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A REVIEW- PRODUCTIVITY IMPROVEMENT BY MODIFICATION IN DUST SEAL PRESS MACHINE USED FOR SHOCK ABSORBER MANUFACTURING

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ABSTRACT

The Paper Studies the working methodology and work study of manufacturing of shock absorber. The shock absorber assembly consists of piston rod and piston rod assembly which requires lock nut to be fastened by the torqueing gun with a specific torque. This torqueing process requires 6-7 sec and the next process station which is a double working station becomes idle for 5-6 sec which leads to low production. The DC gun used for torqueing is unable to display the exact value of torque applied which results in variation in torque from the required torque which leads to increase in number of rejection.The objective of the present paper is study and to design and manufacture a twin station torqueing machine which will enhance the productivity and reduce the rejection level with the implementation of digital DC gun which gives the exact value of applied torque.

The assembly of shock absorber process has been automated by designing and manufacturing of double station torqueing machine. The testing has been carried out using old single station torqueing machine and new machine The comparative analysis has been carried out to predict the effect on productivity. From the result it was observed that there is substantial improvement in the productivity. It was also observed that there is substantial reduction in the rejection level. It was found that by using Twin Station Torqueing Machine the rejection level has been decreased by around 80% i.e. almost null rejection as compared to the rejection level of the twin station torqueing machine.

I. INTRODUCTION

1.1 Introduction to Shock Absorbers

A shock absorber is a mechanical device designed to smooth out or dampshock impulse, and dissipate kinetic energy. Other names for a shock absorber include damper and dashpot. The automotive suspension component is often called just shock. Pneumatic and hydraulic shock absorbers are used in conjunction with cushions and springs. An automobile shock absorber contains spring-loaded check valves and orifices to control the flow of oil through an internal piston. The shock absorber absorbs and dissipates energy. In hydraulic cylinders, the hydraulic fluid heats up, while in air cylinders, the hot air is usually exhausted to the atmosphere. In a vehicle, shock absorbers reduce the effect of traveling over rough ground, leading to improved ride quality and increase in comfort. While shock absorbers serve the purpose of limiting excessive suspension movement, their intended

sole purpose is to dampen spring oscillations. Shock absorbers use valving of oil and gases to absorb excess energy from the springs. Spring rates are chosen by the manufacturer based on the weight of the vehicle, loaded and unloaded.

