Fixture Design for Self Loading Concrete Mixer's Chassis Full Welding

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Abstract—A key characteristic of the modern market place is the consumer demand for variety. To respond effectively to this demand, manufactures need to ensure that their manufacturing practices are sufficiently flexible to allow them to achieve rapid product development. Fixturing, which involves using fixtures to secure workpieces during fabrication so that they can be transformed into parts that meet required design specification, is a significant contributing factor towards achieving manufacturing flexibility. This paper contains CAD design fixture for self loading concrete mixer's chassis full welding process. The problems are indentified in full welding of the chassis. The necessity of fixture for full welding of chassis is outlined

Keywords—Design, Welding ,Fixture , CAD

I. INTRODUCTION

A Fixture is a mechanism used in manufacturing to hold a work piece, position it correctly and support the work piece. Fixtures have a direct impact upon product quality, Productivity and cost. Approximately 40% of rejected parts due to dimensioning error [1].

Therefore with the increasingly intense global competition which pushes every manufacturer in industry to make the best efforts to sharpen its competitiveness by enhancing the products quality, squeezing the production cost and reducing the lead time to bring new product to the market, there is strong desire for the upgrading of fixture design methodology with the hope of making sound fixture design more efficiently and at lower cost. As an important field in manufacturing, research and application of fixture design has been paid much attention over past decades.

II. LITERATURE REVIEW

Iain Boyle, Yiming Rong , David C.Brown in their paper .A review and analysis of current computer aided fixture design approaches 2010 proposed that typically the design process by which fixtures are created as four phases : Setup planning , fixture planning , unit design and verification.

Hui Wang, Yiming Rong, Hua Li, Price Shaun in their paper. Computer aided fixture design: Recent research and trends 2010. A difference between welding fixture and machining fixture is outlined. The workpeice in a welding process is usually an assembly of several parts, while workpeice undergoing a machining process contain only one part.

Mikulas Hajduk, Jan Semjon, Marek Vagas in their paper. Design of the welding fixture for the robotic stations for spot welding based on the modular concept 2009. The principle assembly of the elements of the fixture is presented.

III. PROBLEMS INDENTIFIED IN FULL WELDING PROCESS OF CHASSIS

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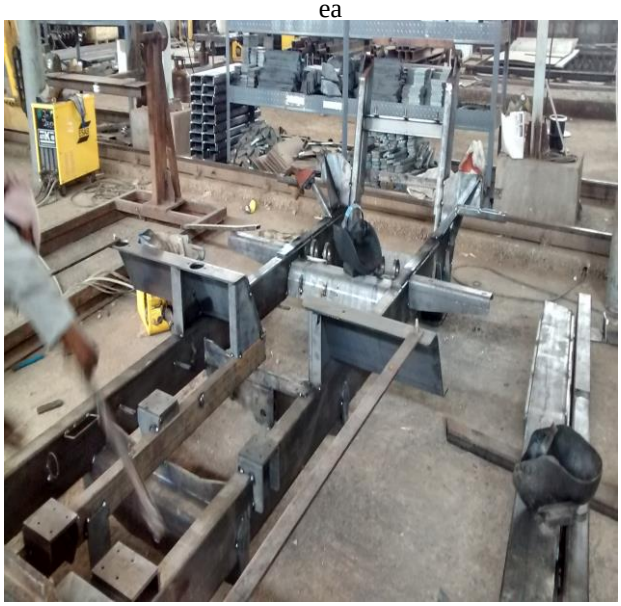

Fig.1 Tack Welded Chassis is kept on bare floor, Chances of dimensional variation in tack welded component

Fig.2 The Chassis is rotated 180 Deg, To full weld bottom components of chassis, While rotating the Chassis there is chance of damage of component..

Fig.3 The Chassis is rotated 90 Deg & Held in over head crane to full vertical weld position.

IV. OBJECTIVE

To Design a fixture, such that chassis is clamped, Supported & providing convenient weld position for the full welding of chassis.

V. DESIGN METHODOLOGY

- Degrees of Freedom
- Supporting the Chassis
- Clamping of the Chassis

A. Degrees Of freedom

Number of independent co-ordinate that required to specify the system completely.

