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Design and Manufacturing of an Indexing Drum for Toolmakers Microscope

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Abstract:

Indexing drum which is a part of microscope to see the structure of a component. To find metallurgical defects in a product or component which facilitate magnification of 5X, 10X, 15X. This project rectifies a problem that is while focusing in the microscope, the images are getting distorted during its operation.

It was rectified by looking in to the feedback given by the client. By reviewing the drawing, to change the manufacturing process, to achieve the dimensional stability of an indexing drum by using aluminum HE20 which have high strength, durability and low cost.

To get cost effective indexing drum in manufacturing it is done in 4 axis C.N.C machine. By designing a special purpose fixture, to manufacture the indexing drum in 3 axis C.N.C machine, instead of 4 axis C.N.C.

The component indexing drum is designed in pro-e modeling software, manufactured and generates the C.N.C part programming with 'G' codes and 'M' codes.

I.INTRODUCTION:

The adaptation of optical principles to the practical needs of workshop inspection has given rise to the construction of toolmaker's microscope and projectors.

These apparatuses incorporate every feature of accuracy and refinement in their design, and hence they are known as precision inspection apparatuses.

Projectors and Toolmaker's microscope are made to the highest possible standard and represent high constructive skill and ingenuity in design.

Surgical microscope:

An operating microscope is an optical microscope specifically designed to be used in a surgical setting, typically to perform microsurgery. Design features of an operating microscope are m components that are easy to sterilize or disinfect in order to ensure cross-infection control. Fields of medicine that make significant use of the operating microscope include dentistry (especially endodontic), ENT surgery, ophthalmic surgery, and neurosurgery.

Types of Microscopes :

Various types of microscopes are available for use in the microbiology laboratory. The microscopes have varied applications and modifications that contribute to their usefulness.

The light microscope:

The common light microscope used in the laboratory is called a compound microscope because it contains two types of lenses that function to magnify an object. The lens closest to the eye is called the ocular, while the lens closest to the object is called the objective.

agnification typically in the range from 4x-40x, In addition to the familiar compound microscope, microbiologists use other types of microscopes for specific purposes. These microscopes permit viewing of objects not otherwise seen with the light microscope.

Phase-contrast microscope:

A second alternative microscope is the phase-contrast microscope.

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This microscope also contains special condensers that throw light "out of phase" and cause it to pass through the object at different speeds.

Fluorescent microscope:

The fluorescent microscope uses ultraviolet light as its light source. When ultraviolet light hits an object, it excites the electrons of the object, and they give off light in various shades of color. Since ultraviolet light is used, the resolution of the object increases.

Electron microscopy:

The energy source used in the electron microscope is a beam of electrons. Since the beam has an exceptionally short wavelength, it strikes most objects in its path and increases the resolution of the microscope significantly. Viruses and some large molecules can be seen with this instrument.

Transmission electron microscope (TEM):

The more traditional form of electron microscope is the transmission electron microscope (TEM). To use this instrument, one place ultrathin slices of microorganisms or viruses on a wire grid and then stains them with gold or palladium before viewing.

Scanning electron microscope (SEM):

The scanning electron microscope (SEM) is the more contemporary form electron microscope. Although this microscope gives lower magnifications than the TEM, the SEM permits three-dimensional views of microorganisms and other objects. Whole objects are used, and gold or palladium staining is employed.

II.CAD/CAM/CAE:

The Modern world of design, development, manufacturing so on, in which we have stepped can't be imagined without interference of computer. The usage of computer is such that, they have become an integral part of these fields. In the world market now the competition in not only cost factor but also quality, consistency, availability, packing, stocking, delivery etc.

So are the requirements forcing industries to adopt modern technique rather than local forcing the industries to adapt better techniques like CAD / CAM / CAE, etc.

The Possible basic way to industries is to have high quality products at low costs is by using the computer Aided Engineering (CAE), Computer Aided Design (CAD) And Computer Aided Manufacturing (CAM) set up. Further many tools is been introduced to simplify & serve the requirement CATIA, PRO-E, UG are some among many.

This penetration of technique concern has helped the manufacturers to

- Increase productivity .
- Shortening the lead-time .
- Minimizing the prototyping expenses.
- Improving Quality .
- Designing better products .

CAD: Computer Aided Designing (Technology to create, Modify, Analyze or Optimize the design using computer.

