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Design and fabrication of milling fixture using POKO-YOKE method to increase the productivity

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Abstract

The target of mass production is to increase the productivity. This can be achieving by selecting the optimal location of fixture elements such as locators, clamps and supports. In existing milling operation few components were rejected due to improper location of locators and clamps in fixture and also the productivity is decreased. So there is need to develop system which can help in improve the productivity and eliminate the rejecting component by using poko – yoke method.

Index words – Fixture, Locator, Poko - yoke method, Production.

I. INTRODUCTION

Maximum technical progressive are produce the piece incontrollable CNC. Individual action point of view such kind of apparatus necessary to observe capitals of additional device specific determination require to assumed point. Trick holds slog in spot is termed fixture. Fixed object is amazing device that charity efficiency. Machining the component by desired acceptance.

Fixture recycled to drop the cost-effective of creating part, intensification the creation, the excessive meticulousness of processes in machining, compromise adjustable of parts, professional extensive and complex shaped lot to be operated by holding rigidly, excellence control expanses, less knowledgeable labor, partially automatic the machine tool, improve safety, thereby dropping amount of accidents.

In motor flange has the rounded shape workpiece. Detector controls the tool to perfect task. The section fixed in the base-plate with detector and closed the detector has assistance for discover where the machining process required monitor the machining. Locator has rounded shape so the dislocation of motor flange has occurred. Also Well trained operator fixes the part in fixture certain time dis place possible.

Dislocation of motor flange the position of the instrument dislocated. So that part is prohibited. Machinist fix the part in interruption .The production of motor flange is down, period, cost, and energy of operator and material is totally unwanted. So these requirements follows that we have to judiciously top quality the datum planes on the motor flange for supporting, detecting and securing, and judiciously pick out the functional fixture foundations, and find for them such layout, which will ensure unopposed motion of the tools.

Advanced scheme that compromises suggestions on the essential format plus build a fixture predictable at any recognized proposal. The build usual imagined solid. Since an arrangement is clever solution for motor flange workpiece.

II. LITERATURE SURVEY

[1] Gaoliang peng et al apply the fixture design b using the case based reasoning and rule based reasoning develop virtual reality integrated system. RBR and fuzzy comprehensive judgment method is proposed for reasoning and locating scheme and feature. He try to apply the RBR and CBR methodology proposed system to perform semi-automated fixture design activity. Make a fixture quickly with referee the previous design. Integration of CBR method measure hybrid using template

retrieval. He says the deep study are also necessary. Useful fixture case could be retrieved quickly and accurately.

[2] Jose F. Hurtado, Shreya's N. Melkote et al provide the synthesis of the fixturing configuration use pin arrays in flexible machining fixtures. It specially introduces the minimum clamping load and optimal number, position and dimension of pins necessary to achieve the comfort ability and stiffness of work piece. Arbitrary geometry and subjected to quasi-static machining/assembly forces.

Minimize the feature error due to elastic deformation of its structural components flexible work-holding device with a known maximum degree of conformability. Optimization model of synthesis algorithm making by mat lab different fixture stiffness and conformability levels to be achieved by varying the extended pin length, the number and position of contacts. X-clamp pins have a finite tip radius and, as a result, yield lower contact stiffness than that predicted by the closed-form contact mechanics solution for a rigid punch indenting an elastic half-space. The average relative error for the rigid body displacement prediction was -17.1%.

[3] Necmettin Kaya et al optimization of fixture using genetic algorithm. The deformation of the work piece may cause dimensional problem in machining. This problem prevent by using support, clamp locations and locator geometrically reduced. Genetic method to optimization of the clamp and support placed. The deflection is analysed through ansys software. The natural environment replace by artificial selection based on computed fitness. The result of the approach shows that the fixture layout optimization problem is multi model problem.

[4] Retfalvi Attila et al introduce order of the needed setups, and proposals on the appropriate fixtures needed at machining a given workpiece. Carefully select the datum surfaces on the workpiece for supporting, locating and clamping, and then have to carefully choose out the functional fixture elements, and find for them such layout, which will ensure unhindered motion of the tools. He introduce for box shaped part for fixture. The fixture built by the FIXCO module on the basis. Which when the operation planning module developed work of the process engineer easier and quicker.

III. FIXTURE

Now a days greatest fabric procedure done large or minor scale industry regularly cast-off CNC (Computer Numerical Router) because operator less work effort compare to non-traditional machine physical work also CNC save time and growth the production and distinction of parts.

