Design and Fabrication of Automatic Universal Machine Bed

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ABSTRACT

The bed of Machine acts as the base on which the different fixed and operations parts of the machine are mounted. Machine beds are usually made as single piece casting of semi-steel (i.e., toughened cast iron)with the addition of small quantity of steel scrap to the cast iron during melting; the material 'cast iron' facilitating an easy sliding action. In case of extremely large machines, the bed may be in two or more pieces, bolted together to from the desired length. Machine Bed are heavy rigid structure which is having high damping capacity for the vibrations generated by machines during machining. The rigid structure will helps to avoid deflections. The guides and ways which are present on the top of the bed will act as rails and supports other parts like tail stock. The bed will be designed in such a way that easily bolted to the floor of the machine shop.

Keyword:- Machine Bed, Universal Machine Bed, Single Piece Casting

1. INTRODUCTION

The main requirement of bed, base or column is that it should maintain the proper relative positions over long period under all sorts of working conditions. The configuration of bed depends on the arrangement of ways for various units, length of stroke of main units, necessity of housing various mechanisms inside the bed, various openings, apertures, etc. required in the walls of the bed. In practice box section is used with certain-modifications, as the strength and rigidity of the hollow frames is increased by incorporating ribs and partitions. This modification is especially necessary when the operating conditions of the components do not allow it to be completely closed so that it remains open to one or two sides e.g., lathe beds .The effectiveness of partitions and ribs largely depends on their arrangement. A most commonly used cross-section of lathe bed Ribbings is provided to offer maximum resistance to bending and torsion stresses and massive sections in castings

The requirements for selecting guide way materials are strength, damping capacity and wear resistance. Usually semi-steel with nickel and chromium is a suitable slide way material capable of resisting wear and bending stresses. Often the bed is a frame hardened by heating the top surface above the critical temperature and then quenching it at a moderate rate. The selection of the saddle material and bed material should be such that the wear I both is equal and minimum as possible. It has been found experimentally that best results are exhibited by using saddle of hardened steel and bed of frame refined cast iron.(In flame refining process, the under surfaces of the bed are pre-heated before the flame heating of the surface, maintaining a temperature gradient instead of obtaining full quenching).Steel slides in the form of strips, rather welded to steel bed or secured by screw to cast iron bed, are also used. The strength and rigidity of lathe beds with parallel and diagonal ribs depends upon the following factors:

1. Numbers of ribs.
2. Arrangement of ribs.
3. Thickness of main members of bed beam.
4. Ratio of depth and length.
5. Ratio of width and length of the bed

2. LITERATURE REVIEW

Change and Lee et al [1] have fabricated a hybrid column by adhesively bonding glass fabric epoxy composites improved. Although the stiffness of machine tool structures can be increased either byemploying higher stiffness materials or by increasing the sectional modulus of structures. Venkata Ajay Kumar G et al. [2] used structural materials in a machine tool have a decisive role in determining the productivity and accuracy of the part manufactured in it. The conventional structural materials used in precision machine tools such as cast iron and steel at high operating speeds develop positional errors due to the vibrations transferred into the structure. Faster cutting speeds can be acquired only by structure which has high stiffness and good damping characteristics. A. Selva Kumar et al. [3] stated that same stiffness, the epoxy granite structure offers a considerable weight reduction, along with high damping characteristics. The epoxy granite structure offers a sharp reduction in mass along with high damping ratio. S.Syath Abutha keer [4] proposed how toimprove static and dynamic characteristics on a CNC machine. Simulation results show that the static and dynamic performances of vertical ribs with hollow bed have been improved. Structural vertical ribs with hollow offers a method to improve the conventional design of machine structure. Based on structural modifications, ribs parameters and distributions can be further optimized. A. Merlo et al. [5] analyzed the combination of hybrid materials (steel, CFRP, Al honeycomb) and an intensive use of gluing technology allows to increase damping and, at the same time, to get a consistent mass reduction (up to 40%) without reducing the overall stiffness. Siva Rao [6] Investigated tangential Force, Horsepower and material removal rate associating HAAS CNC Milling, Al6061-T6511 Work Material & TiAlN Coated End Mill Tool. Autjore described calculation of cutting forces in milling machine process. Thirumaleswara Bhat et al. [7] proposed modified approach for cutting force measurement in face milling process.Author discussed about calculation of cutting forces in universal machine process. Machine Bed supports the all elements like column, work table and servo motors. B. Malleswara Swami et ai. [8] said that the machine bed plays a crucial role in providing the strength and rigidity to a machine. It accommodates all the accessories and cutting tools and other necessary equipment's for the running of the machine

3. SYSTEM MODELING

The below flow chart shows the sequential operation/steps that will be performed during the project process.