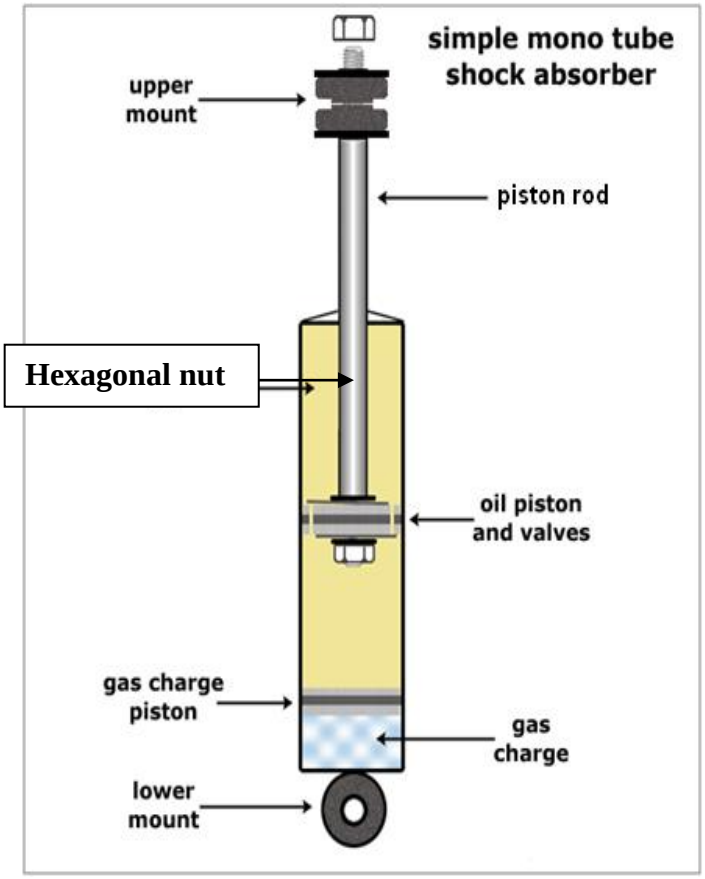

Fig. 1.1:Schematic Representation of Shock Absorber

1.2 Need of Proposed Work

Presently the torqueing for the shock absorber is carried out with a single station torqueing machine. The cell has current productivity of 1800 shock absorbers per shift using single station torqueing machine and also rejection level is high due to variation in the torque. In order to increase the productivity of cell to around 3000 shock absorbers per shift, it is imperative to pay attention towards implementation of twin station torqueing machine rather than single station torqueing machine.In the consequences of above discussion the objective of this proposed project is to minimize the cycle time. The main focus of the proposed project work is to enhance the productivity by designing and manufacturing of twin station torqueingmachine and reduce rejection level by the implementation of digital DC gun for torqueing.Designing of the twin station machine would be done by project members and company will make sure of producing the related fixture component designed by us.

II. WORKING PRINCIPLE ANDCOMPONENT DETAILS

The details of piston rod assembly and shock absorber assembly along with the sequence are given below. The main objective of this proposed project is also stated below in detail.

2.1 Operational Sequence Of Piston Rod Assembly

The assembly of shock absorber begins with the following steps:-

- Assembly of piston rod with oil seal, rod guide, rebound spring, retainer valve, leaf spring, plate valve, back up disc, piston, piston ring and lock nut is executed.

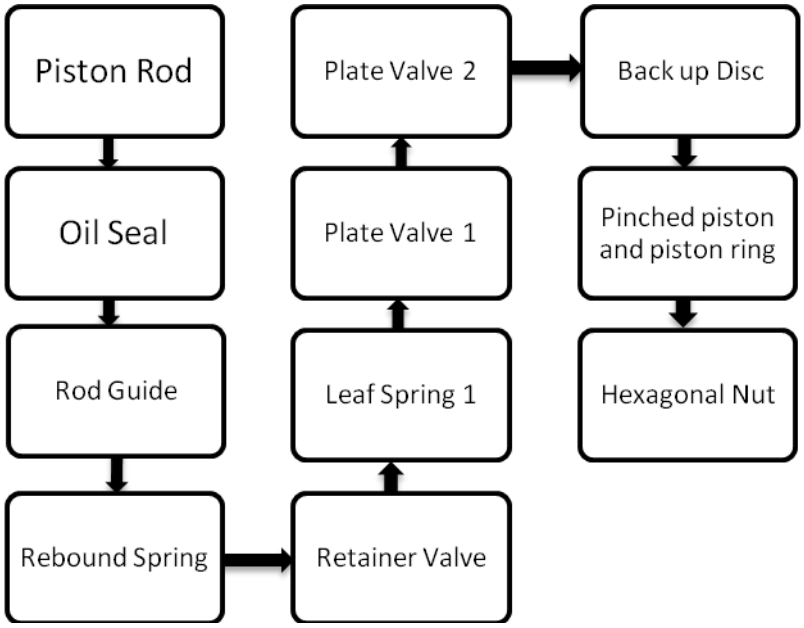

Fig. 2.1: Operational Sequence of Piston Rod Assembly

2.2 Operational Sequence of Shock Absorber Assembly

The assembly procedure for shock absorber is given as follows:

- The piston rod assembled above is taken to the torqueing station where the torque is applied to the lock nut with the help of DC gun.
- The outer cylinder including the inner cylinder and base valve is filled with specified amount of oil.
- Now the piston rod is inserted in the outer cylinder which is filled with oil and press sealing process is carried out to avoid the leakages.
- The whole component is taken to the dynamic testing machine to check the damping force applied. If the component wears the specified damping force then it is passed to the next station otherwise rejected.
- Then the component is taken to the roller spinning process where the edge of outer cylinder is crimped.
- The operational sequence of shock absorber assembly is listed below as shown in Fig 2.2.

