

Design and Development of Pick and Place Mechanism

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Abstract : With the help of effective new product development tools, Computer Aided Design (CAD), Computer Aided Engineering (CAE) and advance automation techniques, the traditional pick and place mechanism can be replaced by a new innovative, fully automated mechanism. The product should be as per customer's requirement, comfortable and user friendly, operable and used a state of art. The aim and objective of this design is To Design, Develop and Manufacture of a Pick and Place mechanism as per the requirement of customer.

Index Terms—CAD, CAE, Pick and place Mechanism, comfort and friendly user.

I. INTRODUCTION

Regularly there arise a need in the market for new product development. This requirement of new product to be developed can be distinct from the old one and can eliminate the existing problems or the problems that are facing in the product they are using. This can be explained in this paper. The requirement of customer is converted into our innovative ideas. These ideas are converted into prototype using suitable 3D modelling tool like SOLIDWORKS 2015. DFMA method is used to optimize the entire mechanism to accommodate it in the existing machine. DFMA method further is used in the preparation of manufacturing drawings of the components. The FEA of the components is done to check the failure mode of the parts, to optimize the shape and size of the components. Selection of standard purchasing parts is done using their respective brochure. The trial of the mechanism is successfully done by assembling this mechanism in the existing machine.

II. MOTIVATION

Present day industry is increasingly turning towards computer-based synchronised automation mainly due to the need for increased productivity and delivery of end products with uniform and excellent in quality. The inflexibility and generally high cost of hard-automation systems, which have been used for automated manufacturing tasks in the past, have led to a broad based interest in the use of mechanical arm capable of performing a variety of manufacturing functions in a flexible environment and at low costs. The use of Industrial mechanical arm characterizes some of contemporary trends in automation of the manufacturing process. However, present day industrial mechanical arm also exhibit a monolithic mechanical structure and closed-loop-system software architecture. They are concentrated on simple repetitive tasks.

The pick and place mechanical arm is a human controlled based system that detects the object, picks that object from source location and places at desired location. There is an advantage of CAD, CAE and rapid prototyping so we can analyse our product design in development stage only.

The pick and place mechanism is becoming so fast and superior than any other mechanism to pick up the objects due to its flexibility in size, flexibility in synchronizing with existing machine elements, perfection of timing, low cost and mass production. Why not the pick and place mechanism to be made user friendly (in operation point of view) and more accurate? This will help to attract our customer to purchase our machine and help in growth of organisation and individuals.

III. AIM AND OBJECTIVE

With the help of effective new product development tools which are Computer Aided Design (CAD), Computer Aided Engineering (CAE) and advance automation techniques, the traditional pick and place mechanism can be replaced by a new

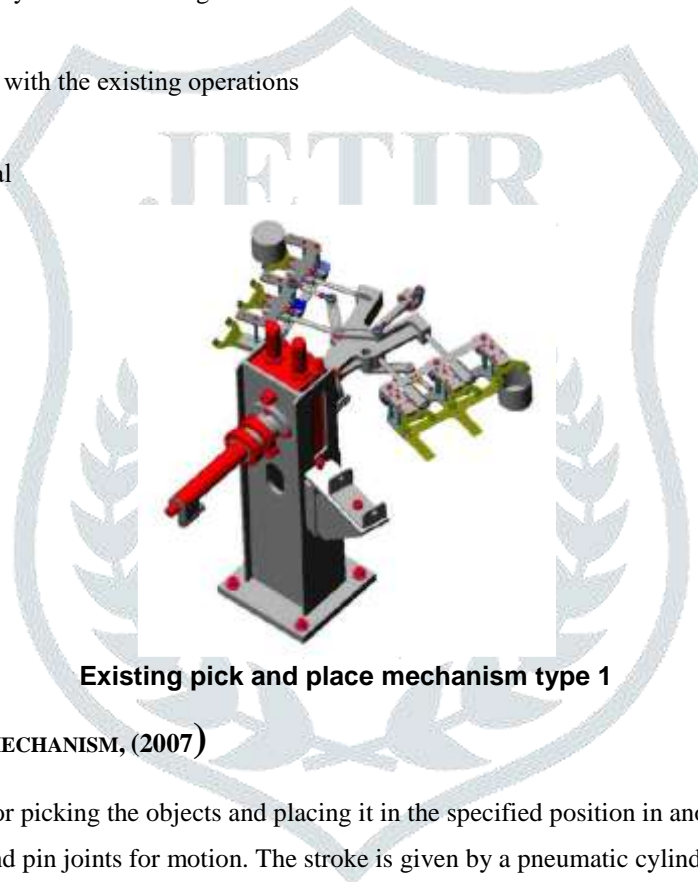
innovative , fully automated mechanism . The product should be as per customers requirement ,confort and user friendly operable and used a state of art. The aim and objective of this design is to Design ,Develop and Manufacture of a Pick and Place mechanism as per the requirement of customer

IV. LITERATURE REVIEW

A. Existing pick and place mechanism, (2010) :

we were using this mechanism for picking the objects and placing it in the specified position in another machine line .It is a fully mechanical device uses levers and pin joints for motion. The stroke is given by a pneumatic cylinder. Following difficulties and errors are occurred during operations.

