DESIGN AND MANUFACTURING OF MISSILE LONG SHELL COMPONENT BY CNC TURN-MILL CENTRE

ALKA SAWALE & MD KHALEEL

Assistant Professor, Department of Aeronautical Engineering, MLR Institute of Technology, Hyderabad, Telangana, India

ABSTRACT

The object of this paper work is to manufacture critical component on CNC TURN MILL CENTRE. In this generation of part programme and implementing the same project consists of various operations that are to be performed to complete machining by maintaining the required dimensional accuracy of the component. It also includes holding devices like fixtures to carry out in the processing.

The first stage is process plan for identification of required operations and sequences adopted to complete the job, as per drawing requirements. The second stage involves identification of machine tools and machining parameters, work holding devices, cutting toll and other accessories. The third stage involves materials status at every stage from the initial to final product and finding the optimal method. The final stage involves inspection plan of product with suitable inspection method.

KEYWORDS: CNC, Missile, Nose cone, Long Shell & Gyros, etc

Received: Nov 25, 2017; **Accepted:** Dec 15, 2017; **Published:** Dec 22, 2017; **Paper Id.:** IJMPERDFEB20188

INTRODUCTION

Long Shell: Long Shell is a vital part in Gyro assembly in MILAN Missile. The long shell contains with components of outer gimbal, inner gimbal, rotor and short shell gyro drive assembly and other components like outer gimbals, which is the whirligig outline is mounted in order to turn around a hub in its own plane dictated by the help. The external gimbals have one level of rotational opportunity and its hub has none. The following internal gimbal is mounted in a spinner, which is a gadget for measuring or looking after introduction, in view of the guideline of precise force. Scientifically, a spinner is a turning wheel or circle in which, the hub is allowed to accept any introduction which can be shown in the figure 1. Despite the fact that this introduction does not stay settled, it changes because of an outer torque, considerably less and an unexpected way in comparison to it, would without the huge rakish energy related with the circle's high rate of turn and snapshot of dormancy. The gadget's introduction remains about settled, paying little heed to the mounting stage's movement, since mounting the gadget in a gimbal limits outer.

Figure (a): Long Shell of a Missile

PROBLEM DEFINITION

Milan is a family of a medium range anti-tank missiles developed by euro missile a joint venture between Germany and France to be employed by two men or mounted on round vehicles. It was introduced on 1970.

The long shell contains with components of outer gimbal, inner gimbal, rotar and short shell gyro drive assembly and other components, external gimbal have one level of rotational flexibility and its hub in its own plane controlled by the help. This external gimbal has one level of rotational flexibility and its hub has none.

The following internal gimbal is mounted in a whirligig is a gadget for measuring or keeping up introduction in view of the guideline of precise energy. Mechanically, a whirligig is a turning wheel or circle on which the hub is allowed to expect any heading.

Gyroscope in view of other working standards likewise exist, for example, the electronic, microchip bundled MEMS spinners gadgets found in buyer electronic gadgets, strong state ring lasers, fiber optic whirligigs, and the outside delicate quantum whirligig. Uses of whirligigs incorporate inertial route frameworks, where attractive compasses would not work. Because of their exactness, gyrators are likewise used to keep up heading in burrow mining.

Table 1: Specifications of Milan 2T

Dimensions	$\phi 125\text{mm}$
Weight	11.8kg(26lb)
War head	2.7kg(6.0lb)
performance	Max range 2,000m(6562ft)
Min range	25mm(8.2ft)
Piercing in armor	352mm(13.86in)
Top speed	200mps(0.60mach)

Figure (b): Milan Missile

The Indian army has placed an order of 4,100 French origins MILAN 2T ANTI-TANK guided missiles (ATGMs). The entire procurement plan of these ATGMs which is to the tune of \$12million has been cleared by the Indian defense ministry due to the rising tension between Indian and Pakistan.

DEVELOPMENT OF MACHINE TOOLS

Introduction

For surviving in the market, fundamental thought process is benefit. Improved administrations should be developed on plan, solid, enhanced and steady nature of item likewise mean benefit. Efficiency in assembling will also benefit the sales.

Profitability is a positive distinction amongst yield and information. To build the profitability in this way, one needs to expand the yield and keeping in mind that, keeping the contribution as low as could be expected under the circumstances.

Evolution of the machine tool science is shown in the figure below. Though there is a rapid growth in the machine tool technology and invention of automatic computer aided manufacturing machines, the importance of conventional machines cannot be neglected in production technology.

