

# Modeling & Manufacturing of Knuckle Hub Assembly Line

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**Abstract** - The assembly line is a series of workstations which is used to assemble the different parts and form it to one for efficient working. In the assembly line parts are added to the various stations in order to form a complete assembly. Each station consists of various operations which are performed while doing the assembly. Objective is to design an assembly line to reduce the manufacturing cost of itself and increase the efficiency of the production.

**Key Words:** Torque Wrenches, Lower Control Arm (LCA), POKAYOKE, Bearings, Rollers, Castor Bearing

## 1. INTRODUCTION

Now-a-days automation have been included in the assembly line no matter what type of assembly is to be done. Automations like Torque Wrenches, Pneumatic Clamping and De-clamping, Automatic Belt Drive, Conveyers, Magnetic Fixtures, Pneumatic Magnetic Cylinders, Etc. are used in modern Assembly Lines. The assembly lines also become highly accurate and precise by using automation and balancing techniques. Balancing techniques are used to reduce vibrations in assembly line which consequently improves the safety of assembly line. Assembly line balancing is to know how tasks are to be assigned to the workstation, so that the predetermined goal is achieved. Minimization of the number of workstations and maximization of the production rate are the most common goals. The reviews of different works in the area of assembly line balancing and tries to find out latest developments and trends available in industries in order to minimize the total equipment cost and number of workstations.

### 1.1 Objective:

The objective of this project is to overcome the problems faced by industry in the assembly work of the product.

The main objectives of the project includes:

- To increase accuracy and precision of assembled product.
- To reduce time required for assembling.
- To make the process of assembling simpler in working.

- To make the complex products easy to assemble.
- To increase productivity.
- To reduce human interference/errors while doing assembly.
- To reduce the fatigue to operator.

### 1.2 Methodology:

Every assembly line consists of various stages to perform a specified task. The assembly line consisting of multistage makes the assembly process simpler and efficient.

There is modeling of assembly line for the manufacturing of various parts, fixtures and assembly of the same. The modeling of all the parts and fixtures is done in different CAD software. So, we have to design the on basis of safety parameters.

Also the material selection is to be done a. After theoretical and analytical work the actual manufacturing will start.

There are five stages of assembly line consisting of following stages which are stated below as following

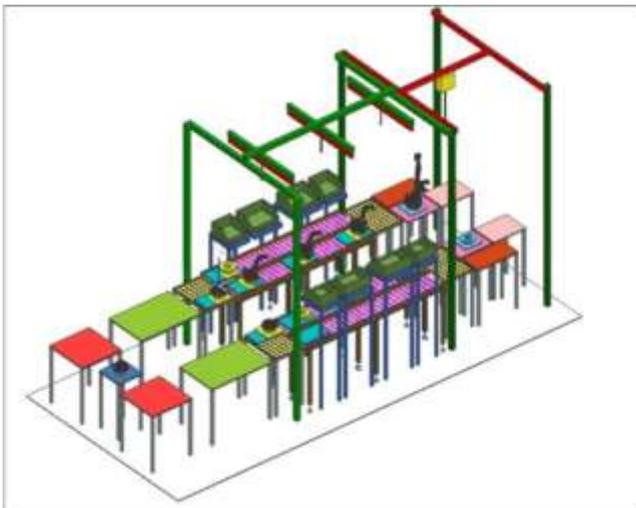
- a. Stage 1 LCA assembly
- b. Stage 2 Assemblies of Disc Brake and Wheel Hub
- c. Stage 3 Assembly press Fitting and Bolt Fitting
- d. Stage 4 Caliper mounting and Bolt Fitting
- e. Stage 5 Assemblies of Sensor Cable Bracket and Bolt Fitting

The stages mentioned above do the assembling of the product in sequence by using the various modern automation techniques. The assembly line has various automation techniques like torque wrench, pneumatic Clamping using Pneumatic Cylinder integrated with magnet. The problems which are faced by conventional assembly line are reduced by using automation techniques.

## 2. DESIGN OF ASSEMBLY LINE

An assembly line is a manufacturing process in which interchangeable parts are added to a product in a sequential manner to create an end product. The assembly line is a series of workstations which is used to assemble the different parts and form it to one for efficient working. In the assembly line parts are added to the various stations in order to form a complete assembly. Each station consists of various operations which are performed while doing the assembly.

The design of the assembly line is done on the basis of product size, accuracy required, and time required for assembly. The assembly line takes number of product which are unusable when not put together and assemble them into a single product which is then used as one product to perform certain task. The assembly line used to assemble the upright (Knuckle Hub Assembly) which is used in Four wheeler motor vehicle.



