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Design and Analysis of Bearing assembly in Knuckle steering using sensor

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Abstract - This project work will be done in the academic area of "Bearing pressing on the knuckles". The prime focus will be on introducing Error proofing in steering knuckle and Bearing assembly to ensure the pressing of ABS bearing on ABS knuckle and Non ABS bearing on Non ABS knuckle. The difference between ABS and Non ABS knuckle is both the part is common but one additional hole will be there in the ABS knuckle, in the same way difference between ABS and Non ABS bearing is both the part is similar but Magnetic strip will be there in the ABS bearing. The requirement is ABS bearing should be pressed in the ABS knuckle and Non ABS bearing should be pressed in the Non ABS knuckle. During pressing there will be a chance of wrong assembly of Non ABS Bearing in to ABS knuckle or ABS Bearing in to Non ABS knuckle. The major impact is ABS sensor will not work if Non ABS bearing pressed in ABS knuckle. If the ABS bearing pressed in Non-ABS knuckle then there will not be any problem but there will a loss because bearing cost is high when compare to Non ABS Bearing. The main aim of the project is to overcome the manual error during the assembly of steering knuckle and bearing.

Index words – Error proofing, sensor, knuckle, bearing.

I. INTRODUCTION

In recent years, many project attempted to automate everything and remove human element. But people are still found on many assembly lines. So semi-automated system is one of the familiar ways to assemble bearing in the knuckle steering. The prime focus will be on introducing Error proofing in steering knuckle and Bearing assembly to ensure the pressing of ABS bearing on ABS knuckle and Non ABS bearing on Non ABS knuckle. The difference between ABS and Non ABS knuckle is both the part is common but one additional hole will be there in the ABS knuckle0, in the same way difference between ABS and Non ABS bearing is both the part is similar but Magnetic strip will be there in the ABS bearing. Customer requirement is ABS bearing should be pressed in the ABS knuckle and Non ABS bearing should be pressed in the Non ABS knuckle. During pressing there will be a chance of wrong assembly of Non ABS Bearing in to ABS knuckle or ABS Bearing in to Non ABS knuckle. The major impact is ABS sensor will not work if Non ABS bearing pressed in ABS knuckle. If the ABS bearing pressed in Non-ABS knuckle then there will not be any problem but there will a loss because bearing cost is high when compare to Non ABS Bearing.

II. LITERATURE SURVEY

[1] Hong - Ming Chen (2014) the primarily intended to design a PC-based control system to control the force of an electro-hydraulic servo press system for implementing precision force control. Therefore we can observe that the hydraulic press force is controlled by electronic control system. So we termed to implement this process in our project.

[2] O. Schwyer (2016) the study shows the losses in clearance gap while the operation is carried out. So we analysis the experimental setup of the hydraulic machine to avoid the losses.

[3] Rakesh Y. Suryawanshi (2015) the modification made in easy removing and installing bearing. The purpose of modification are required less human effort , simplicity of operation , Removing and installing bearing done without damaging bearing surface, compact, portable and well suited .The hydraulic

bearing puller based on hydraulic system on the principle of Pascal's law which states that Pressure distribution in enclosed cylinder is uniform in all direction. So we choose the hydraulic system for our project.

[4]Nikhil Mahajan (2016) Considering the requirement of the company a hydraulic punching machine of 2.5 tones capacity is designed in this work. The C frame type of the press is selected as is mostly used by all manufacturers. So we can analysis to use the moderate capacity for the operation.