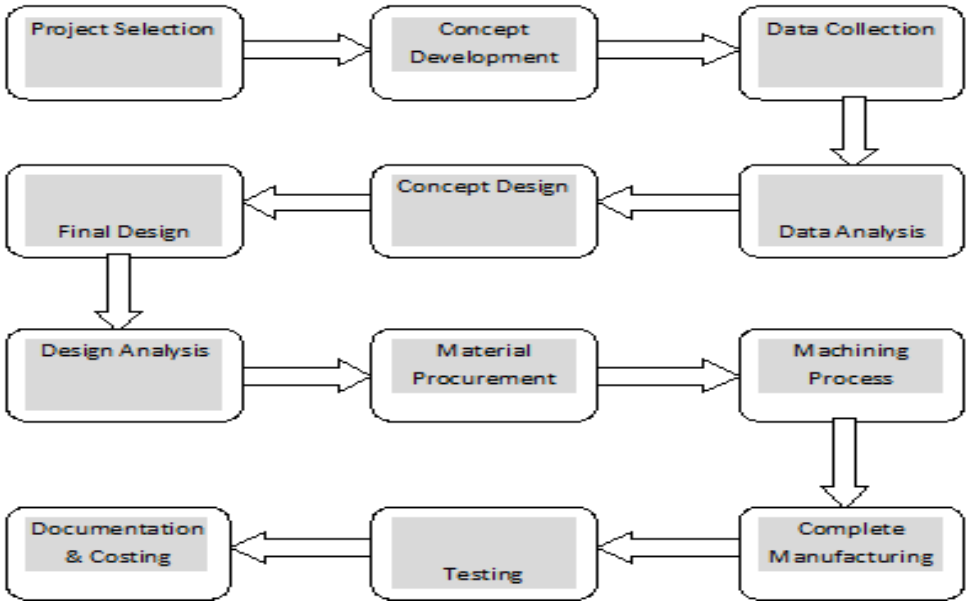

Figure No.1.1:- Process Flow Chart

Table No.1.1:- Major Component's

Sr. No.	Component Name	Quantity	Functions
1	Supporting Frame	1	To Provide Foundation
2	Lead Screws.	2	To Transmit Power
3	Guide Ways.	2	To Provide Sliding Motion
4	Electric Geared Motor.	2	12 Volt D.C. Motor
5	Electronics Control Unit.	1	Transformer 230 Volts /12 Volts
6	Spur Gears	4	For Torque Transmission
7	Nut & Bolts	4	For Locking Position
8	Washers	4	For Fitting
9	Foundation Grippers.	4	For Better Griping