Comparison of General Purpose, Special Purpose & Computer Numerical Control Machines

General Purpose Machine – conventional type.

Special Purpose Machines – fully automated /bulk manufacturing/ modification is merely impossible.

CNR - fully supportive/ desirable to batch manufacturing /Job manufacturing may be some times convenient.

Computer Numerical Control of Machine Tools

Toward regulating those developments b/w the device around & the job part (machined part) of effort bit dimensions would be changed. Control from claiming this co-development from alphabets, numerical and symbols will be known as NC from MT.

The use of super computers in controlling the machines and making them operate on the program prepared by the part programmer is known as CNC. This CNC cannot be accomplished alone with the super computers, it needs the combination and co-ordination of servo motors, actuators, supply chains and the tape reader/ buffer memory. The main advantage of CNC over NC is the elimination of tape reader and the program once copied in the buffer memory can be recalled anytime whenever it is used and can be modified then and there itself

Elements of NC

CODING

The coding is a brief sequential order of procedure of machining operation MT has to follow.

MCU

This comprises of programmed electrical components, which read and interpret the coding & convert into physical operations of the MT.

Working Platform (MT)

This is the tool which do all the physical work on the work piece

OPERATING PRINCIPLE

Conventional Machine Tool	- Numeric Control MT
Human Mind	- NC Controller
Arms	- Direct Control Servo Drivers
Monitoring System	- Feedback System

SPMT

Due to that CNC innovation, new sorts for machines are continuously produced such as machining focuses, which need aid, predominantly committed for prismatic parts. Turning center need aid being committed for machining segments, which bring a greater amount of turning operations as well as Hosting function, which calls for processing penetrating also. This type of machinery is likewise known as Computer Numerical Control Lathe with determined devices. This lathe needs multiple tool post, which's having a free storage, coded from CNC framework. Also, few device places could need devices which will turn. Utilizing this lathe, those machining function such as turning, thread route processing also tapping cam wood a chance to be finished after finishing those machining operations. Accordingly, the operation focuses are provided for CNC controlled confronting.

CMM and Inspection Probes

Some sort of Computer Numerical Control is CMM & it is utilized for examining segments which results from Computer Numerical Control. This machinery has a touching component it inspects the measurements according to coding & will show changes as a graph. This lathe can likewise be connected to the Computer Numerical Control will show appropriate counterbalances to adjust measurements changes.

This utilization of on-process assessment tests is ending up more typical in present day NC apparatus frameworks. This investigation tests are modern pointers that should be fixed in the lathe instrument axle. These lathes, which programmed instrument changers, the test would be put in the apparatus stockpiling drum and stacked in to the shaft or holder when required, much the same as any of the general cutting devices.

CNC PROGRAMMING

Introduction

A program of coding for a Numerical Control MT is a part program. A Numerical Control part program is a progression of coded guidelines that direct the operation of a NC machine. This guideline contains all the machine and control capacities important to influence the machine to play out a particular assignment. The program is set up by posting arranged values. The arranged values are prefixed with preliminary codes 'G' to demonstrate the kind of development required for starting with one operation, then onto the next and supplemented with feed rate figures. The directions are suffixed with random codes for starting the machine device like begin, stop and so on

Part Programmer's Job

- Study the pertinent part drawing altogether
- Examines the kind of material to be operated
- Determines the determinations and elements of MT and highlights of the Computer Numerical Control framework
- Shows the machining instructions for the activity/apparatus mix
- Coding for the part will be finished

When the part program is being prepared, rely on ease of the highlights in the programming language, the beneath demonstrated system are the mix of various highlights that can be utilized profitably, relying upon the measure of material to be expelled in machining arrangement. A portion of the Computer Numerical Control framework highlights are stored

Job Part Dimensioning & Input Method

Fixed measurements methods info is utilized as a part of Computer Numerical Control. It should be modified to FPS i.e. inch co-ordinate framework by doing out G70 Code.

STEPS INVOLVED IN MACHING OPERATION

ABOUT THE COMPONENT

Required Material and Design Specification

AL ALLOY DIA 42MM

It is vital part in an explosive assembly, which in turn assembled in to an anti tank wire guided missile. It forms as housing and support to the GYRO ASSEMBLY and assembled to GD Housing.

Upon ignition of explosives due to the hot pressurized gasses, thrust will be given to the initial moment of the missile, later acts as a dampener gyro assembly, which will give the exact direction to the missile.

This gyro assembly consists of rotor which rotates at high speed.