CAE: Computer Aided Engineering (Technology to analyze, Simulate or Study behavior of the cad model generated using computer.

CAM: Computer Aided Manufacturing (Technology to Plan, manage or control the operation in manufacturing using computer.

Need for CAD, CAE &CAM:

The usage of CAD CAE & CAM have changed the over look of the industries and developed healthy & standard competition , as could achieve target in lean time and ultimately the product reaches market in estimated time with better quality and consistency .

In general view, it has lead to fast approach and creative thinking.

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ADVANTAGES:

- Cut off of the designing time.
- Cut off of the editing time.
- Cut off of the manufacturing time.
- High & controlled quality.
- Reduction of process cost.

DRAWBACKS:

- Requires skilled operators.
- Initial setting & assumption consumes time.
- Over heads are high and
- Applicable if production is high.

III.COMPUTER INTEGRATED MANUFACTURING SYSTEMS:

Introduction:

Computer Integrated Manufacturing (CIM) encompasses the entire range of product development and manufacturing activities with all the functions being carried out with the help of dedicated software packages. The data required for various functions are passed from one application software to another in a seamless manner. For example, the product data is created during design. This data has to be transferred from the modeling software to manufacturing software without any loss of data.

CIM uses a common database wherever feasible and communication technologies to integrate design, manufacturing and associated business functions that combine the automated segments of a factory or a manufacturing facility. CIM reduces the human component of manufacturing and thereby relieves the process of its slow, expensive and error-prone component. CIM stands for a holistic and methodological approach to the activities of the manufacturing enterprise in order to achieve vast improvement in its performance.

CIM hardware and CIM software:

CIM Hardware comprises the following:

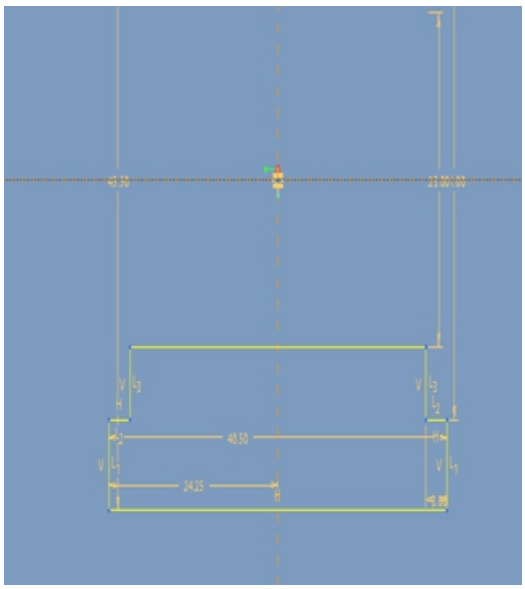
- Manufacturing equipment such as CNC machines or computerized work centers, robotic work cells, DNC/ FMS systems, work handling and tool handling devices, storage devices, sensors, shop floor data collection devices, inspection machines etc.

- Computers, controllers, CAD/CAM systems, workstations / terminals, data entry terminals, bar code readers, RFID tags, printers, plotters and other peripheral devices, modems, cables, connectors etc.

Engineering Design:

Creo Elements/Pro offers a range of tools to enable the generation of a complete digital representation of the product being designed. In addition to the general geometry tools there is also the ability to generate geometry of other integrated design disciplines such as industrial and standard pipe work and complete wiring definitions. Tools are also available to support collaborative development. A number of concept design tools that provide up-front Industrial Design concepts can then be used in the downstream process of engineering the product. These range from conceptual Industrial design sketches, reverse engineering with point cloud data and comprehensive free-form surface tools.

The profile and revolve 360 deg:



