THE WORK HOLDING FIXTURE ANALYSIS AND OVERVIEW OF DESIGN

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Abstract
A fixture's design is a very intuitive and sophisticated procedure that calls for expertise. At the setup planning stage, fixture design is crucial. For improving product quality in terms of accuracy, surface finish, and precision of the machined parts, proper fixture design is essential.In present design the fixture set up is done manually, thus the purpose of this project is to replace with fixture to reduce time for loading and unloading of component. Fixture gives the maker freedom in holding forces and allows for design optimization for machine and process performance.

Keywords— *Fixture, product Quality, Quick holding ability, Firmly Locating work piece, Improve Accuracy, Save time.*

INTRODUCTION
Fixtures locate and hold workpieces during manufacture. Fixtures firmly hold components to machine them accurately. To make exact components, pieces must be firmly and precisely fixed to fixtures. A fixture holds, supports, and locates the work piece to ensure it is machined within the prescribed limits. Workpieces are referenced to in the fixture using cutting tools, set blocks, feelers, or thickness gauges.

Fix a fixture to the machine table where work is done. Despite being mostly utilized on milling machines, fixtures contain work for most machine tools. Whether costly or basic tools are employed, fittings vary in design. Fixture simplifies specialized metalworking procedures.

Fixtures hold work pieces in position during production. Work piece support and clamping device. Fixtures reduce frequent inspection, placement, individual marking, and uneven quality throughout production. This enhances productivity and reduces operating time. Due to its advantages, fixture is widely employed in industrial manufacturing. Fixtures hold work pieces for machining, inspection, assembly, and other procedures. Fixtures have clamps and locators. Clamps attach work pieces against locators, which establish their position and orientation.

Machining fixture design must consider clamping.

LITERATURE REVIEW
Chen Luo, LiMinZhu,Han Ding[1] A unique model for work piece placement analysis is presented in the 2011 publication Two-Sided Quadratic Model for Work Piece Fixturing Analysis. Due to the curvature of one or both of the contacting bodies being ignored, existing fixturing models may incorrectly estimate the positioning error.

S. Kashyap W.R. DeVries[2] In their article, "Finite Element Analysis and Optimization in Fixture," the authors suggested reducing the amount of workpiece deformation brought on by machining loads at fixturing support points, particularly for thin castings.

Y. Zheng& Y. Rong& Z. Hou[3] They

suggested a systematic finite element model in their study, A finite element analysis for stiffness of fixture units, to predict the fixture unit stiffness by adding nonlinear contact elements on the contact surface between fixture components.

M. Y. Dakhole, Prof. P.G. Mehar, Prof. V.N. Mujbaile[4]In their paper**,** Design And Analysis Of Dedicated Fixture With Chain Conveyor, gives a feasible solution on conventional roller chain conveyorised arrangement with dedicated moving fixture with conveyor for the tractor components like rear axle career, bull gear and shaft of a tractor model.

J. C. Trappey and C. R. Liu [5] This article reviews fixture-design research, the majority of which was completed in the 1980s. Fixturing principles (supporting, locating, and clamping), automated fixtures design (configuration, assembly, and verification), and fixtures hardware design (delicate, modular, electric/magnetic type) are the main subjects of the review.

Shrikant.V.Peshatwar, L.P Raut [6] This study presents an eccentric shaft fixture design solution for a ginning machine. Depending on their use, fixtures are needed in a variety of industries.Designers create fixtures based on the specifications needed by business to meet our production tar gate. It is crucial to execute operations on the eccentric shaft in conventional manufacturing processes. Therefore, retaining a work piece in the appropriate position throughout a manufacturing activity is crucial. Due to the eccentric nature of the shaft, an appropriate fixture had to be designed by the designer for the manufacturing process. Fixtures provide for the possibility of high-quality operation while reducing operating time and increasing output.

IDENTIFIED GAPS IN THE LITERATURE

The goal of this project is to replace the manual setup of the fixture in the present design in order to speed up component loading and unloading. Fixture gives the producer freedom in holding forces and allows for design optimization for both machine and process performance.

PROBLEM FORMULATION

Workpiece is held in place by a workpiece holder, which is fixed to the fixture plate. The workpiece is rigidly positioned in the shortest possible amount of time. Springs are made to bear pressure without allowing the work piece to be deflected; cams are used for mounting and unmounting. The frames' slot accepts the cam. Base plate for a fixture's stiff support.To maximize the use of the fixture and benefit from rotation, two mesh bull gears are mounted to a rotating purpose. For locking purposes, a fixed plate with a central attachment is offered. When using the fixture, press from the center into the fixed plate hole to secure the attachment of the hole.

This fixture is used by a vertical mill. Using this fixture, several electrode profiles may be produced with ease. The workpiece may be mounted, removed, and located extremely easily. This electrode is then utilized on an electro discharge machine to create molds. This method is used to create complex mold profiles. Electrodes are made from materials like grafite or cooper.

