Design of Base Structure of Deep Hole Boring Machine

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Abstract: Recent tread of technology require advanced machinery for large amount of application and reduced human effort as per technology concern. In these project as per company require to cost optimization of deep hole boring machine which useful to manufacturing different type of pipe which is used in injection molding machine and also in other application. In these project to understand basic design of base structure because it is core component of machine and major cost of overall machine depend on base structure. For optimization we will use optimization method like Johson method for optimization and also analysis base on weight and cost to change existing design with respect to geometry so that we use solid work for analysis and conclude in research paper.

Index Terms **– Design, Manufacturing Process, Base Structure, CAD Model, Deep Hole Boring Machine.**

1. INTRODUCTION

A deep hole is defined by its depth-to-diameter ratio (D:d), and typically holes greater than 10:1 are considered deep holes. Deep hole drilling into metal has a range of applications across several industries, with its origins tracing back to the need for straighter, more accurate gun barrels, and expanding as other industries integrated deep hole drilling processes to improve their own applications.

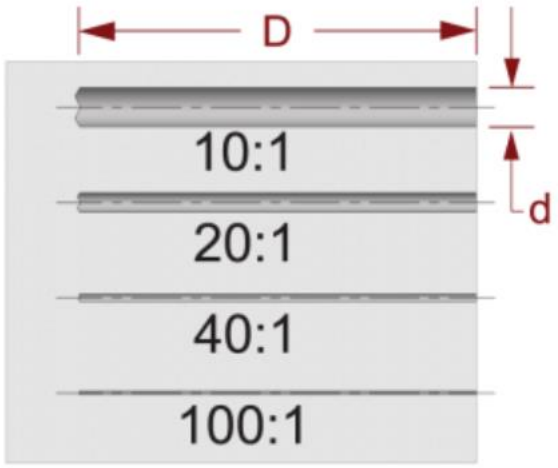

Fig. 1: Detail Process of Deep Hole Drilling

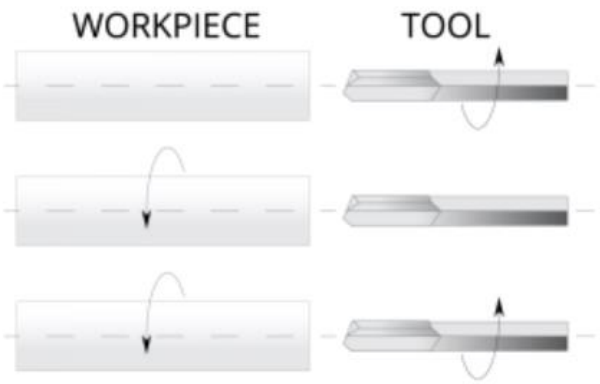

Fig. 2: Tool and Work piece Movements

Rotating Tool
•Typically used for non-symmetrical components, or round parts with off-center holes
•Cutting speed is determined by tool spindle speed
•Drill drift can be significant when compared to rotating work piece, or counter-rotating process
Rotating Work piece
•Typically used for round parts with a deep, on-center hole

•Cutting speed is determined by part, balanced to allow high rotating speeds
•Drill drift is reduced compared to rotating tool only
Counter-Rotating Tool and Work piece
•Ideal process for round parts with a deep, on-center hole
•Cutting speed is determined by a combination of tool and work piece rotation
•Provides optimal hole straightness and concentricity

2. Literature Survey

Friedrich Bleicher, Manuel Reiter, Jens Brier (2019) **[1]** were represented to promote active chip breakage in machining with single-lip drills for drilling deep holes with small diameters, vibration-assistance can be effectively applied. The aim of this work is to investigate the influence of low-frequency and high-amplitude vibration-assistance on the chip formation of age hardened copper-zirconium for small diameters down to 0.94 mm and L/D-ratios up to 40.

Xinquan Zhang, Guan Leong Tnay, Kui Liu, A. Senthil Kumar (2018) **[2]** was presented the critical performance indicator in deep hole gun drilling process, particularly in manufacturing of corrosion resistant alloys like Inconel 718 with high yield strength. Poor understanding on the root causes of straightness deviation and difficulty to reduce it has dramatically increased the complexity and the manufacturing cost of this manufacturing process.

D. Biermann, F. Bleicher, U. Heisel, F. Klocke, H.-C. Möhring, A. Shih (2018) **[3]** had represented differ significantly from conventional drilling processes, are relevant for a lot of different applications where holes with high length-to-diameter-ratios and very good qualities are necessary. This paper gives an overview of different methods, which are established to produce bore holes with demanding aspects related to diameter, length-to-diameter-ratio, bore hole quality, work piece materials and complex internal contours. Beside the detailed explanation of the deep hole drilling methods and tools also the fundamentals of the deep hole drilling principle are explained and completely new developed figures and tables summarize the state of the art. In addition for the most important areas the latest results of process and tool development are included.

