Design And Optimization of Automatic Air Blow In Vmc For Burr Removals

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Abstract- *This paper represents the design of an automatic air blow for the application of a burr removal in vertical machining center (VMC). The mechanism is controlled by pressure system in FRL unit hence it can be implemented in all VMC based machining operation in small scale as well as big industries for faster operation and less labor requirement. It eliminates the existing methods of manual air blow technique of burr removal. This effectively improves the productivity rate at the higher level in the machine shop.*

Keywords- Automatic air blow, VMC, FRL Unit, Pressure, Burr Remove.

I. INTRODUCTION

The conventional method for chip removing in VMC after machining process is manual, it is very time consuming and in non-automatic form. The existing method required each machine for each one-man results in more man power for machine shop so the manual method must be replaced by Automation. Automatic air blow of chip removal has received significant attention because automatic is reliable and reproducible. This not only reduce manual effort but also gives more time for marketing also prevent danger which might occur when human being works in hazardous environment. Automation greatly improves the profit and productivity; it is very scalable.

II. LITERATURE REVIEW

Deburring and burr control are two possible ways to deal with burrs. For both, an insight into current research results is presented. Finally, a number of case studies on burr formation, control and deburring in Burrs—Analysis, control and removal. [1]

Aurich et al. (2009), [2] state that burrs are sharp and may cause small injuries on finger to assembly workers. Furthermore, they may become loose during operation on a product and provoke damages.

Kilickap (2010) and Et.al. [3] studied the modeling and optimization of burr height in the drilling of aluminum alloy and stated that lower feed rates and cutting speeds are preferred.

M. Brezocnik et al [4], Proposed the genetic programming approach to predict surface roughness based on cutting parameters (spindle speed, feed rate and depth of cute) and on vibrations between cutting tool and workpiece. From their research, they conclude that the models that involve in the three cutting parameters and also vibrating, give the most accurate predictions of surface roughness by using genetic programming. In addition, feed rate has the greatest influence on surface roughness.

K. Kadirgama et al [5], Develop a surface roughness prediction model for 6061-T6 Aluminum Alloy machining using statistical method. The purposes of the study are to develop the predicting model of surface roughness, to investigate the most dominant variables among the cutting speed, feed rate, axial depth and radial depth and to optimize Surface Roughness Prediction Model of 6061-T6 Aluminum Alloy Machining Using Statistical Method the parameters. Response surface method (RSM) based optimization approach was used in that study. It can be seen from the first order model that the feed rate is the most significantly influencing factor for the surface roughness. Second order model reveals that there is no interaction.

Mandara D. Savage et al [6], Developed a multilevel, in-process surface roughness recognition (M-ISRR) system to evaluate surface roughness in process and in real time. Key factors related to surface roughness during the machining process were feed rate, spindle speed, depth of cut and vibration that had generated between tool and workpiece. The overall MR-M-ISRR system demonstrated 82% accuracy of prediction average, establishing a promising step to further development in-process surface recognition systems. Kim and Dornfled (2001)[7], carried out a cost estimation of drilling operation based on drilling burr control chart and Bayesian statistics. The cost of drilling operation consists of cost of hole making and cost of deburring. The procedure developed by them can be effectively used to minimize the total cost without sacrificing the hole quality and the productivity.

Pande and Releker (1986) [7], carried out experimental investigation on reduction of burr formation in drilling of through-holes in metals and it was observed that the larger diameter of drill bit yields maximum burr height. For an optimum feed, the formation of burr is minimum and is independent of drill diameter. The burr formation in small diameter holes was carried out by Stein and Dornfeld (1997). They reported that in drilling of 0.91 mm hole in stainless steel, the burr height and the unformed burr thickness ratio was constant in different level of feed rate and spindle speed.

Dornfeld et al. (1999) carried out drilling on titanium alloy (Ti-6Al-4V) plate and investigated the effect of tool geometry and process condition on the drilling burr formation. The effect of different drill bit material (solid carbide and high-speed cobalt) and application of coolant was studied. The different types of burr formations such as ring type, lean back burr, roll back burr and uniform burr were formed. They also observed that helical point drill produces small burrs than split point drill. Some interesting observations were made by them. The point angle has major influence on optimal burr height for drill diameters of 4 mm, 10 mm and 28 mm. Lip clearance angle has significant effect in reducing the burr height for 20 mm drill bit diameter and large point angle is required to minimize the burr height for higher drill bit diameters.

