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# Development of Fixture-Based Slitting Chamfer Machine

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**ABSTRACT:** In the current manufacturing setup, slitting operations were initially performed on VMC (Vertical Machining Centre) machines. However, this method presented several drawbacks such as being time-consuming, causing lower daily production output, and leading to high electricity consumption. These limitations significantly affected overall productivity and cost-efficiency in the industry. To overcome these issues, a fixture-based slitting and chamfering machine was designed and developed as a special-purpose alternative. This new system enables precise and consistent edge finishing while holding the components firmly using a custom-designed fixture. The goal was to reduce operation time, increase daily production rate, and minimize power usage without compromising the quality of the process. The machine integrates mechanical and simple automation principles to ensure faster cycle times and ease of use. This project demonstrates that replacing high-end VMC usage with a focused, low-cost, fixture-based slitting solution can significantly improve operational efficiency in mass production environments.

**KEYWORDS:** Slitting operation, Fixture-based machine, Chamfering, VMC alternative, Productivity improvement, Cost-effective machining, Burr removal, Edge finishing,

## I. INTRODUCTION

Slitting and chamfering operations are essential for removing burrs and achieving smooth edges in machined parts. In many industries, such operations are traditionally carried out on high-precision machines like VMCs (Vertical Machining Centres). While effective, VMC-based slitting is often not practical for mass production due to high operational cost, increased power consumption, and longer cycle times. These challenges reduce overall productivity and increase production expenses. To address these limitations, a fixture-based slitting chamfer machine has been designed and developed. This custom setup, as shown in the provided images, includes a simple electric motor-driven system and a specially fabricated fixture for holding components securely during the slitting process. The fixture not only ensures alignment and stability but also allows for faster and repeatable operations. This setup is especially suitable for small to medium-scale industries seeking cost-effective alternatives to CNC/VMC operations. This alternative solution not only reduces the overall production cost but also simplifies the operation by eliminating the need for complex programing or skilled CNC operators. The machine is compact, consume significantly less power, and requires minimal maintenance. Moreover, the specially designed fixture ensure proper alignment of the workpiece and consistent chamfering result across batches.

## II. LITERATURE SURWAY

**Design and Implementation of Slitting Chamfer Machines for Gear Manufacturing" by Dr. M.Desai, Prof. T. Nair: -** This paper presents the design principles and implementation strategies for slitting chamfer machines used in gear manufacturing. It delves into the mechanical and control system design considerations necessary to achieve precise chamfering of gear teeth. The study also discusses the integration of automation and quality control measures to ensure consistency and accuracy. Case studies demonstrate the effectiveness of the proposed designs in industrial applications, highlighting improvements in production rates and product quality.These papers offer a comprehensive overview of current research and developments in the fields of CNC machining, VMC optimization, and slitting chamfer machine design, providing valuable insights for professionals and researchers in the manufacturing industry.

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**"Review on Chamfering Machine Operations" by Sangram Kotkar and Dr. R. J. Patil (2014):** This paper discusses the transition from manually operated chamfering machines to automated systems, emphasizing the benefits of automation in reducing human interference and increasing productivity. The authors explore various methods to achieve automation, including the use of hydraulic systems.

**"Double Head Chamfer Machine Design & Development of Double Head Chamfer Machine" by Yash D. Shah and Tusharkumar Raut (2021):** This study presents the design and development of a double head chamfer machine aimed at enhancing mass production efficiency. The machine is designed to chamfer both ends of a component simultaneously, reducing time consumption and labour.

**"Manufacturing of Chamfering and Deburring Unit Using Lathe Attachment" by Aniket Sane (2016):** This research explores the creation of a special-purpose unit made from a cylindrical grinding attachment on a lathe machine to perform chamfering and deburring operations on workpieces of various sizes. The unit aims to reduce machine setting time and the need for skilled labour.

**"Research & Development of Cot Chamfering Machine" by Shashank Patil:** This paper focuses on the development of an automated cot chamfering machine to handle cots of varying sizes in textile industries. The machine aims to improve chamfer quality, reduce operation time, and increase productive.

**A.Ghosh and A.K. Malik (2010)** discussed the importance of Special Purpose Machine (SPMs) in reducing time for repetitive operations. They emphasized that fixture design plays a vital role in improving machine accuracy and efficiency. This align with the fixture-based approach adopted in the current project, where the component is held in a stable position for consistent slitting.