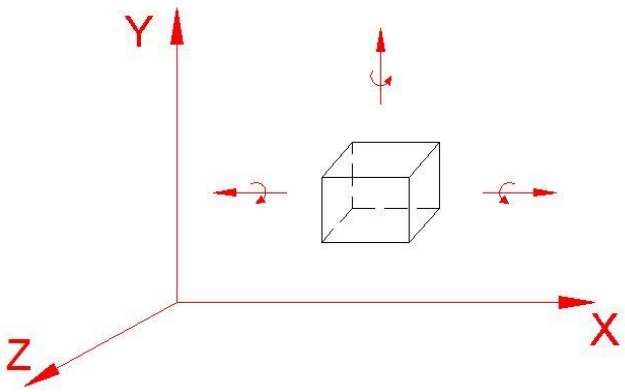

Fig.4 A cube considered in Cartesian system

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- As we studied the full welding process of chassis, we need to design a fixture such that chassis should have single degree of freedom
- Arresting all 3 translation motion in X, Y & Z direction & Arresting 2 rotational motion in Y& Z direction

A.1 Grubler Criteria for Degress of Freedom

$F=3(n-1) - 2j – i$ ------- (1)

F- Degrees of freedom

n- No of Links

j- No of joints

i- Higher pair

Since we need 1 DOF

Putting F=1 in eqn (1)

$1=3(n-1) - 2j-i$

$2j-3n+4=0$ ------- (2)

The above eqn (2) which satisfies the single DOF.

Then the Free Body Diagram of the fixture is

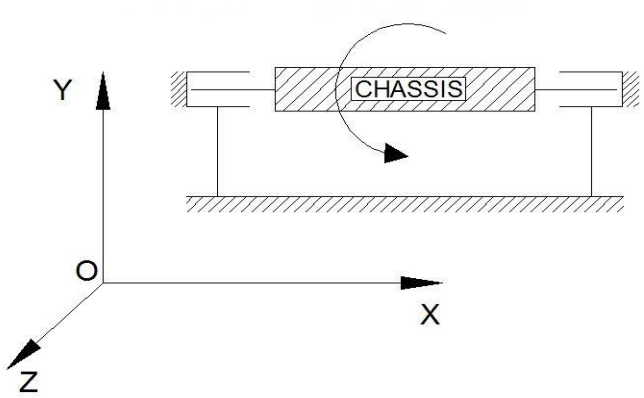

Fig.5 Free Body Diagram of Fixture.

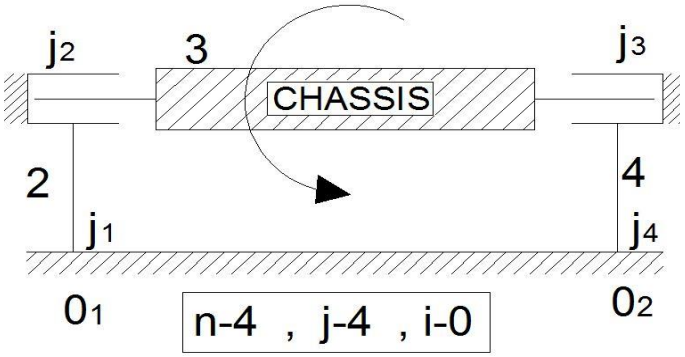

Fig.6 Mobility Analysis of Fixture Mechanism

Putting the values of n & j in equation (1)

F= 3(n-1) – 2j – i

F= 3(4-1) – 2x4 -0

F=9-8

F=1

Thus the FBD of fixture has single Degrees of freedom.

B. Principle for supporting the chassis[3]

- Supporting elements and system have to be enough strong and rigid to prevent deformation due to clamping.
- Supporting should be at least at two points.
- Unsupported span should not be large to cause sagging.

C. Principle forclamping the chassis[3]

- Clamping need to be strong & rigid enough to hold the chassis firmly.
- Clamping should be easy, quick & consistently adequate.
- Clamping should be such that it is not affected by vibration, chatter or heavy pressure.

