used to plot the graph between the load and time.

V. SPINNING PROCESS

It is the process of bending spinning's at the outer tubes end to seal the damper assembly. It is done on the spinning machine.

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VI. INSPECTION LINE

Following are the inspection counters:

1. Outer tube testing machine
2. Inter tube tolerance testing machine
3. Seal fitting testing machine
4. Assembly manual inspection counter

The parts are directly packed and sent to customers in distant locations. Going green, it has now started using returnable bins. The company supplies about 16 times in a day as the OEM holds stock only for 3 hours. The vehicle manufacturer also gives a JIT (Just in Time) schedule well in advance on the time slot for the parts to be delivered. The time allocated is 120 minutes (75 minutes for transportation and the rest for loading and unloading), therefore, Gabriel holds one day stock

VII. OCCURANCE OF ERROR

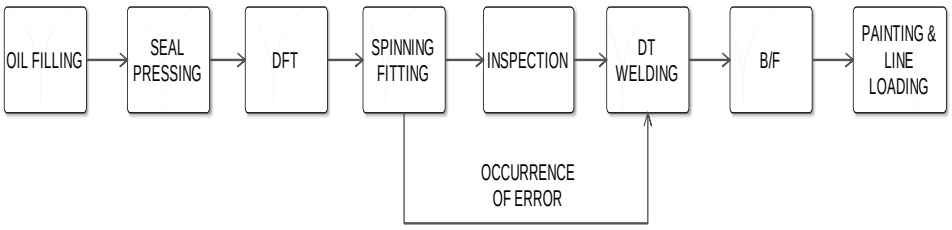

Fig. Bock Diagram for Occurrence of Error

After main assembly oil is filled within the cylinder. Filling a shock absorber with oil is a messy and time consuming job, and in the end all that effort, the shock absorber still has quite some air left in it. Specialists fine-tune their shock absorbers constantly, changing shim settings or adjusters to achieve the maximum performance. However they tend to forget that they already started with a badly filled shock absorber by hand will always leave air inside the shock absorber, the air gets stuck within little corners and hand will always leave air inside a shock absorber should not be underestimated, air absorber contains air. The effects of air inside a shock absorber should not be underestimated, air is compressible and because of this heavily effects damping. On top of this problem, air also causes damper fading. To tackle these problems all together, oil filling machines XP and LT that use cycles of high vaccum and pressure, that allows the oil filling. On filling of oil within cylinder, the piston is inserted. Then the mouth of the cylinder is press fitted with seal cap to close the opening of cylinder. Seal is tightly fitted to ensure no leakages occur during fitting. A shock absorber sealing machine is used for sealing shock absorber. The hydraulic machine is PLC Operated with load cell. Few rate control can be achived through servo valve. Can seal sizes and thickness by simply changing the tooling and setting.Shock absorber is then brought to direct field testing (DFT). Here its tolerances and other important properties are checked and approved.After DFT process shock absorber is finally fitted with spinning. This is a manual process. At this stage each dampers is one by one attached with spinnings and circlips.It is found that

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being a manual process this is constant site of error.On placing spinning the final damper product is send to inspection department for checking. This inspection is done in lots. The method implemented is sampling method.It may so happen that by any consequence of the inspection is skiped by any damper an error is induced. Spinning beening very short part can be easily overlooked.The final product is than painted and send to line wherethe are box filled and loaded on the loading platform and dispatched. Thus an error has occurred in the entire process without prior detection.

VIII. POKA- YOKE

Poka-yoke is a Japanese improvement strategy for mistake-proofing to prevent defects (or nonconformities) from arising during production processes. Poka-yoke is a preventive action that focuses on identifying and eliminating the special causes of variation in production processes, which inevitably lead to product nonconformities or defects. This concept was initially called Idiot Proofing but it was understood that this name may heart workers so term Mistake Proofing was coined by Shigeo Shingo. Poka-yoke gives a strategy and policy for preventing defects at the source. These solutions are not only cost-effective but also easy to understand and apply. It is one of the important tools to add to any organization's Continuous improvement. towards a higher level of performance.Thepoka-yoke concept was generated in the mid-1960s by Shigeo Shingo who is Japanese industrial engineer. Shingo was working for Toyota and other Japanese companies, where he developed entire production systems focused on achieving zero defects in production and gave birth to this revolutionary work.

IX. THE PULLING MACHINE

Figure show a schematic diagram of PULLING MACHINE, used for extension of closed damper assembly. It's a multipurpose detection- type Poka Yoke device for spinning process. Spinning's are projections at the end of larger tube which after insertion of inner tube and filled with oil with piston assembly is bended to ensure engagement of two tubes. If not so this split under tensions offered by constant subjected loads on road and may result in spilling of damper oil causing failure of damper which may give rise to accidents.