Chamfering and burr removal are critical finishing process in manufacturing, especially in industries such as automotive, aerospace, and heavy machinery. According **to K.F.Ehmann et al. (2001),** burr formation is a common challenge during machining, and its removal often requires secondary operation that increase cycle time and cost. Traditional methods like manual deburring are labour-intensive, while automated system such as CNC or VMC-based setup are expensive and consume high energy.

**"Static and Dynamic Analysis of Base of Vertical Machining Center by Nikunj Aadeshra, Prof. R L. Patel:-**This review focuses on the static and dynamic analysis of the base structure of a Vertical Machining Centre (VMC). It emphasizes the importance of structural stiffness and damping characteristics in machine tool bases to ensure precision and repeatability. The paper discusses the application of Finite Element Analysis (FEA) for estimating stresses, strains, and deflections, and highlights the significance of predicting natural frequencies and mode shapes to prevent catastrophic failures. Finite Element Analysis (FEA) for estimating stresses, strains, and deflections, and highlights the significance of predicting natural frequencies and mode shapes to prevent catastrophic failures.

## III. PROJECT ASSESSMENT

**3.1 Project Concept**: - In Advance Technoworks Ichalkaranji Manufacturing Industry in Manufacturing Different types of Automobile Parts.

We Observed Slitting Operation done on VMC Machine (Vertical Machining Centre).

One Major part Manufacturing in Industry:-

**Part Name: - Throttle Shaft**

Mostly Slitting Chamfer Operation Performing of this Job on VMC.

We Observe some Drawbacks in Slitting Operation Performed on VMC:-

1. Time Required= 40sec for 2 Jobs
2. Daily Production= 1300 jobs
3. Electricity Charge= 350-400rs
4. Labour Charge on VMC= 300rs
5. Total= 650rs minimum 700 max

From this all Drawbacks we create a Fixture based Slitting Chamfer machine Concept which can increase Productivity and helps to Reduce Product Cost.

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Fig.1 (Side view of Fixture)

Fig.2 (Front View)

**3.2 Components:**

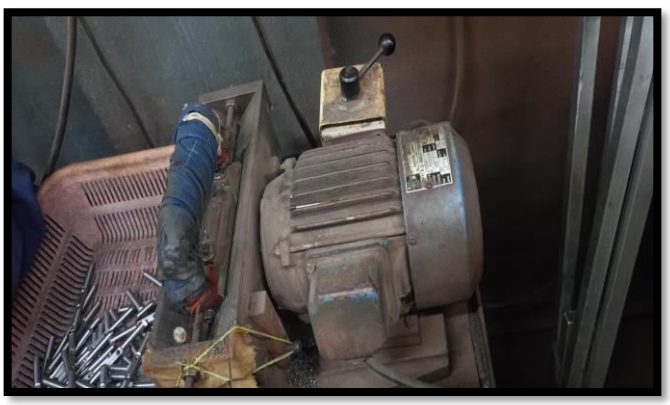
1. Base Plate (Body): Made of hardened steel or mild steel. Machined slots accurate positioning of the allow for workpice**.** Rigid and flat to maintain alignment during operations.

2 .V-Groovs or Custom Slots: The fixture has machined grooves of pockets shaped to the contour of the workpiece, ensuring proper orientation and preventing rotational movement during machining.

3. Clamping Mechanism: A spring loaded shaft with a handle allows for quick loading/unloading.
The shaft locks the workpice in place by pressing it against the V-groove or base.
The mechanism may use a cam or eccentric to generate enough clamping force.

4. Application Specificity: Design for repetitive chamfering/slitting operations where precision is key.
Reduces time spent aligning parts manually on CNC/VMC machines.
Ideal for mid-to-high volume production environments.