VI. FIXTURE CONCEPT

Fig.7 3D CAD model of Chassis

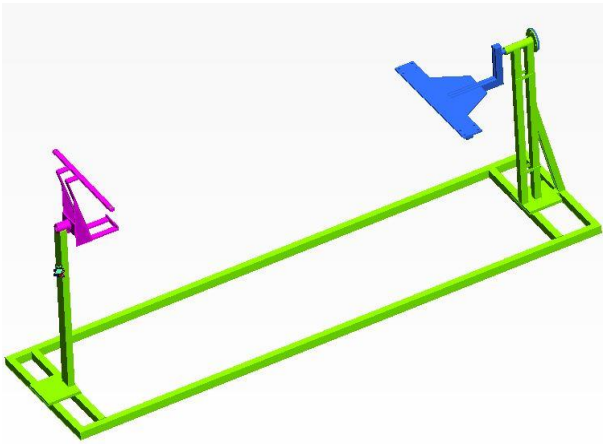

Fig.8 3D CAD model of Fixture

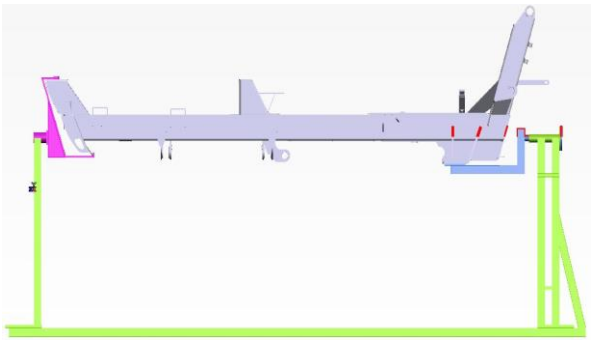

Fig.9 Chassis is held in horizontal position

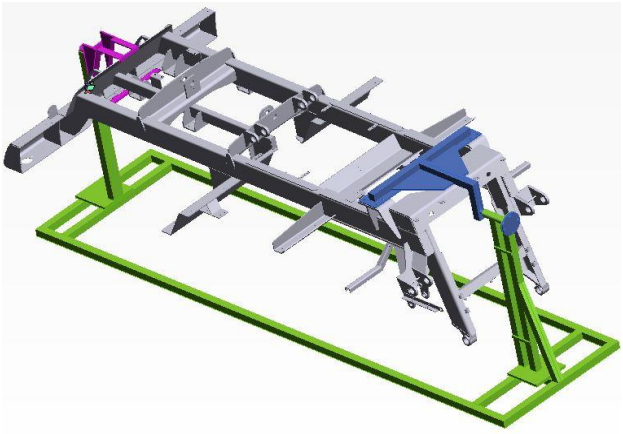

Fig.10 Chassis is rotated 180 Deg Position

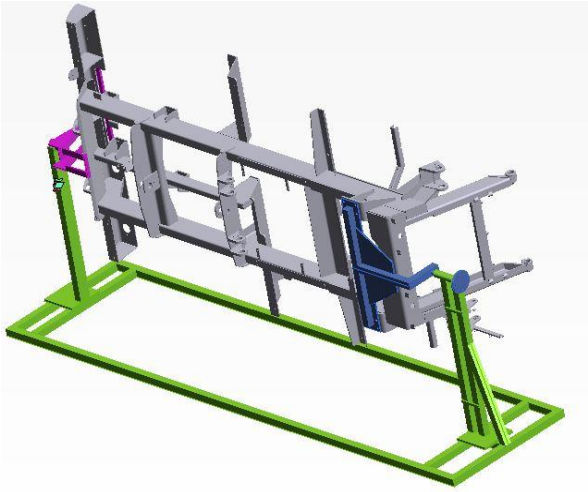

Fig.11 Chassis is rotated 90 Deg Position

VII. CONCLUSION

- Elimination of keeping tack welded chassis on Floor thus any damages to the chassis can be avoided.
- Elimination of holding chassis in overhead crane by thus utilization crane for other shop floor application.
- At any angle chassis can be held with help of fixture.
- Ergonomic weld position for the welder.

ACKNOWLEDGMENT

I owe Sincere and Earnest thankfulness to Mr. M.Venkatesha, Proprietor Adishwar Industries, & G Sathishkumar, Plant in Charge, Adishwar Industries, Bangalore for their motivation and assistance.

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