Difficult operation complete by rapid time by wonderful finishing. The superiority of lot is great equated to manual progression. The procedure lot not stimulated, if move the process mistake so work holding strategies used to fix the part process period. Fixture recycled to grip trick and attendant the apparatus machining process. Process complete by portion by detector and also discovering pins. Pins control tool path portion successfully. Detector of the fixture accidentally fixed the part the machine tool also moved so the part rejected. The fixing of the part has suitably the part has machined accurate dimensions. So the fixture is the main part of the CNC machines that will controller of the tool to task.

This type of fixture has used to machining the part hold in vertical position on operation start. Before starting the operation the fixing part has checked once because the fixing part has not closely tight the machining of position and defect occur on manufacture and the part as rejected. So the fixing of part has been checked before the operation.

The well trained person has fix the mistaken position since the employed and setting of the portion has continue so the operator has wrongly fixed the part so the locating pins also change their position for machining basic operator has static the part on closely fitted only the complicated fixing not identify so the position is changed. One of the difficult in fixture that prevent only the operator side only he didn't fix the part correctly total work off machining has waste also the material has waste and time spending on the machining has waste and the productivity is down. Work and cost has lose due to mistaken fixing of the part so one or more time check the position of fixing of the part has checked before the machining.

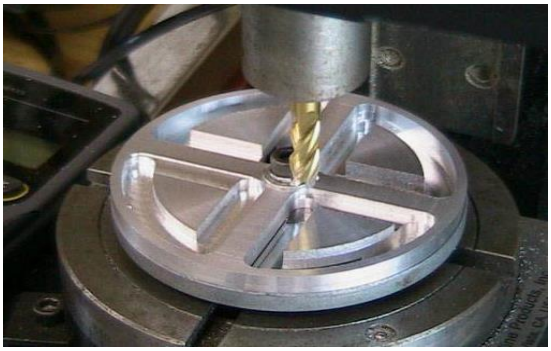


Fig. 1 Fixture of circular workpiece

IV. DESCRIPTION OF PARTS

Portion of the fixture briefly clarify in subsequent base plate, clamps, pins, locator.

Base Plate of Fixture

Baseplate is a part of fixture. Baseplate grip lot in plate. Various hovels include for rise the strength of plate. Holes used to locate the portion by indicator pins. The baseplate used exact dimension because portion mate in the plate. The hardness and resilience of the plate material created the functional material.

It include the portion pin cooperate in process interval. The material of base plate decides on fixture OHNS material.

Locator Pins

The locating system pins conductor the device system processed.

The detector pin has incorrectly fixed the controller of the trick also changed. Position of the pin change the process of the portion position incorrect so the part has rejected the position finder pin is the most important of fixture considering the process. The locating system pin has closely contact on the base plate and the portion. The locator pin has fixed correctly the machining tool has guide proper way to machining the part. Locator pin change on the type of part shape.

Locator

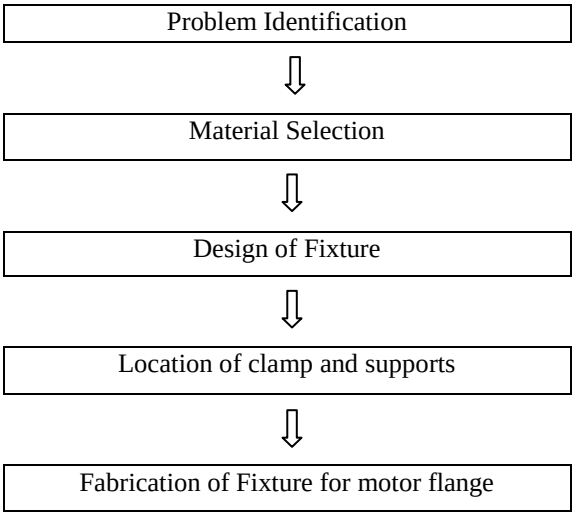
Locator has key role in the process of fabrication. The position finder part movable in every way of the lot so the light change of point detector the machining of portion place changed so the machining part has completely rejected. Decrease economic growth and creation decrease and quality of the product down in particular part. The locator has locate and the pins are both same because the locator has locate where the process has done. The pins are used to guide the tool. So the locator has supreme preference need to the worker correctly fix the locator particular part.