III. PROBLEM STATEMENT

According to the research of Aurich that burr formation could not be prevented completely rather, it could be minimized by additional deburring operation. But According to Narayanswamietal.additional deburring may also damage the object. The problem was that the components were not able to fulfill the customer requirements. The company’s actual production was very less as compared to customer requirement as formation of burr while machining of aluminum alloy while milling, boring, and grooving, drilling operation, while cleaning the materials by pneumatic high pressurized air some burr was remained in that which affected the company quality. That burr generation also lead to rejection of 4000 components on quarterly basis. An extra manpower is required for cleaning those burr and leads to human errors, affects the quality of product and company also. We saw that this method has many problems like labour fatigue, labour idle time, damage to costly parts, etc.

IV. OBJECTIVES

The given objectives are to be predicted while doing this project work are given below,

- To develop new techniques in order to eliminate the chip formation after machining.
- To reduce delays, and damage.
- To promote safety and improve working conditions.
- To maintain or improve product quality.
- To promote productivity and time will save.
- To reduce man power. (Labor fatigue)
- To less accident prone & One-time investment.
- To reduce damage to costly products.

V. MACHINING OPERATION

5.1 Check fixture on machine:

Check fixture on machine whether it is suitable for required casting or not while setting. Check jig identification name.

5.2 Check for defect:

Task casting from input shutter bin, Check the casting and VMC operation condition. Once confirm limit sample. If any casting defect or machining operation not complete. Put redline, inform to redline leader

5.3 Loading and unloading:

Initially unloading the casting from station 1 and directly put into the station 2. Remove the casting from station 2and air blow on fixture rest pad loads in station 2. Take the casting from input bin and the loads in station1.

5.4 Machine start:

Press the start button in green color. If not pressing the button not move and the operation will not complete

5.5 Removal of chip:

After machining complete casting is dipping into the hot water (1 time). Put air blow on the air gun to remove the minute chip in the minute chip in the holes of casting. If not dipping casting will be oily and burr, appearance of casting is not good. If not air blow on casting properly, remains in the part burr will be inside and outside.

5.6 Check for dimensions

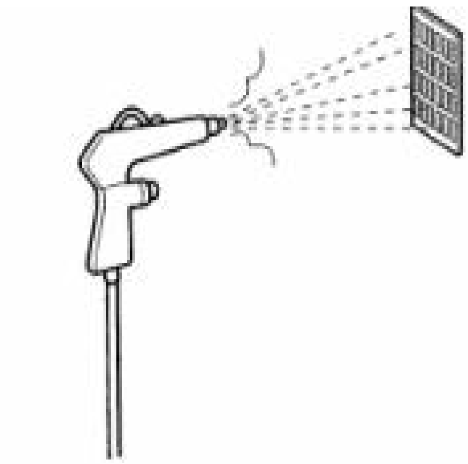
Check milling surface unwilling, dent & damages, check Dia 55.0 Dia 40, m8*1.25 m5*0.8, m3*0.5 & Dia 16.0 using core plug gauge (STD-QAD-230) GO/NOGO. If any surface, gauge no-go and go gauge tight, stop the machining center and inform to the line leader.

VI. WORKING METHODOLOGY

This project consists of small bin like components that contains work holder, manifold, tube, connectors. It basically works on pneumatic system. The air from the compressor in the FRL unit. FRL Units ensure clean air delivery to pneumatic system parts hence system blockage may be avoided. Lubrication causes better life of parts. Regulator devices avoid pressure drop or rise so that leakages and parts damages may be avoided. Now the pressure comes from the FRL unit is divided into the 3-way. One system of pressure is connected to the VMC for proper working of chuck, hydraulic unit, tail stock. The pressures in Hydraulic unit, Chuck, Sub-chuck and Tail Stock are listed below:

1) Hydraulic unit: 35 kgf/cm2 (3.5 MPa)
2) Chuck: 5 ~ 27 kgf/cm2(0.5 ~ 2.7 MPa)
3) Tail Stock: 1 ~ 20 kgf/cm2 (0.1 ~ 2 MPa)

The second way of pressure is connected to air gun for cleaning the burr settled in the fixture, chuck and also clean the coolant from the work piece. Now the next way of pressure is directly given the bin contain required set up. By simply release valve from the passage air from it passes over the manifold in the bin. Due to light weight of the work piece start rotating in the bin then the minute burr in work piece and the coolant in that is also get dry. The air could be release by some duration burr in the workpiece is get completely removed then the work piece is subjected to some other process.