- Noise was high
- Difficult to manufacture precisely due to balancing
- Output was low
- Not suitable to synchronisation with the existing operations
- Misfiring
- Action of picking was horizontal



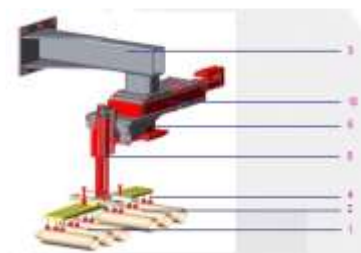
Existing pick and place mechanism type 1

B. EXISTING PICK AND PLACE MECHANISM, (2007)

we were using this mechanism for picking the objects and placing it in the specified position in another machine line .It is a fully mechanical device uses levers and pin joints for motion. The stroke is given by a pneumatic cylinder.

Following difficulties and errors are occurred during operations.

- Noisy and vibration was a problem
- Difficult to manufacture precisely due to balancing
- Not meeting the output requirement
- Not suitable to put into assembly due to its horizontal mountings
- Action of picking was horizontal



C. PROBLEM IDENTIFICATION AND DEFINITION WITH THE PRESENT PICK AND PLACE MECHANISM:

After the detail literature review and close observations of the existing mechanism and constant feedback from the customer we understood the need of upgradation of the existing mechanism to the new one . Every customer wants there product should be comfortable to operate , precise ,user-friendly, easy to maintain , easy to synchronize with the existing mating mechanisms and low cost . In case of existing pick and place mechanism there were some drawbacks

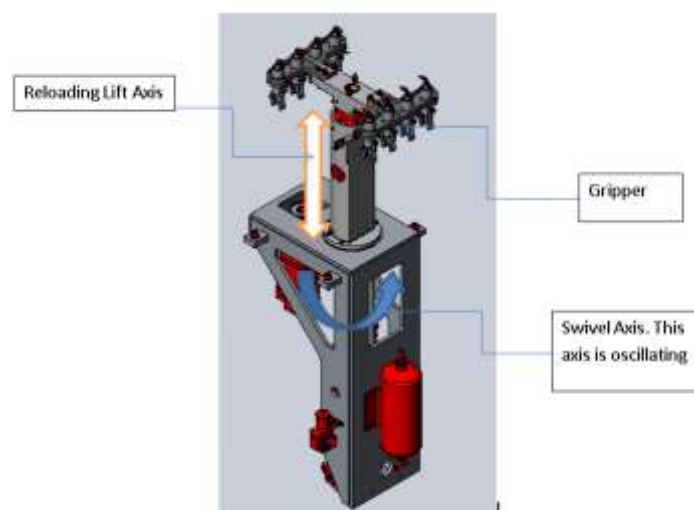
- Bad ergonomics as there was absence of symmetric structure , so sometimes difficult to mount symmetrically.
- Strengthwise weaker
- Noise was more , as it contains mechanical levers and joints
- Difficult to manufacture precisely due to balancing .
- Output was low
- Not suitable to synchronisation with the existing operations
- Misfiring and frequent breakdown
- Action of picking was horizontal , difficult to hold the round tube .

From the above reviews , problem can be defined as the present mechanism are having problems with structural design, esthetics, strength, output,vibrations and synchronisation. So there is a requirement of new product to design , develop and manufacture which will overcome these discrepancies that are identified .

V Prototype Development:

Prototyping is the design verification phase of Product development used to demonstrate or prove aspects of a design .Prototyping is simply taking the design from the virtual , imaginary realm, conceptual base into the physical design. There are many levels of Prototypes. Some are simple duct type to vitalise how something will work, some are highly polished ,fragile representations for show and tell ,still others are functional .The of prototype chosen should fit the specific needs of the project or tests- especially that should not involved higher cost since cost is a very significant factor in prototyping , that can add to the higher cost of the product. Typical prototyping methods include mock-ups (clay, wood , wax etc) ,fabrication is another technique of prototyping especially for the product which contains structure and sub-assemblies . In this method the components of the product are anufactured and assembled together and put into test. 3D.Printing is another new developed method in prototyping. In this method componetns are manufactured using 3D printing technique. Bur this method is used if the parts are less.