III. DESIGN OF HYDRAULIC PRESSING MACHINE

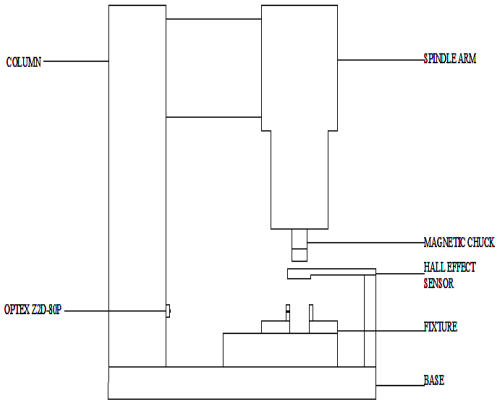


Fig.1 2D diagram of hydraulic machine with sensor

IV. DESCRIPTION OF PARTS

ABS And Non-ABS Bearing

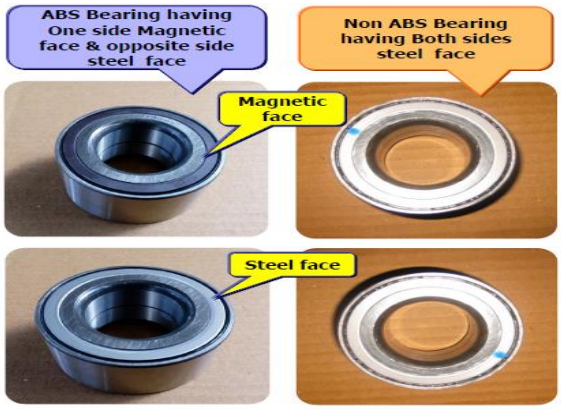


Fig.2 ABS and Non-ABS bearing

In ABS bearing one side magnetic face and opposite side steel face are present. The magnetic faces have a encoder for its working operation. In Non-ABS bearing both sides having steel face only. The major problem held in the operation is fixing ABS bearing to Non-ABS knuckle and the Non-ABS bearing to ABS knuckle.

ABS And Non-ABS Knuckle

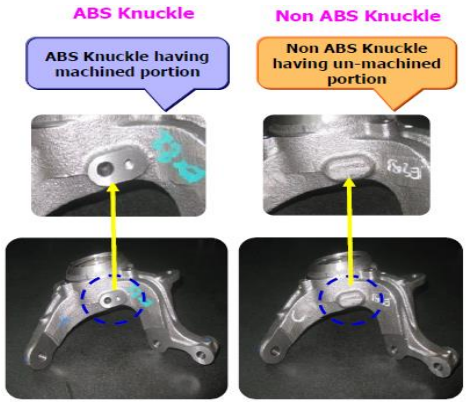


Fig.3 ABS and Non-ABS knuckle

Both the knuckle having similar variation only. In ABS knuckle there is a machined portion is present and in Non-ABS knuckle un-machined portion is present. The ABS and the Non-ABS knuckle is identified by using photo sensor.

Photo Sensor

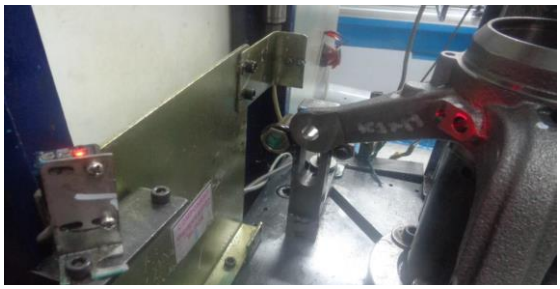


Fig.4 Photo sensor

Photo sensor is used to sense the machined portion of the knuckle. It is fixed horizontally straight towards the hole present.

Magnetic Sensor

Fig.5 Magnetic sensor

Magnetic sensor is used to sense the presence of magnetic face in the ABS bearing. This sensor is placed in a mechanical arm, a rotational operation done by stepper motor.

Proximity Sensor

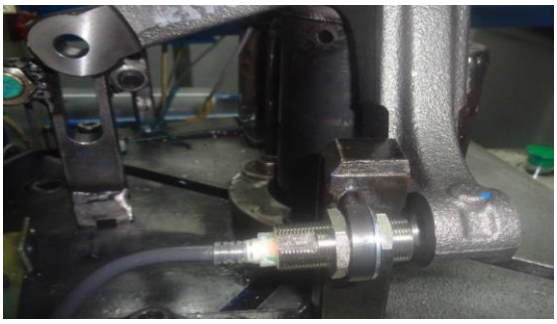


Fig.6 Proximity sensor

Proximity sensor is used to check the parts are fixed correctly in the fixture. If any wrong seating is occurred it will not send a frequency to ECU. It is the main part for this setup.