**3.2.1Motor**



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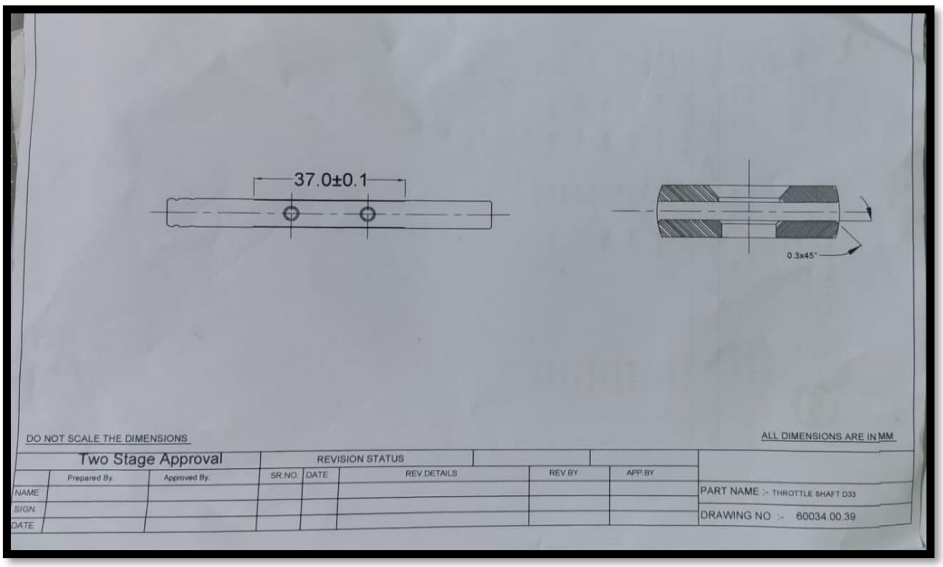
**Type:** Squirrel cage induction motor.
**RPM:** 1440 or 2880 RPM
**Frame:** Probably standard foot-mounted.
**Usage:** 1-5 HP based on size.

How it fits the application:
**High Torque:** Provide sufficient power to handle metal workpieces.
**Continuous Operation:** Designed for heavy-duty industrial tasks.
**Stability:** Its weight and build allow for stable operation with minimal vibration.
**Customization:** You can attach custom grinding or slitting wheels on the shaft.
**3.2.3 Switch:**
Type: Rotary Switch or Directional lever. Commonly used for starting induction motor.
Features: A manual lever or push button is visible at the top, used to engage/disengage the starter.
A rotary switch typically found on industrial machines like grinder, lathe, or milling machines.

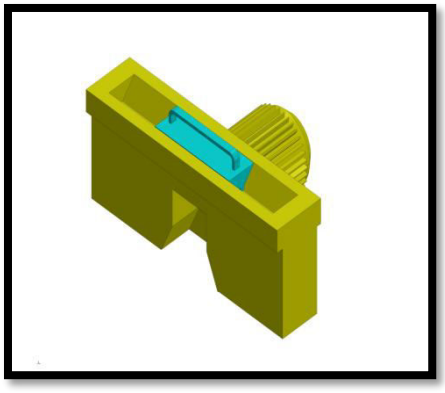
### 3.3 Operation Drawing




**Chamfer Operation**

### 3.4 Design of V-block

The v-block are desined to locate and accommodate the Throttle Shaft. This block clapping on a motor front side. This



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### 3.5 Comparison

| Parameter | VMC Machine | Slitting Chamfer Machine |
|---|---|---|
| Daily Production | 1000-1300 Jobs | 2000-2880 Jobs |
| Operation Time per Job | 60sec 60 sec for 2 Jobs | 5-10 sec 1 Job |
| Programing | Programing is Required | No need of Programing |
| Operating Cost | High | Low |
| Operator Skill Level | High | Semi – Skilled |
| Electricity Charge | 350-450 rs | 100-150 rs |
| Machine Load | Heavy | Light |

## IV. CONCLUSION

This review highlights the limitations of traditional slitting and chamfering methods using CNC or VMC machines, especially in terms of production time, cost, and energy consumption. It also identifies the growing need for a simpler, more efficient alternative that can handle repetitive operations in small and medium-scale manufacturing setups. The proposed fixture-based slitting chamfer machine addresses these issues effectively by offering a low-cost, compact, and power-efficient solution. With the help of a customized fixture, the machine ensures consistent results, reduces operational cycle time, and minimizes the requirement for skilled labour. Its design supports lean manufacturing principles by increasing daily production rates and simplifying the overall process. In conclusion, this machine has the potential to replace expensive and complex setups for specific operations like chamfering and burr removal. It serves as a valuable contribution to the field of special-purpose machines and provides a practical approach to improving productivity in industrial finishing processes.

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