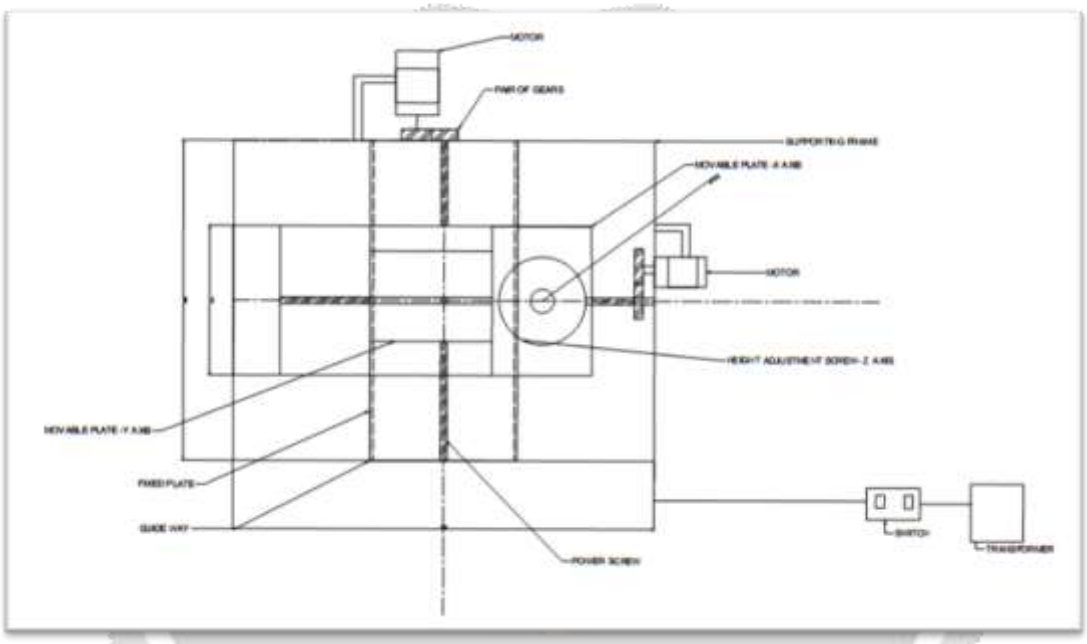

Figure No.1.2:- CAD Drawing

Our universal machine table with auto feed machine has two main parts first X-slide& another is Y-slide of the table. Job holding table assembly normally involves six ways work piece moving adjustments, while adjustment of table during job holding also in inclined machining. In this project job moves in 6-ways as shown in fig.1.2. having co-ordinates of moving machine table with auto feed machine which is capable of machining straight as well as inclined machining operations which is requirements for industry. The motion of universal machine table as given below,

1. Linear +X & -X.
2. Linear +Y & -Y.
3. Linear +Z & -Z.
4. Clockwise +Z & Anticlockwise –Z.
5. Angular Inclination about X-axis.
6. Angular Inclination about Y-axis.

In additional it provided job holding fixture for machine at to the table which can give machining & Up & Down, clockwise & anticlockwise rotation.

4. RESULTS

Table 1.2:- Analysis

Sr. No.	Direction	Component	Distance In mm	Time in Minutes	Degree of Freedom
1	X- Direction	Power Screw 1	380mm	1 minutes 21 Sec	Only In One Direction
2	Y-Direction	Power Screw 2	380mm	1 Minutes 34 Sec	Only In One Direction
3	Z- Direction	Screw	265mm	Manual	360^0

1. The degree of freedom for X axis is 380 mm (from left to extreme right)
2. The degree of freedom for Y axis is 380 mm
3. The degree of freedom for Z axis is 120 mm

ACKNOWLEDGEMENT

We thankful to MET's BKC IOT-P as they provided all the resources required for the study.

This work was encouraged by Hon. Principal Prof. R. S. Narkhede, MET's BKC IOT-P with their consistent guidance and valuable support.

6. REFERENCES

1. Sagar Pandit Mahajan, Nitin A. Kharche, Yogesh Kharche "Milling Bed Modelling and Analysis with Composite Material", INTERNATIONAL JOURNAL OF INTERDISCIPLINARY INNOVATIVE RESEARCH AND DEVELOPMENT Vol.1. Issue 1, 06/2016
2. Kartavya S. Sagar, Alpesh B. Damor, Dr. Haresh P. Patolia, "A Literature Review on Design of CNC Machine Tool Structure", the International Journal of Science & Technoledge (ISSN 2321 – 919X)
3. Sujeet Ganesh Kore, M I Sakri, L N Karadi, "Design And Analysis of A Machine Tool Structure Based on Structural Bionics." ISSN 2278 – 0149 www.ijmerr.com Vol. 3, No. 3, July 2014
4. Venkata Ajay Kumar, G.V. Venkatesh, "Modelling and Analysis of CNC Milling Machine Bed with Composite Material." IJSRD - International Journal for Scientific Research & Development| Vol. 2, Issue 09, 2014 | ISSN (online): 2321-0613
5. Khurmi R.S; Gupta J.K, "A textbook of machine design", first edition, S. Chand, Publication,1979.
6. Thomas Bevan, "The Theory of Machines", Third edition, CBS publishers, 2005.
7. Ballany P. L., "Theory of machines & mechanisms", Twenty fourth editions, Khanna publishers, 2005.
8. Bhandari "V.B. Design of machine elements", eighteenth edition, MC grew-hill companies, 2003.
9. PSG College of Technology, "Coimbatore design data", first edition Kalaikaikathir Achchagam, 2003.
10. Anthony Esposito, "Fluid Power with Application", sixth edition, Pearson edition, 2006.