Buzzer

Fig.7 Buzzer

Buzzer sounds when there is an error. Buzzer is on continuous beep when combination error is found. Buzzer sounds with the interval when the obstacle found in the path of the motor. It is small in size.

Hall Effect Sensor

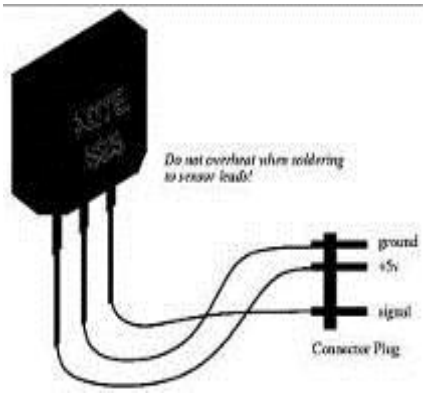


Fig.8 Hall effect sensor

A Hall impact sensor is a transducer that fluctuates its yield voltage because of an attractive field. Corridor impact sensors are utilized for nearness exchanging, situating, speed recognition, and current detecting applications. In its least difficult frame, the sensor works as a simple transducer, specifically restoring a voltage. With a known attractive field, its separation from the Hall plate can be resolved. Utilizing gatherings of sensors, the relative position of the magnet can be found.

Attractive sensor is extraordinarily influenced lobby to impact sensor which has the capacity to detect attractive field up to 20m tesla. The sensor can detect the attractive field of the orientation of separation 2mm hole. Diminishing the separation won't influence the detecting capacity of the sensor. On recognizing the attractive field the sensor emits state to the controller.

Green Diffuse Sensor

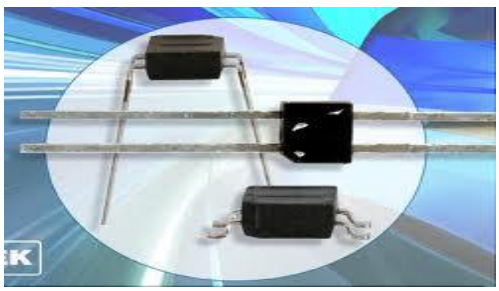


Fig.9 Green diffuse sensor

This is used to detect the obstacle in the path of motor. It can sense a distance of 150mm. It should be trained for detecting the particular distance objects. On detecting it gives ON state to

the controller. In this transmitter and receiver are assembled in a single housing unit. Its sensitivity will be very high.