Being an aluminum alloy, the strength to weight ratio is more, thereby, no oxidation formation or rust formation occurs. During its functioning: it can even with stand very high pressures.

Sequence of Operations

There are few operations, which are involved in the manufacturing process of the missile component, so called Long shell. The sequence of operation performed on CN machines for the manufacturing of a Long shell are:

- Cutting
- Turning
- Drilling
- Boring
- Finish bore
- Deburring
- Counter shrinking
- Trepanning&
- Tapping

Table 2 Inspection Details

Dimension	Actual Reading after Machining	Gauges, Instruments
Dia31(+0.1,-0.2)	30.85	Intrapid
Dia32H7	32.05	STD PPG
0.8(+/-0.05)	0.81	Depth dial
Dia6(+0.014,0.008)	6.012	Ppg/bore dial
2.2(+0.3)	2.45	Micrometer
Dia33(+0.1)	33.5	Comb.fix./micrometer
1.5(+/-0.1)	1.5	Vernier/ micrometer
36(+0.5)	36.3	Vernier/ micrometer
Dia7(-0.1)	6.95	Trep gauge
Dia8.7(+0.1)	8.75	Trep gauge
1.6(+/-0.1)	1.5	Comparator
Pcd 28.(+/-0.05)	28.35	Position gauge
62deg(+/-10mints)	62	Position gauge

Table 2: Contd.,		
59 deg(+/-10mints)	59	Microscope/3D
Dia17(+/-0.2)	17	Vernier
PERP0.02	0.02	Dialing
90deg(+/-30°)	90	Microscope
Dia31.5H7	31.55	Std ppg
42.5(+0.1/-30)	42.4	Combo fixture
0.2(+/- 0.1)*45deg(+/-deg)	45	Microscope
Flatness0.02	0.2	Dialing
Check plating thickness	3 to 6 microns	Fisherscope, visual

CNC Machine

Specifications of GE42 NC

Type of machine	: CNC TURN MILL CENTRE
Make	: INDEX
Type	: GE 42 NC
Type of Control	: CNC FAGOR control

TECHNICAL DETAILS

Turning Diameter	: 370mm
Turning Length	: 400mm
Control	: FAGOR CONTROL
Spindle Bore	: 52mm; 160mm; 42mm
Centre distance	: 340mm
Total Power Required	: 22,00kW
Weight of the machine	: 290 tons
Dim.s of the Machine	: 500x200xH180 cm

Figure (c): CNC Milling

CONCLUSIONS

The project is all about geometric modeling of the component, which is to be manufactured and procedure adopted for the production of the component, so designed. The component is long shell, which is mainly used in the MILAN-2T missile.

This component plays a very important role in the guiding the missile direction. Manufacturing of such component requires a precision of about 6 microns, which can be achieved using only precision machining equipments like CNC. Once the setting time is done, any number of components can be manufactured in a single step. Hence, the machining time is reduced. Reduction of cycle in the manufacturing of the component has been achieved by introducing cycles feed and speed rate, and also by using latest tools. The production quality of the component improved a lot due to controlled dimensional accuracy.

REFERENCES

1. *FAGOR automation programming manual CNC 8055 control.*
2. *CNC turn mill centre by ACE MICROMATIC.*
3. *Fakulti Kejuruteraan Mekanikal dan Pembuatan, Kolej Universiti Teknologi Tun Hussein Onn (KUiTTHO), 86400 Parit Raja, Batu Pahat, Johor, Malaysia.*
4. *Sai Kumar, M. Ganesh And G Hima Bindu, 2017. Application of CNC Milling In Manufacturing Turbine Blades. International Journal of Civil Engineering & Technology (IJCET)*
5. *Gaurav Thakur & Gurpreet Singh, Experimental Investigation of Heat Transfer Characteristics in Al₂O₃ Water Based Nanofluids Operated Shell and Tube Heat Exchanger with Air Bubble Injection, International Journal of Mechanical and Production Engineering Research and Development (IJMPERD), Volume 7, Issue 4, July - August 2017, pp. 263-274*
6. *Wolfson School of Mechanical and Manufacturing Engineering, Loughborough University, Loughborough, LE11 3TU, UK.*
7. *Department of Mechanical Engineering, University of Bath, Bath, BA2 7AY, UK.*
8. *Space saving fin deployment system for munitions and missiles*
9. *The United States Of America As Represented By The Secretary Of The Navy*
10. *Diehl Gmbh & Co, "Artillery rocket", US5467940. Nov 21, 1995*