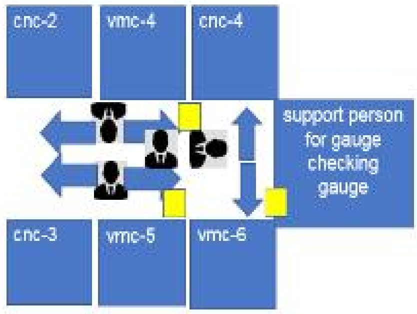
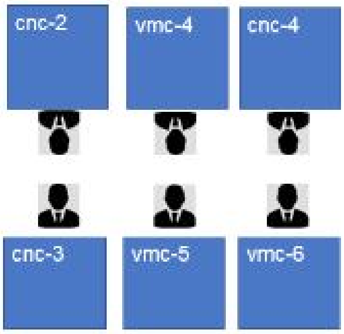


Fig 1:- Actual Project model

VII. COMPARATIVE STATEMENT

7.1 Manual method of chip removal:

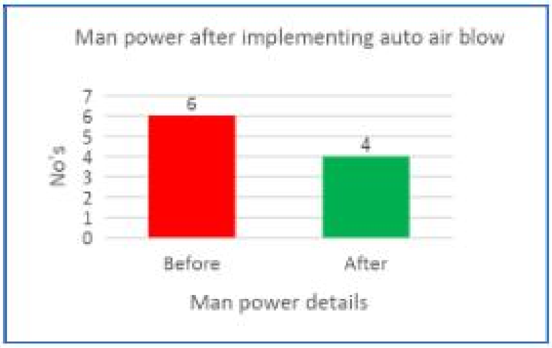
Before cover part machining operation done, Manual air blow done upon part by operator & cycle time 25 sec’s. (Man power used 6 man power/shift), Productivity 85% only achieved

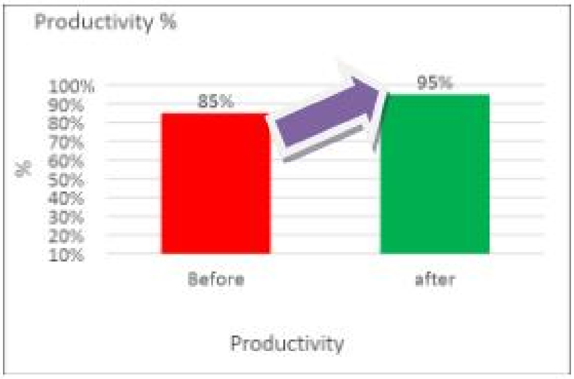


7.2 Auto air blow of chip removal:

After cover part auto air blow system provided with minimum investment 30,000. Reduced manual air blow from 6 man power per shift to 4 man power per shift, Productivity improved from 95%.

VIII. EFFECTIVENESS & ANALYSIS





IX.CONCLUSION

As a result of increased demands on part quality and functional performance, edge conditions after machining have become an issue of particular importance for many industries. Even small burrs on edges cannot be allowed in many cases. This requirement leads to deburring and cleaning operations which make up for a considerable portion of manufacturing costs. Development and application of the technologies necessary for clean mechanical machining have just started. By providing modification in process, we have improved the production rate in machining from 21,150 set/month to 24,000 set/ month as time required for deburring using manual deburring method is significantly reduce by following other modified techniques described in proposed solution in which labour work completely eliminated. It has given good results, in profit also and reduces extra man hours required for deburring.

X. FUTURE SCOPE

The future development for comprehensive and integrated strategies for burr minimization and prevention will depend on the continued development of predictive models with powerful databases, including ‘‘expert data bases’’ for process specification, simulation models of burr formation capable of indicating the interaction and dependencies of key process parameters for burrs at all scales ,strategies for burr reduction linked to computer-aided design and process planning systems (and close coordination with CAD/CAM resource suppliers),inspection strategies for burr detection and characterization including specialized burr sensors, development of specifications and standards for burr description and measurement.

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