Clamp

In fabrication process clamp used. The clamp is the part strictly in handling time. Different type of clamps used in the machining method and type of profile. The lock strictly connection on the top shield slices to the baseplate to fix strongly to process. The clamp has fixed insecurely the machining part not accurately.

The clamp has used for don't shake occur on machining of part. The slice after the clamp checked wisely because the part has shacked on the machining time it will affect the portion and also risk to worker.

V. METHODOLOGY



VI. PROBLEM IDENTIFICATION

In motor flange portion make a drill operation thorough by spending CNC. Motor flange part has static in the fixture. Locating system small dislocation that will occur small distance of drill bit variation. So part has rejected. In ordinary worker fix the portion correctly the locator shape rounded type so the small variation in location of angle guide tool change to the small angle on drill position that will rejected due to mistaken position of drill, design of fixture is develop by poko-yoke method.

The motor flange has circular type so fixture baseplate and locating system and clamp fix part on process. Motor flange locator is motionless in the center of the part and locator has circular type and the locator has only have two drill so the motor flange part has fixed that two hole by dislocation so the drilling process the six drill are machined in CNC vertical milling. The part motor flange six semicircle shape of inner circle the drilling of hole has occur on the semicircle that part is accepted.

The locator has small change in position part has the six drill hole has variation occur the position of drill the figures are shown accept part of motor flange and rejected part of motor flange. This is occur while position change in locator of workpiece.

Fig. 2 Rejected piece of Motor Flange

Fig. 3 Accepted piece of Motor Flange

VII. MATERIAL SELECTION

Fixture design the general substantial is OHNS (Oil Hardening Non Shrinking die steel).

Oil dwindling steel is frugally accountable cutting measure, blank, trappings and confidential strictness and commendable cutting performance. It is effortlessly roughened, extraordinary surface laboriousness support mitigating, does not collapse strengthening process and process fine. Low strengthening hotness and does not fail the shape smothering. Inflexibility of the material 60-64, high temperature resistance small, standard wear resistance good machinability, medium distortion in the course of strengthening, hardening hotness 760– 870.

OHNS maximum capability to yield straining, disagreement to wear and scratch, influence control.

VIII. POKO-YOKE METHOD

Poka-yoke means the guileless humanoid effort has been prevent and too no error happen on a process acknowledged poko-yoke. It is also notorious as error proofing, misstep proofing and foolproof work.

Japanese word that worth accidental inaccuracy avoidance. Careless there is no poko-yoke solution that safeguard hominoid interrupt, but sabotage erratic surrounded by people. The procedure approach by Applied Problem Solving (APS).

Three step analysis of possibility managed

- Credentials of the need
- Documentation of possible mistakes management
- Mistakes before sufficient the need

IX. DESIGN OF FIXTURE

In previous fixture objective badly behaved occur tiny change pointing scheme and top shelter has the main cause that is mate the locator part in any angle the similar way top cover is plain circular shape that will fix on any angle to the locator. Circular type of the locator has fix in the dislocation. After that clamp has fixed closely. So the little change of locator that guide the tool process part translation of the locator. Design of the fixture upgraded to rising proficiency of motor flange.

X. IMPLEMENTATION OF DESIGN

Execution strategy concept of poko-yoke method. The concerted error takings place on machining holding and spot identify the work portion, locator is urbanized shield improved in motor-flange fixture. The new design of the motor flange has implement on previous design the top cover has changed by the position to locate only on the six semicircle shape of the motor flange correctly fixed,

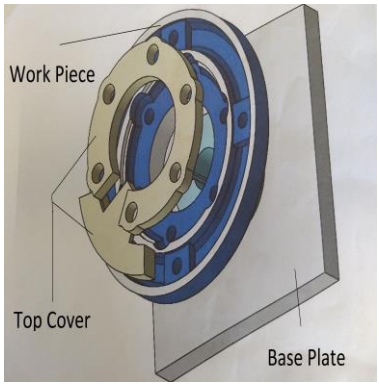


Fig. 4 Fixture Design of Motor Flange

Otherwise the top cover has not fixed in the workpiece. Also the top cover has two part one is cover the six semicircle edge on the workpiece and another one is used to locating of the position because the six semicircle edge fixed on any angle. But the second part of the pin has only fix in the outer part.