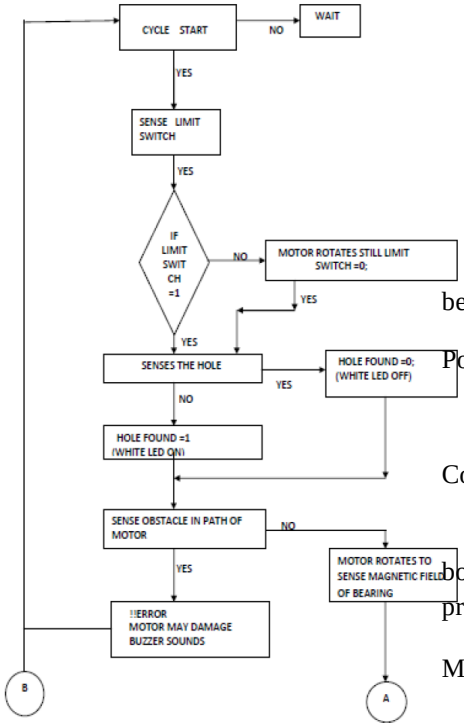
Optex Z2d-80p

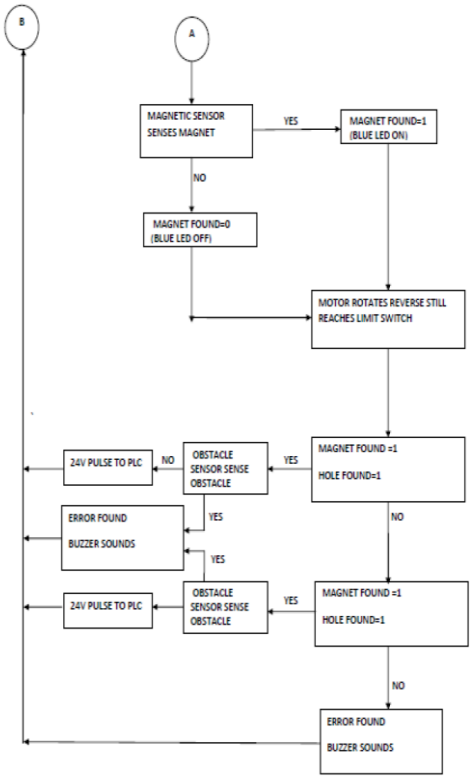
This is used the hole to detect the hole. It can detect the hole at a distance of 120mm. It should be trained for particular angle to detect the hole. on detecting it gives ON state to the controller.

Power Supply

It gives power supply to the entire system. Input 230 volt 50 Hz AC power supply. Output of 12 v and 5 v D.C of 10 amps.

V. PROCESS CHART





VI. CHECKING PROCESS

If the system halts, the following checks can be done.

Power Supply

Check the power supply A, B, C.

Controller Check

Check RED LED status on the controller board, if ON, controller is ok. If there is no status press reset switch (momentary switch).

Motor Check

Check RED LED status on the driver board; else check the wiring connection on the board. Check for wires with colour RED, BLUE, BLACK, WHITE. Check for any loose connection in the limit switch fixed near the motor. Check NC of limit switch is in OFF state.

Hole Sensor

Normally the RED light from sensor can be visible. Check for the status in hole sensor by noting LED on the sensor itself. On sensing the ABS knuckle orange light in sensor goes to OFF state. On sensing

the non-ABS knuckle orange light in sensor goes to ON state.

Obstacle Sensor

Normally the obstacle sensor LED present at the back of the sensor is in OFF state. On detecting the object the RED led present at the back of the sensor glows.

Magnet Sensor

Normal operation can be viewed in this sensor. BLUE led glows when ABS bearing is detected. BLUE led doesn't glow when non ABS bearing is detected.

VII. WORKING PRINCIPLE

Here we are installing sensors and other interfacing devices and the entire system is completely automated, in order to overcome the errors. In this sensor will sense both knuckle and bearing (ABS or Non-ABS), when both signals are similar then the pressing machine will engage the parts. Once the signals are mismatched alarm is given by buzzer. The ABS bearing having one side magnetic face and opposite steel face and the Non-ABS bearing having both side steel face. ABS knuckle having machined portion and the Non-ABS knuckle having un-machined portion. In the pressing machine spindle is modified into magnetic spindle so it will fix the bearing easily. Near to it a magnetic sensor is used to sense the magnetic face of the bearing for ABS and Non-ABS parts. A photo sensor is used to sense the machined or un-machined portion on the knuckle for ABS and Non-ABS. Proximity sensor is used to sense the knuckle is present or not. If the parts are in presence then it send a frequency to ECU. Then the ECU processed as per the command. The pressing machine is fully controlled by electronic control machine. So no error is occurred.

VIII. IMPLEMENTATION

Fig.10 Experimental setup

In implementation the operation are carried out by this machine. In it ECU, sensor, etc. are attached for avoiding the error. So the correct operation is taken, ABS bearing to ABS knuckle and Non-ABS bearing to Non-ABS knuckle. So no error is occurred.

IX. CONCLUSION

This project provides a good solution to prevent the error in assembly of Non ABS Bearing to the ABS steering knuckle and vice versa**.** Before implementation the error occurred by manual operation and we use semi-automated system to prevent the error. The semi-automated system consists of ECU, sensor to control the system.

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