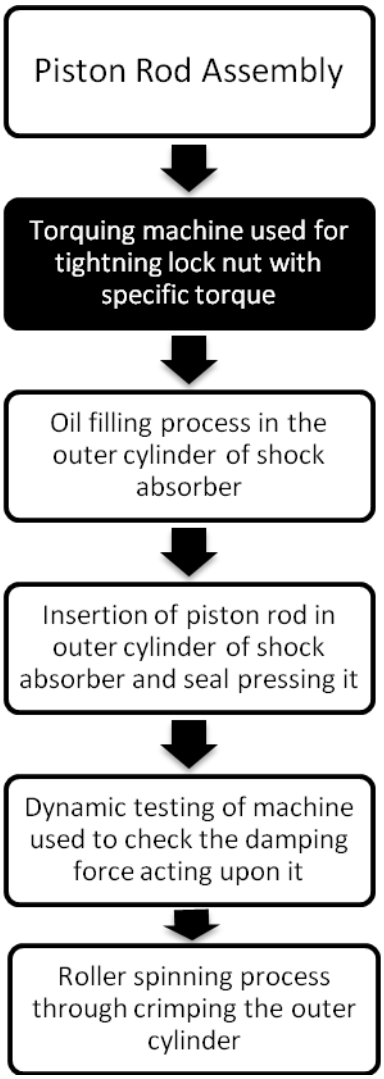

Fig 2.2: Sequence of Shock Absorber Assembly

2.3 Working Principle

The torqueing machine which is presently a single station includes an individual clamping device working on hydraulic arrangement which holds only one piston rod at a time.

Before the product reaches the torqueing station two rods are assembled at a time which is ready for torqueing. Due to single station it is not possible to pre-torque both the rods at a time which increases the cycle time for torqueing and subsequently for whole assembly.

Also the DC gun used for torqueing is unable to display the exact value of torque applied. Due to which there is variation in torque from the range of required pre-torque. Hence during dynamic testing, the number of rejection increases.

Initially the single station has low productivity with more cycle time which results in delay of other processes. Moreover this process results in discontinuity in flow of assembly line, and thus low productivity. This cycle time has to be minimized for the required purpose.

2.4 Component Details

- Base Plate:
- Base plate supports the whole assembly of machine. It is attached to the frame/structure. It has two holes for mounting of the sleeve and collet housing. The material used for base plate is mild steel. Base plate is considered to be integral part of the frame.
- Collet Housing:
- Collet Housing is used to operate the Collet for clamping by virtue of hydraulic cylinder. The collet used is rested inside the collet housing and the collet housing is inserted in the sleeve.
- Sleeve:
- Sleeve is used to support the collet housing. It is firmly attached to the cylindrical plate. It is used to keep the collet and collet housing in exact vertical alignment in order to avoid slipping and misalignment of the piston rod.
- Cover Plate:
- Cover plate is used to cover the sleeve. It is placed over the sleeve and attached to it with the use of bolts. It is also used to keep the piston rod in proper vertical alignment.
- Clamping Cylindrical Plate:
- The Clamping cylindrical plate is basically installed to provide sufficient height to the sleeve for easy replacement of piston rod. It also transfers the weight from the collet to the frame.
- Cylinder Mounting Plate:
- The cylindrical mounting plate is placed between the cylinder and the bottom of the base plate. It is attached to the cylindrical plate of the hydraulic cylinder on one side and to the bottom of the base plate on the other side.
- Cylindrical Plate:
- The cylinder plate is directly welded to the top of the hydraulic cylinder. It supports the hydraulic cylinder to be firmly attached to the base plate. This cylindrical plate is bolted to the cylindrical mounting plate.
- Collet:
- Collet is used to hold the piston rod during clamping and declamping.It is been cut into three equal parts for easy clamping and declamping of the piston rod. It works as a human hand for clamping and declamping.
- Hydraulic Cylinder:
- The hydraulic cylinder is used to clamp and declamp the piston rod hydraulically. Hydraulic cylinder powers the collet to clamp and declamp the Pistonrod with the help of hydraulic pressure. It is a double acting cylinder supplied with hydraulic fluid for both the retraction and extension process.
- Aluminum Bush:
- To prevent the piston rod from damage it is clamped with a hardened bush made of SAE8620. The bush takes the most of the abrasion and if it loses its dimensions. It can easily be replaced with another piece.
- Torqueing Spring Bush and Nylon Pin:
- It is used to compensate axial misalignment. These are placed in the sleeve to avoid any clearance if any.