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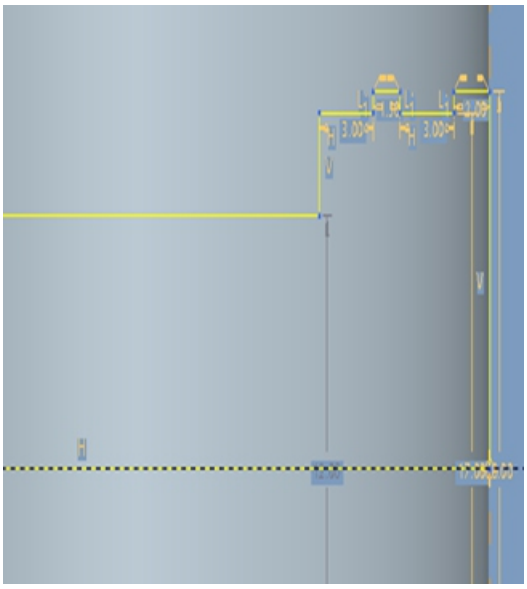
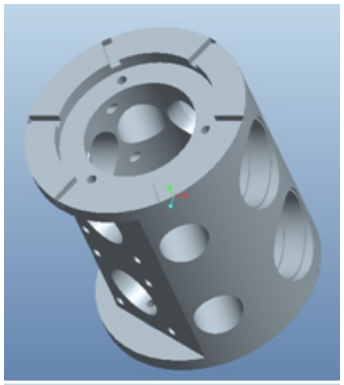
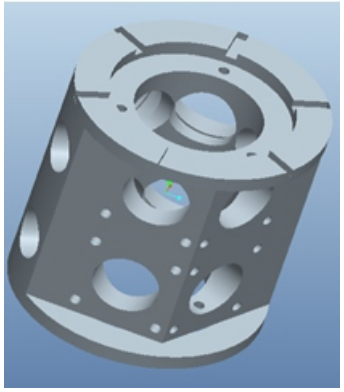
The whole profile and revolve 360 deg, pick remove material:

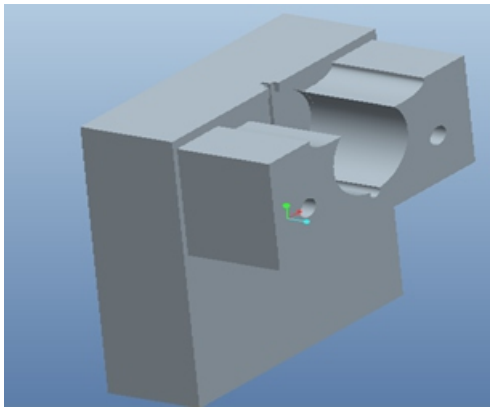


Take the datum plane parallel to the top plane with 11 mm offset, and draw the profile, revolve, and remove material to make the hole. And mirror the hole.
The final product.





Special purpose fixture to hold the component

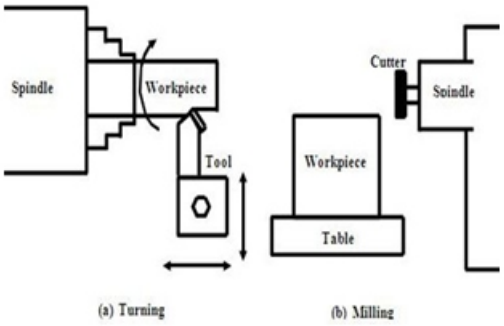


IV.COMPUTER NUMERICALLY CONTROLLED (CNC) MACHINES:

Instructional Objectives :

After learning the lesson students should be able to

- Define Numerical Control and describe its advantages and disadvantages.
- Name and describe the major components of a CNC system.
- Explain the coordinate systems adopted for CNC programming.
- Describe the major types of motion control strategies.
- Describe the major classifications of CNC machines.



Drive in metal cutting

Introductory Concepts of Machining :

Machining is basically removal of material, most often metal, from the work piece, using one or more cutting tools to achieve the desired dimensions.

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There are different machining processes, such as, turning, milling, boring etc. In all these cases metal is removed by a shearing process, which occurs due to the relative motion between the work piece and the tool.

Numerical control Automatically controlling a machine tool based on a set of pre-programmed machining and movement instructions is known as numerical control, or NC.

NC equipment has been defined by the Electronic Industries Association (E1A) as "A system in which actions are controlled by the direct insertion of numerical data at some point.

The system must automatically interpret at least a portion of this data." This is an old definition as is apparent from the terminology used in the definition Turning centers can realize a fusion of various types of lathes.

Over a period of time, several additional features were introduced, leading to increased machine utilization and reduced operator intervention. Some of these are:

• Tool/work monitoring: For enhanced quality, avoidance of breakdowns.

• Automated tool magazine and palette management: For increased versatility and reduced operator intervention over long hours of operation

• Direct numerical control (DNC): Uses a computer interface to upload and download part programs in to the machine automatically.