**Fig -1:** Name of the figure

### 2.1 Various stations in Assembly line

The Assembly consists of five stations which are to be done in Stages given below. The Assembly line consists of various stages which help in assemblage of knuckle and hub:

1. Stage 1 LCA assembly
2. Stage 2 Assembly of Disc Brake and Wheel Hub
3. Stage 3 Assembly Press Fitting and Bolt Fitting
4. Stage 4 Caliper mounting and Bolt Fitting
5. Stage 5 Assembly of Sensor Cable Bracket and Bolt Fitting

### 2.2 INSTRUMENTS/COMPONENTS USED IN ASSEMBLY LINE

The assembly line will contain various components which are stated as below:

1. Controller
2. Roller
3. Castor Bearing assembly

Due to use of such type of automation techniques in the assembly line various problems like accuracy and precision, proper fitting, productivity are solved easily and they can be overcome ease.

These type of techniques help in improving the productivity of assembly line.

### 2.3 CONTROLLER:

Controller is a device which prevents human errors in the assembly line by providing the signals like OK and NOT OK on the display.

The functions which are carried out by controller are stated below

- Starting and stopping the torque wrench.
- Controlling the Torque applied by torque wrench.
- Sending signals to the computer for record.
- Receiving signal from pneumatic cylinder of clamping device.
- Preventing system from doing mistake.



## 2.4 ROLLER

A line shaft roller conveyor or line-shaft conveyor is, as its name suggests, powered by a shaft beneath rollers. These conveyors are suitable for light applications up to 50 kg such as cardboard boxes and tote boxes. A single shaft runs below the rollers running the length of the conveyor. On the shaft are a series of spools, one spool for each roller. An elastic polyurethane O-Ring belt runs from a spool on the powered shaft to each roller. The rotation of the rollers pushes the product along the conveyor. The shaft is usually driven by an electrical motor that is generally controlled by an electronic PLC (programmable logic controller).

Advantages of this conveyor are quiet operation, easy installation, moderate maintenance and low expense. Line-shaft conveyors are also extremely safe for people to work around because the elastic belts can stretch and not injure fingers should any get caught underneath them. Moreover, the spools will slip and allow the rollers to stop moving if clothing, hands or hair gets caught in them.

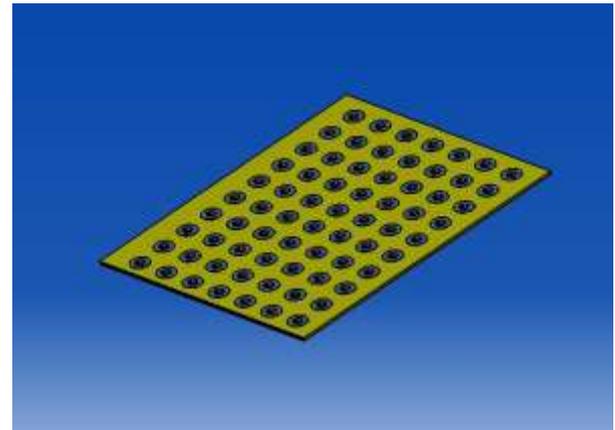
A disadvantage of the roller line shaft conveyor is that it can only be used to convey products that span at least three rollers, but rollers can be as small as 17mm in diameter and as close together as 18.5mm. For items shorter than 74mm, the conveyor belt system is generally used as an alternative option.



## 2.5 CASTOR ASSEMBLY:

This is an assembly which consists of two main components viz. castor Screw in which spherical steel ball is inserted. This type of assembly is mainly incorporated in assembly line where free sliding motion is required. Usually at the ends of assembly line as this castor assembly have high load carrying capacity.

It can carry heavy loads without affecting sliding motion of the component. No. of castor screws are mounted on the table with the help of normal screw fastening to provide free sliding motion and reduce load on each bearing.



## 3. CONCLUSION

In this type of project the modeling of fixture and assembly line will be done. This will help any manufacturing company to save their production cost by using different instruments such as Controllers, Rollers which make easy movement on the line, Castor assembly which will help in better handling of the product, also torque wrench, trays can be used in simplified manner to make the assembly line semi-automatic. This will reduce the production cost and also save the full automation cost in any industry. Hence it may be very efficient cost saving idea for any assembly line.

## REFERENCES

- [1] V. P. Jaganathan (2014) "Line balancing using largest candidate rule algorithm in a garment industry: a case study". International journal of lean thinking, issue 1 December 2014.
- [2] Shailesh S.Pachbhai1, Laukik P.Raut A Review on "Design of Fixtures", "International Journal of Engineering Research and General Science Volume 2", Issue 2, Feb-Mar 2014 ISSN 2091-2730 126 www.ijergs.org
- [3] Naveen Kumar & Dalgobind Mahto(2013) "Assembly Line Balancing: A Review of Developments and Trends in Approach to Industrial Application" Global Journal of Researches in Engineering Industrial Engineering Vol 13 Issue 2 Version 1.0

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