- Hydraulic Solenoid Valve:
- Hydraulic solenoid valve is used to operate the hydraulic cylinder. Its function is to control the flow of hydraulic fluid often at around 3000 psi (210 bar, 21 MPa, 21 MN/m²).

III. DESIGN AND MANUFACTURING

Design and manufacturing process adopted for the twin station torqueing machine is given below. The Fig 3.1 shows 2D representation of twin station torqueing machine after fabrication.

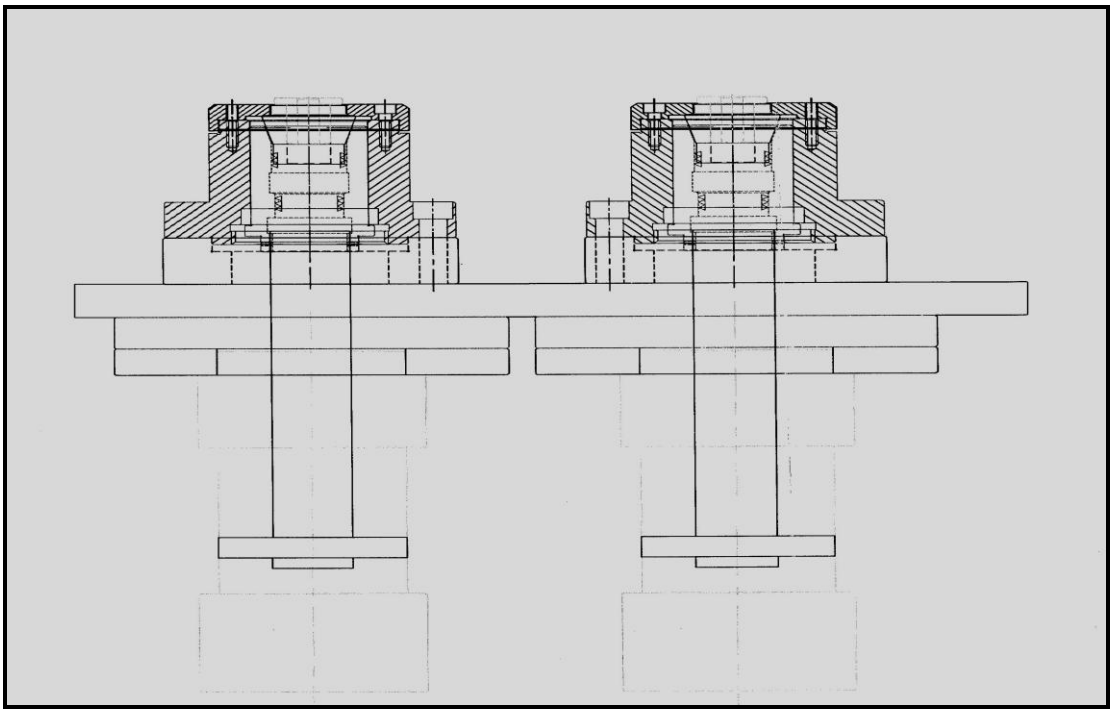

Fig 3.1: 2D Representation of Twin Station machine

3.1 Design Parameters

Different parameters are considered for design which includes mainly stresses induced, applied torque, weight of different components, hydraulic pressure applied by hydraulic cylinder, factor of safety and space limitations. With these design considerations the values for the same are appended in table given below.

Design Parameters:-

Sr no.	Design Parameters	Value of Parameter
1	Applied Torque	145 kg-cm
2	Weight of different components	93.3 kg
3	Hydraulic Pressure Applied	30 bar
4	Factor of Safety for clamping	3
5	Space Limitations	660×390 mm

Table 3.1

IV. CONCLUSION

In this paper we study the new designed fixture for working station in the production line. The complete work holding device of the high torque drilling machine is fabricated in the shopfloor of the institute central workshop. Before fabrication a complete CAD model was prepared for optimum use of material and space. All the components were manufactured in house. The device is controlled by tightening the screws provided on the rear side of the frame. The fixture can hold flat components and is operated manually.The process parameters and its effects will be studied after implementation of the new designed fixture for the working station.

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