Advantages of a cnc machine :

CNC machines offer the following advantages in manufacturing.

• Higher flexibility: This is essentially because of programmability, programmed control and facilities for multiple operations in one machining centre.

• Increased productivity: Due to low cycle time achieved through higher material removal rates and low set up times achieved by faster tool positioning, changing, automated material handling etc.

• Improved quality: Due to accurate part dimensions and excellent surface finish that can be achieved due to precision motion control and improved thermal control by automatic control of coolant flow.

The above disadvantages indicate that CNC machines can be gainfully deployed only when the required product quality and average volume of production demand it.

Classification of NC systems :

CNC machine tool systems can be classified in various ways such as:

• Point-to-point or contouring: depending on whether the machine cuts metal while the work piece moves relative to the tool .

• Incremental or absolute : depending on the type of coordinate system adopted to parameterize the motion commands

• Open-loop or closed-loop: depending on the control system adopted for axis motion control.

V.CNC PROGRAM:

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0332;
N1G00 G90 G21 G54 G17 G40 X0 Y-60 ;
N0006 M03 S1500 ;
N0011 G00 Z0;
N0016 M98 P333 L25;
N0021 G00 Z150;
N0026 M03 ;
0333;
N1 G01 G21 G91 Z – 2 F500;
N0006 G01 G90 G41 D32 X10Y – 48;
N0011 G03 X0 Y – 38 R10 F2000 ;
N0016 G02 X – 17 . 07 Y – 33 . 95 R38 ;
N0021 G03 X – 28 . 18 Y – 34 . 38 R10 ;
N0026 G02 X – 34 . 38 Y – 26 . 81 R5 . 5;
N0031 G03 X – 33 . 95 Y – 17 . 07 R10;
N0036 G02 X – 20 . 1 Y32 . 63 R38;
N0041 G03 X – 18 . 35 Y37 . 41 R3;
N0046 G02 X – 25 . 45 Y68 . 19 R28;
N0051 G03 X – 27 . 16 Y77 . 15 R10;
N0056 G02 X – 19 . 51 Y85 . 16 R5 . 5;
N0061 G03 X – 9 . 57 Y84 . 08 R10;
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N0066 G02 X9.57 Y84.08 R28;
N0071 G03 X19.51 Y85.16 R10;
N0076 G02 X27.16 Y77.51 R5.5;
N0081 G03 X25.45 Y68.19 R10;
N0086 G02 X25.34 Y46.08 R28;
N0091 G03 X25.12 Y42.37 R5;
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N0101 G03 X22.72 Y29.98 R3;
N0106 G02 X33.95 Y-17.07 R38;
N0111 G03 X34.38 Y-26.81 R10;
N0116 G02 X26.18 Y-34.38 R5.5;
N0121 G03 X17.07 Y-33.95 R10;
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0337;
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N7G03X15.26Y31.5R3;
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N7 M30;
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N1 G01 G91 Z-1.5 F200;
N2 G01 G90 X0 Y58;
N3 G02 X-8.5 Y58;
N4 G02 X8.5 Y58 R8.5;
N6 M99;
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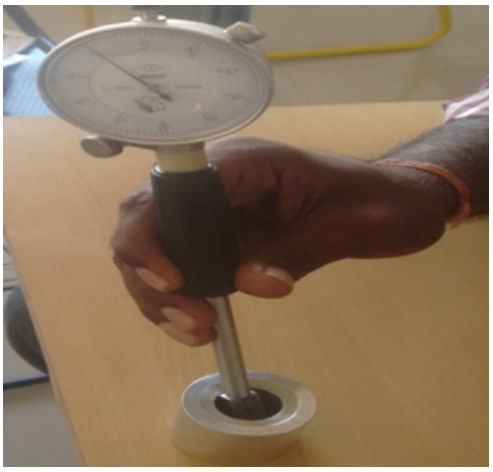
VI.TESTING THE COMPONENT:

Checking the diameter (O.D)



Checking the diameter (I.D)

Checking the length

Manufactured Component

VII.CONCLUSION:

In this project a modified the design and manufacturing process of an indexing drum. For cost effectiveness we use special purpose fixture to reduce manufacturing cost, and also we use material aluminum HE20 having high strength, durability and low cost. For the manufacturing process we use C.N.C part programming, and finally we get perfect indexing drum for a toolmakers microscope.

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