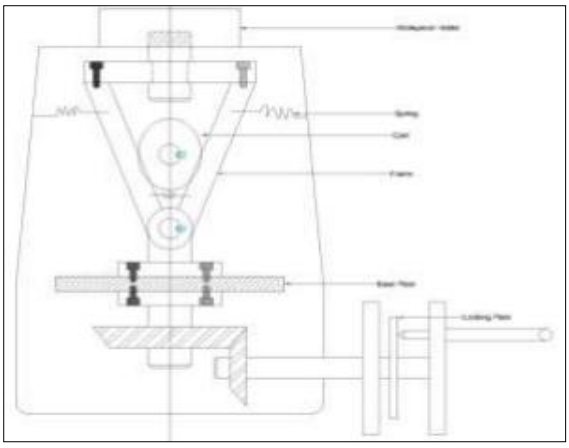

Fig1 Concept design of Work holding Fixture

CONCLUSION

It preserves performance precision while reducing or sometimes eliminating the labor involved in marking, measuring, and placing a workpiece on a machine. Before the operation is automatically performed, the workpiece and tool are almost in their precise locations. It thereby shortens the product cycle time. Jigs and fittings are used in manufacturing operations to ensure consistency in quality since mass production has extremely minimal dimension variation. Assembly operations become simple owing to minimal dimension variability, and low rejection is shown as a result of less faulty manufacturing. It boosts production capacity by shortening the length of the manufacturing cycle. It is feasible for many tools to operate simultaneously on the same workpiece. Due to the stiffness of the work piece's clamping by fixtures, operating conditions including speed, feed rate, and depth of cut may be adjusted to greater levels. Operator comfort increases as the effort involved in arranging the work piece may be reduced. The task may be given to semi-skilled operators, saving on labor costs as well. As long as the quality of the equipment being used is high-grade, there is no need to check the quality of the product.

REFERENCES:

1. *Melkote, S. N. –Optimal fixture design accounting for the effect of workpiece dynamics,‖ International Journal of Advanced Manufacturing Technology, Vol. 18, pp. 701-707, 2001.*

2. *Michael Stampfer ―Automated setup and fixture planning system for box-shaped Parts‖ International Journal of Advance Manufacturing Technology 45:540–552 DOI 10.1007/s00170-009-1983-1, 2008.*

3. *DjordjeVukelic, UrosZuperl&JankoHodolic ―Complex system for fixture selection, modification, and design‖ Int J AdvManufTechnol 45:731–748 DOI 10.1007/s00170-009-2014-y, 2009*

4. *WeifangChen ,Lijun Ni &JianbinXue ―Deformation control through fixture layout design and clamping force optimization‖ Int J AdvManufTechnol 38:860–867 DOI 10.1007/s00170-007-1153-2,2008*

5. *J. Cecil ―A Clamping Design Approach for Automated Fixture Design‖ Int J AdvManufTechnol 18:784–789,2008*

6. *Nicholas Amaral · Joseph J. Rencis · Yiming (Kevin) Rong –Development of a finite element analysis tool for fixture design integrity verification and optimization‖ Int J AdvManufTechnol 25: 409–419, 2005*

7. *Y. Wang, X. Chen. N, Gindy –Surface error decomposition for fixture development‖ Int J AdvManufTechnol DOI 10.1007/s00170-005-0270-z, 2007*

8. *Shrikant.V.Peshatwar, L.P Raut –Design and development of Fixture for eccentric shaft: A Review‖ International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 Vol. 3, Issue 1, February 2013.*

9. *Asada, H. and A.B. By. Kinematic Analysis of Work part Fixture for Flexible Assembly with Automatically Reconfigurable Fixtures, IEEE Journal of Robotics and Automation, Vol.1(2), pp. 86-94. 1985.*

10. *Cogun, C. The Importance of the Application Sequence of Clamping Forces. ASME Journal of Engineering for Industry, Vol. 114, pp. 539-543. 1992.*

11. *Daimon, M., Yoshida, T., Kojima, N., Yamamoto, H., Komatsu, and Hoshi, T. –Study for designing fixture considering dynamics of thinwalled plate and box-like workpieces,‖ Annals of the CIRP, Vol. 34, No. 1, pp.*

319-324, 1985.

12. *Deb, K. ―An introduction to genetic algorithms,‖ Sadhana Journal, Vol. 24, pp. 293-315, 1999.*

13. *Deiab, I. M., Veldhuis, S. C. and Dumitrescu, M. –Dynamic modeling of face milling process including the effect of fixture dynamics,‖ Transactions of NAMRI/SME, Vol. 30, pp. 461-468, 2002.*

14. *Fang, B., DeVor, R. E. and Kapoor, S. G. ―An elastodynamic model of frictional contact and its influence on the dynamics of a workpiecefixture system,‖ ASME J. Manuf. Sci. Eng., Vol. 123, pp. 481-489, 2001.*

15. *Hockenberger, M. J. and DeMeter, E. C. –The effect of machining fixture design parameters on workpiece displacement,‖ ASME, Manufacturing Review, Vol. 8, No. 1, pp. 22-32, 1995.*

16. *Haiyan Deng, ―Analysis and synthesis of fixturing dynamic stability in machining accounting for material removal effect,‖ Ph.D. thesis, Georgia Institute of Technology Atlanta, Georgia, 2006,*

17. *Hurtado, J. F. and Melkote, S. N. ―A model for the prediction of reaction forces in a 3–2–1 machining fixture,‖ Transactions of the North American Research Institution of SME, pp. 335-340, 1998.*

18. *Kang Y., Rong Y. and Yang J.A. –Geometric and kinetic model based computer-aided fixture design verification,‖ ASME Journal of Computing and Information Science in Engg., Vol.3, pp.187-199, 2003.*

19. *Kulankara, K., Satyanarayana, S. and Melkote, S. N. –Iterative fixture layout and clamping force optimization using the Genetic Algorithm,‖ Journal of Manufacturing Science and Engineering, Transactions of the ASME, Vol. 124, No. 1, pp.119-125, 2002.*

20. *Lai, X. M., Luo, L. J. and Lin, Z. Q. –Flexible assembly fixture layout modeling and optimization based on genetic algorithm,‖ Chin. J. Mech. Eng., Vol. 1, pp. 89-92.*