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Design and Analysis of Rotary Power Steering System

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ABSTRACT : *The sole of the power steering is the medium through which the steering task is performed.This medium involves steering column,universal joint,yoke joint.we had reviewed that the area of bores of universal joint are subjected to high temperature conditions.So,we had introduced a high temperature resistive fibre at that location to avoid failure of the cross nut.Also,we had introduced an adhesive rubber for insulation in shaft column in the inner periphery.This will reduce the vibration failure at high temperature,easy assistance.*

Keywords : *Adhesive Rubber insulatio,high heat resistive fibre,vibrationless system,feel of ease,easy driving.*

I. INTRODUCTION

The beginning of this project is obtained from the concept of creating the ease with which the driver can drive the car.The EPS and HPS systems are already providing high performance,but still the old manual steering system can take up and compete with these advanced systems.we had targeted the weak points of EPS and HPS systems in order to proceed our research work.we came to know that universal joint is subjected to high temperature conditions while working.As a result the cross nut is subjected to tremendous heat and may fail.So,there must be a component which will reduce the intensity of heat at that location.we had used such high heat resistant material at that location.The material is the polypropylene,it provides high heat resistance.This material can be placed over the periphery of bearing cap at all of its four locatons as shown in figure 1.It shows the detailed view of the cross nut,bearing cap,snap rings,spindle yoke,bearing,shaft yoke.
As we know that due to continuous usage of the universal joint through steering column,its component may fail and it can also experience high temperature.This phenomenon is minimized by the high heat resistant material,which can be fixed over the bearing cap.

II. PROPERTIES OF POLYPROPYLENE

It is a thermoplastic polymer used in a wide variety of applications including packaging and labeling, textiles(e.g., ropes, thermal underwear and carpets), stationery, plastic parts and reusable containers of various types, laboratory equipment, loudspeakers, automotive components, and polymer banknotes. An addition polymer made from the monomer propylene, it is rugged and unusually resistant to many chemical solvents, bases and acids.Polypropylene is normaly tough and flexible,especially when copolymerized with ethylene.This allows polypropylene to be used as an engineering plastic,competing with materials such as acrylonitrile butadiene styrene(ABS).Polypropylene is reasonably economical,and can be made translucent when uncoloured but is not as readily made transparent as polystyrene,acrylic or certain other plastics.Polypropylene has good resistance to fatigue The melting point of polypropylene occurs at a range, so a melting point is determined by finding the highest temperature of a differential scanning calorimetry chart.Perfectly isotactic PP has a melting point of 171^0C.Polypropylene has good metal flow rate .It can be used in blow moulding process also.Polypropylene with higher MFR will fill the plastic mold more easily during the injection or blow-moulding production process.Ther are three types of polypropylene:homopolymer,random copolymer and block copolymer.Polypropylene is improved in recent years by two methods and they are:improvement in uniformity of the polymer particles produced using a circulation type reactor,and the other is improvement in uniformity among polymer particlesproduced by using a reactor with a narrow retention time distribution.

Also,ther is a need of adhesive rubber for insulation in shaft in its inner periphery.This will absorb the vibrations taking place at the instant of accident.This rubber is having thickness of 0.1 mm.This material is the sorbothane plastic material.It provides water resistant material,it can be used in any wet environment,it maintains the superior shock attenuation and vibration isolation,it has low creep rate compared to other polymers.Sorbothane has superior damping coefficient,over a very wide temperature rangecomkpared to any other polymer.It eliminates the need of metal springs to return the system to its equilibrium position after absorbing a shock.Sorbothane has absorbed up to 94.7% of impact shock.It stays stable over a broad temperature range,enabling it to isolate damaging vibration and attenuate impact shock in many varied conditions.Its near faultless memory ensures a return to original shape,even after repeated compressions.It is produced in a durometer range from 25 to 85-shore 00 scale.Sorbothane is considered a super soft polyeurethane.Sorbothane bushings and washers are combined to create a floating bolt.The location where this material is at the inner periphery of the steering column.

III. PROPERTIES OF ADHESIVE RUBBER.

The adhesive rubber is the Sorbothane material which absorbs 94.7% vibrations ocuuring in the component. Vibration damping is an important part of building machines or working factories. When you're talking about situations in which there are lots of moving parts and lots of friction, you definitely need to be able to control vibrations. Excess vibrations can create unnecessary noise, break a machine's moving parts down more quickly, or even cause the machine to come apart of stop working sooner rather than later.

There are many different ways to control vibration. One is to simply absorb it. This is a process known as vibration damping. Through the years, many different substances have evolved that can help to absorb and damp vibration from a variety of sources. Here are some of the options that are still available today .