VI Assembly of Pick and Place mechanism :



Above fig. shows degree of motion of pick and place mechanism

VII Design Parameters and Calculations:

Details of rotating mass (Reloader gripper cpl.) :

Mass properties of Roatating mass (Reloader gripper cpl.)

Mass = 13.3 kilograms

Volume= 3931112.6 cubic millimetres (mm³)

Surface area =1772760.6 square millimetres (mm²)

Center of mass: (millimeters)

X =0.0

Y =622.8

Z =0.0

Principal axes of inertia and principal moments of inertia:

kilograms * square millimeters

Taken at the center of mass.

I_x = (0.0, 1.0, 0.0)

I_y = (-1.0, 0.0, -0.1)

I_z = (-0.1, 0.0, 1.0)

Details of Synchronous Motor :

Type = Synchronous

Rated speed = 3000 RPM Rated Torque = 2.1 Nm

Step 1 :

Calculation of Load Inertia

Moment of Inertia of rotating mass = 1/8 x mass of the rotating boy x Dia²

= 1/8 x 13.3 x 588x588

= 574799.4 Kg. mm²

Moment of Inertia of rotating mass , JD = 574799.4 Kg. mm²

Annexure

VIII Speed Vs Torque characteristic of 8LSA35 Motor :

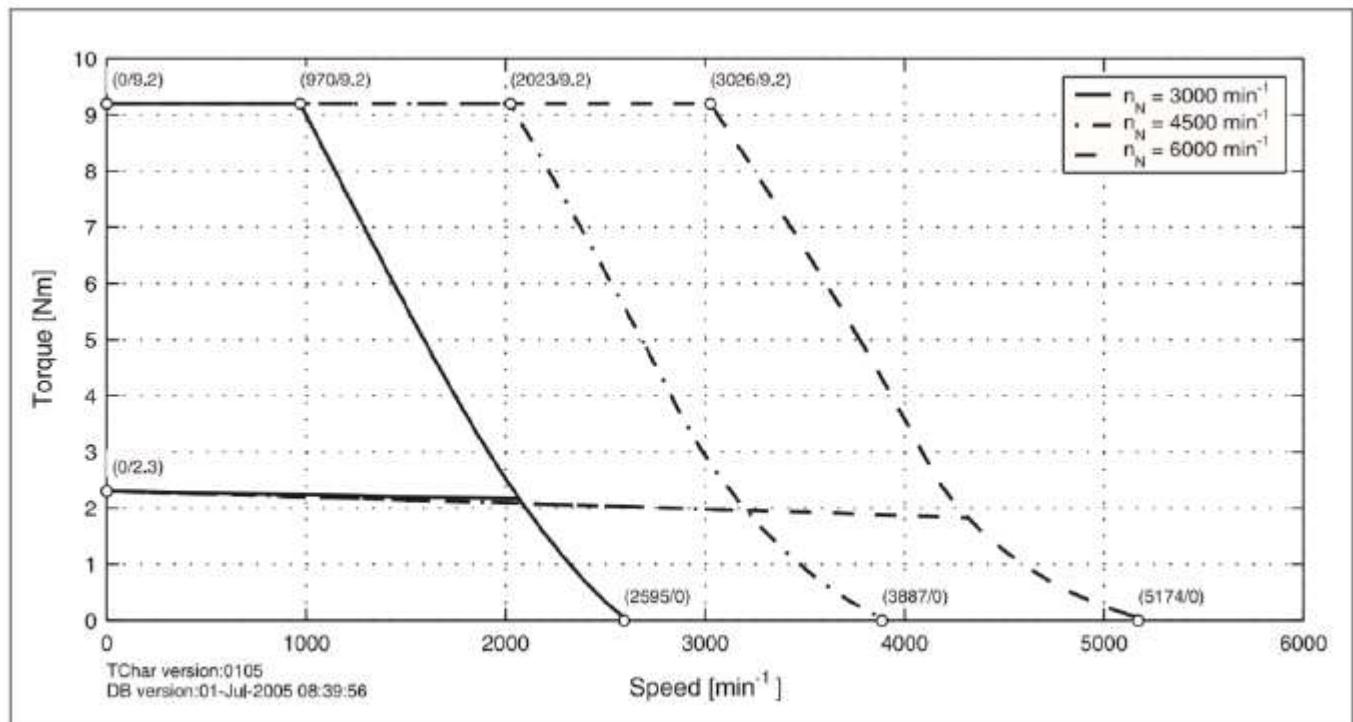


Figure 21: Speed - torque characteristic curve for 8LSA35.eennnffgg-0

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