In the gap of the fixing point 1 and 2 only otherwise the second part of the top cover has not fixed, the dislocation of basing operator also not possible in this fixture. This motor flange fixture has increase the productivity. Because the fixture has the location of the top cover has fixed on the particular point only otherwise the top cover is not clamped at the time the operator has locate the workpiece correctly and also this fixture reduce the percentage of rejection of work part. The fixture has no fault occur in the location. That will increase the productivity on previous design of fixture.

XI. FABRICATION OF THE FIXTURE

The new design of fixture has fabricated by the process of hardening and drilling process.

Hardening Process

The maximum route used fabricate fixture of motor flange has hardening. This handling escalation the mechanical material goods upturn the level of stiffness, constructing rougher and long-lasting item. Case-hardened materials are commonly annealed or pressure comforted to improve dimensional immovability and sturdiness. Contaminants passionate critical change in hotness. It ventilated quenching oil, water or alternative fluid be influenced by quantity of alloying element.

It consist of constituent directly above the critical malaise for single hour per inch of thinness conserving at a degree dissolute enough to allow the material enough to transform much harder.

Drilling Process

Drill tool make whole on spherical cross section of solid body. Fixture creating the superior shield the lot six hole required so the drilling process important to make the fixture.

Fabricating proficient fixture accumulated the work portion and patterned the topmost shield fix on the six semicircles and the second part of the chief shield has fixed on two points then only clamp tight otherwise the top cover not fixed. That avoids error of fixing.

XII. RESULT

Existing Design

Total quantity	= 300
Rejected quantity	= 25
Production	= 275
Percentage	= 94.8

New Design

Total quantity	= 300
Rejected quantity	= 3
Production	= 297
Percentage	= 99

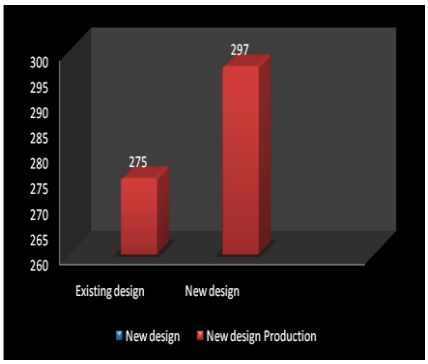


Fig. 5 Production chart

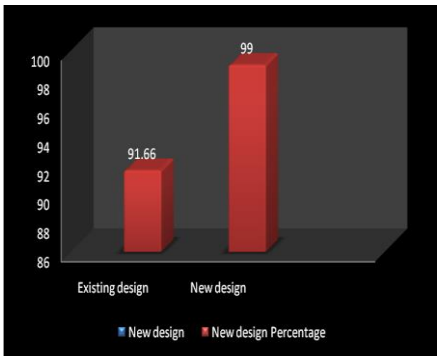


Fig. 6 Percentage chart

XIII. CONCLUSION

In this paper the target of mass production achieved by selecting the optimal design of the fixture to reduce the rejection workpiece by using the poko - yoke method. In existing design 25 workpiece rejected per month, after implement new design in 3 workpiece rejected per month. New design increase the productivity nearly 7.34%

XIV. REFERENCE

[1] Gaoliang peng, *"Applying RBR and CBR to develop a VR based integrated system for machining fixture design"*, Expert Systems with Applications 38 (2011) 26-38.

[2] Jose F. Hurtado, Shreya's N. Melkote, *"A model for synthesis of the fixturing configuration in pin-array type flexible machining fixtures",* International Journal of Machine Tools & Manufacture 42 (2002) 837–849

[3] Necmettin kaya, *"Machining fixture locating and clamping position optimization using genetic algorithm"*, Computers in Industry 57 (2006) 112-120.

[4] Rétfalvi Attila, *"Fixture and Setup Planning and Fixture Configuration System"*, Procedia CIRP 7 (2013) 228–233.

[5] Heidar Hashemi, *"Fixture Designers Guidance: A Review of Recent Advanced Approaches"*, Jordan Journal of Mechanical and Industrial Engineering, Volume 8, Number 6(ISSN 1995-6665) Pages 377 – 384.

[6] Todorovic, p; Vukelic, d; *"Modeling of dynamic compliance of fixture /workpiece interface",* Int j simul model 13 (2014) 1, 54-65. ISSN 1726-4529.

[7] Todorovic, p; Vukelic, d; *"Fixture layout design based on a single surface clamping with local deformation"*, Int j simul model 14 (2015) 3, 379-391 ISSN 1726-4529.