Oil: This age-old substance is used to take some of the vibration out of a system by absorbing it. It can't isolate vibrations, but it can keep the overall vibration of the system a bit lower. It's easy to use, and it can be good for very limited applications, especially those in which friction is the main problem.

Springs: These aren't a true vibration damper, but they can help isolate vibration in a system. They basically absorb energy in one way and release it in another, making vibration easier to control. Before you try springs, though, consider that they have limited applications and may actually break down over time.

Rubber: This was really the next step up from springs. It also absorbs energy and releases it in a different format, so it can isolate vibration. It can damp vibration a little, but it really just works to isolate it and doesn't have true damping abilities.

Polyurethane: Newer substances like foam and foam-like polyurethane can be used to absorb some of the energy in a system. They are sometimes used for isolation, but they can also be used in order to damp the amount of vibration and energy in an entire system.

Sorbothane: This proprietary viscoelastic substance combines the properties of some of the older vibration dampers and adds a few new properties of its own. It absorbs energy, but it can also release it. Because of this, it can be used for isolation or damping purposes

IV. METHODOLOGY

The size of the polypropylene material is 1mm thich and can be fixed on the outer periphery of the bearing cap of cross nut of the steering universal joint.This Bearing cap is shown in figure 3 atddresed by point 4.Also the Sorbothane rubber material is 1 mm thick and is provided on the inner periphery of the steering column .This steering column ic shown in figure 4.In that figure the purple coloured area can by provided with a washer of Sorbothane Material at that location .This is the way to reduce the vibrations and to provide heat resistant conditions to steering column assembly of the power steering.The EPS system can work more fluently by the use of these two materials.

V. FIGURES AND TABLES

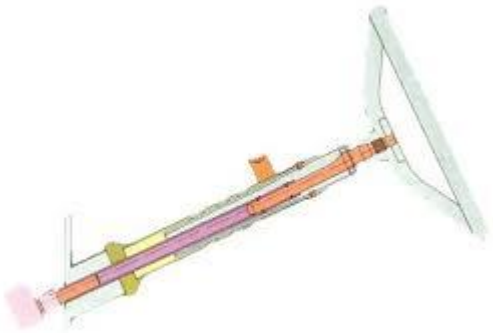
A. Application of polypropylene

B. Steering column

C.Common Failure Points.

C.Bearing Cap

D.Steering Column



VI. CONCLUSION

It is observed that by the use of Polypropylene material the cross nut of universal joint remains safe and the bearing cap is exposed to reduced temperature conditions. Also the use of Sorbothane at the inner periphery of the steering column provides effective damping and reduces vibrations at that instsnt of collapse. This prioject is targeted towards reducing the vibrations in the steering shaft and to increase in life of the steering column.

REFERENCES

Journal Papers:

[1]. "Structural Analysis for a Cardon Joint in steering column assembly through FEA Techniques".Ashish Bharatrao.Nitalikar,R.D.Kulkarni,Swapnil.S.Kulkarni,Asst.Prof.TPCT college of Engineering,Osmanabad,Director-Able Technologies India Pvt.Ltd,Pune.IJAERS.E-ISSN2249-8974

[2]. "Failure analysis of overhead power line yoke connector" Miroslav Dzˇupon, Ladislav Falat, Jan Slota, Pavol Hvizdoš, a Institute of Materials Research, Slovak Academy of Sciences, Watsonova 47, 040 01 Košice, Slovak Republic b Technical University of Košice, Faculty of Mechanical Engineering, Department of Technologies and Materials, Mäsiarska 74, 040 01 Košice, Slovak Republic a r t i c l e i n f o Article history: Received 28 February 2013 Received in revised form 4 April 2013 Accepted 26 April 2013 Available online 7 May 2013

[3]. "Model for localized failure with thermo-plastic coupling: Theoretical formulation and ED-FEM implementation" Van-Minh Ngo, Adnan Ibrahimbegovic, Delphine Brancherie, Ecole Normale Supérieure, LMT-Cachan, 61 Avenue du, Président Wilson, 94235 Cachan, France b Université de Technologie de Compiègne, Laboratoire Roberval, 60205 Compiègne, France article info Article history: Received 18 October 2012 Accepted 7 December 2012 Available online 20 March 2013.

[4]. "Study on Steering Column Collapse Analysis using detailed FE Model" Tae Hee, Lee Byung Ryul, Ham Seong Oh, Hong Advanced Safety CAE Team / Hyundai Motor Co. Korea Paper No. 11-0262