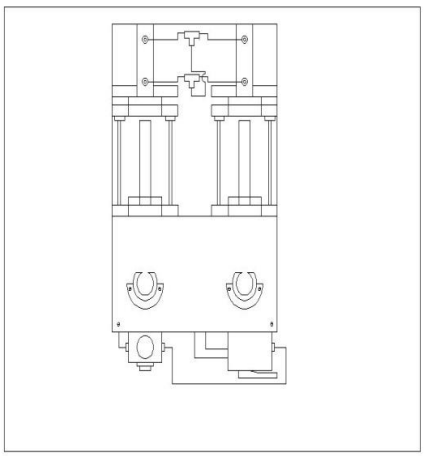

Fig. Schematic Diagram of PULLING MACHINE

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Thus ensuring that spinning process though being such a small work is quit essential task to be carried out. Checking so many parts after painting process is almost impossible. Thus a poka device was needed after painting of damper to detect any faulty piece to ensure zero defects. But this might increase cost of installation and labor resulting in extension in manufacturing time. For the said purpose PULLING MACHINE is designed. This is placed after the painting line and before preloading, packaging and dispatch.

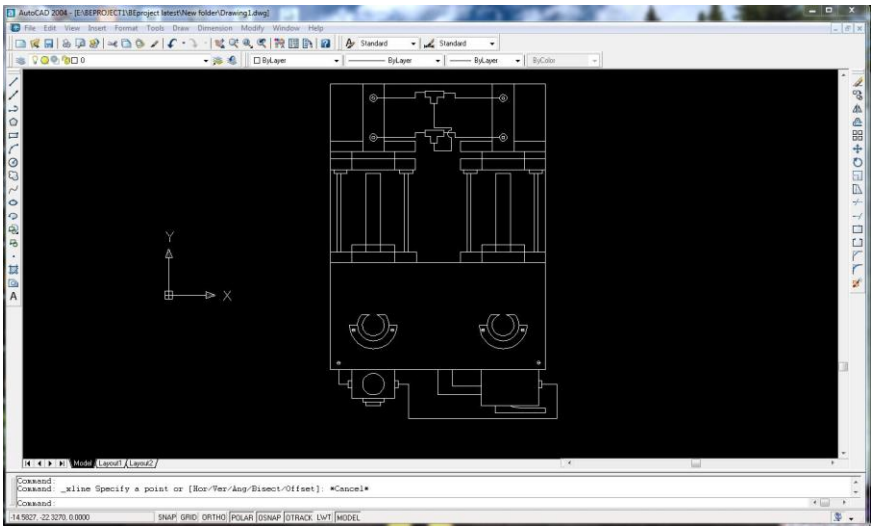

Fig. AutoCAD window showcasing Pulling Machine model

Working: The PULLING MACHINE is basically works on Pneumatic principle. It is divided into two portions. The lower portion consists of jaws called the Locators placed parallel to each other. They are reverted to table floor through nuts. At one pass two dampers could be clamped together for stretching. The upper portion consist of holder and shaft arrangement which is constantly under tension offered by springs at one end while other end is subjected to pneumatic pressure of 100 parts per unit by volume to 125 parts per unit by volume. The pneumatic pressure and the spring pressure balance each other. This pressure is supplied by compressed air flowing within tubes connected to these shafts which in turn is connected to the holder and pins. Compressed air is supplied by pressure cylinder fitted at the rear end. Now when a damper is clamped to the table and sealed by holders to the place, the knob or handle is pressed down this opens the hand operated valve. Air rushes through this valve under pressure. When this compressed air pressure exceeds spring force acting on opposite side, the guide rods is pulled backwards and thus the closed damper assembly is stretched to its fullest extend till it is stuck at a particular point due to spinning's holding the disengagement. That is how the presence of the spinning is detected by the Pull Machine. It also checks for unpainted areas and induces an initial strain within the damper body which is released during fitting.

Precautions:

1. Check the pressure in pressure gauge before operating the machine.
2. Ensure that the fixture is at the home condition.
3. Load the component properly in the locators.
4. After the checking switch the hand valve to home condition.

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X. CONCLUSIONS

Thus we have studied different types of shock absorbers and the shock absorber commonly used in three wheelers.Acknowledged entire manufacturing process with post production processes.Understood the reasons of fault occurring at Existing Company. during its assembly of spinning to shock absorber.Discussed the need of zero defect and its effects on shock absorber.Studied the poka yoke method of shingosheigo to develop a poka device for the said problem.

REFERENCES

[1] Six-degree-of-freedom three-Wheeled-vehicle model validation; T.R. Gawade, Research Scholar, Department of Mechanical Engineering, IIT Delhi, India.

[2] Review Paper On "Poka Yoke: The Revolutionary Idea In Total Productive Management"; Mr. Prikshit S. Pandit, Final Year U.G. Students, Mechanical Engg. Department,Rajarambapu Institute of Technology Islampur (Sangli),Shivaji University, Kolhapur (India)

[3] DESIGN AND ANALYSIS OF A SHOCK ABSORBER;ISSN: 2319-1163,Lakshmana Kishore,M.Tech (Associate Professor), Mechanical Department, GIET, Andhra Pradesh, India.

[4] Vibration Damper (Viscous type and Rubber Type) checking methods; SPT 226031-01, June 1975.