Aydin Shaterpour-Mamaghani, Hanifi Copur, Engin Dogan, Tayfun Erdogan (2018) **[4]** had represented drilling/excavation of shafts and other inclined structures in mining and construction fields. Proper selection and accurate performance estimation of RBMs are two main parameters that affect the cost estimation and planning of the mining and construction projects. This paper aimed to suggest new empirical models for estimation of performance and operational parameters of RBMs in reaming operation by using simple (linear and non-linear) and multiple (linear and non-linear) regression methods.

Huang Zhang, Xingquan Shen, Arixin Bo, Yaoming Li, Haifei Zhan, Yuantong Gu (2017) **[5]** had represented one of the most important manufacturing techniques to produce a large length-to-diameter ratio hole for industrial applications. In addressing the challenge of excessive surface damage, inefficiency and poor indexing in BTA deep hole drilling, for which there are limited studies reported.

V.S. Bykador, Zh.E. Bykador (Bronzova) (2017) **[6]** had represented technological system that allows revealing different mechanisms of the processes occurring in the cutting zone. The article shows the bifurcations inherent in the process of deep drilling that allows explaining a number of phenomena that affect the tool breakdown and development of typical defects of the deep holes mechanical processing.

Eckart Uhlmann (Prof. Dr. h.c. Dr.-Ing.), Sebastian Richarz (Dr.-Ing.) (2017) **[7]** had represented high performance twisted deep hole drilling tools has been a significant innovation achieved some years ago. The use of these tools in machining centres permits substantially higher productivity and flexibility compared to existing deep hole drilling tools or alternative manufacturing processes for holes with a high aspect ratio. The aim of the present work is the systematic consideration of twisted deep hole drilling tools for reliable and economical hard cutting operations with a high level of quality assurance.

S. Malarvizhi, Akshay Chaudhari, Keng Soon Woon, A. Senthil Kumar and Mustafizur Rahman (2016) **[8]** had represented the critical components in the oilfield and aerospace industries are made of Inconel 718 alloy. Thus far, the precision of high aspect hole making operation in these has been the bottleneck. This article explores the usability of single lip deep hole drilling tools for such high aspect drilling applications.

Wenrong Xiao, Yanyang Zi n, Binqiang Chen, Bing Li, Zhengjia He (2014) **[9]** had represented machining condition monitoring (MCM) plays an important role for efficient tool change policies, product quality control and lower tool costs. This paper proposes a novel approach to the MCM of deep hole boring on the basis of the pseudo non-dyadic second generation wavelet transform (PNSGWT). This approach is developed via constructing a valuable indicator, i.e., the wavelet energy ratio around the natural frequency of boring bar. Self-excited vibration occurs at the frequency of the most dominant mode of the machine tool structure.

D. Biermann, M. Kersting, N. Kessler (2009) **[10]** had represented machine boreholes having a high length-to-diameter ratio, deep hole drilling methods are applied. Especially when drilling ductile materials, the removal of cooling lubricant and chips can be hindered by long chips which block the inside of the chip mouth. In order to increase the volume flow rate of the cooling lubricant and chips, the chip mouth cross-section of a commercially available state-of-theart BTA (Boring and Trepanning Association) boring tool was analyzed. Structure topology optimization was applied to reduce the drill head material without the drill head losing its stiffness to maximize the chip mouth cross-section.

Dirk Biermann, Marko Kirschner (2015) **[11]** had represented miniaturization of components, increase the importance of deep hole drilling with small diameters in various industrial applications. For the manufacturing of deep holes, many processes are used. In addition to mechanical cutting, processes based on thermal material removal mechanisms like electrical discharge machining (EDM), laser drilling and electron-beam drilling are established. Whereas non-mechanical processes can be used for the machining of extremely hard and high-strength materials, substantial disadvantages are the restrictions in the realizable hole diameter and depth dimensions, the long production times, the requirement for special-purpose machinery, as well as the limited bore hole quality. In the aerospace industry, where nickel-based super alloys are widespread, high requirements lie on the surface integrity due to high stress loads during operation. Hence, the major drawback of these non-mechanical processes is the alteration of the subsurface zone, which could affect the part safety.

C.H. Gaoa, K. Cheng, D. Kirkwood (2002**) [12]** had represented a computer-based approach is presented to the investigation of machining mechanisms in boring and trepanning association (BTA) deep hole drilling processes. The cutting mechanisms investigated are focused on the chip deformation and associated drilling forces in deep hole situation in particular. The machining models are further investigated for such processes. The models are evaluated and validated based on the data acquired with a computer-based acquisition system. It is found that the chip deformation cut by the centre edge is the largest, whereas the change tendency of the cutting force and the sum of chip deformation cut by three blades of drill are about the same. This paper also describes the measurement and analysis of the forces including the axial force in BTA deep hole machining.

3. 3D design of Deep Hole Boring Machine Base Structure

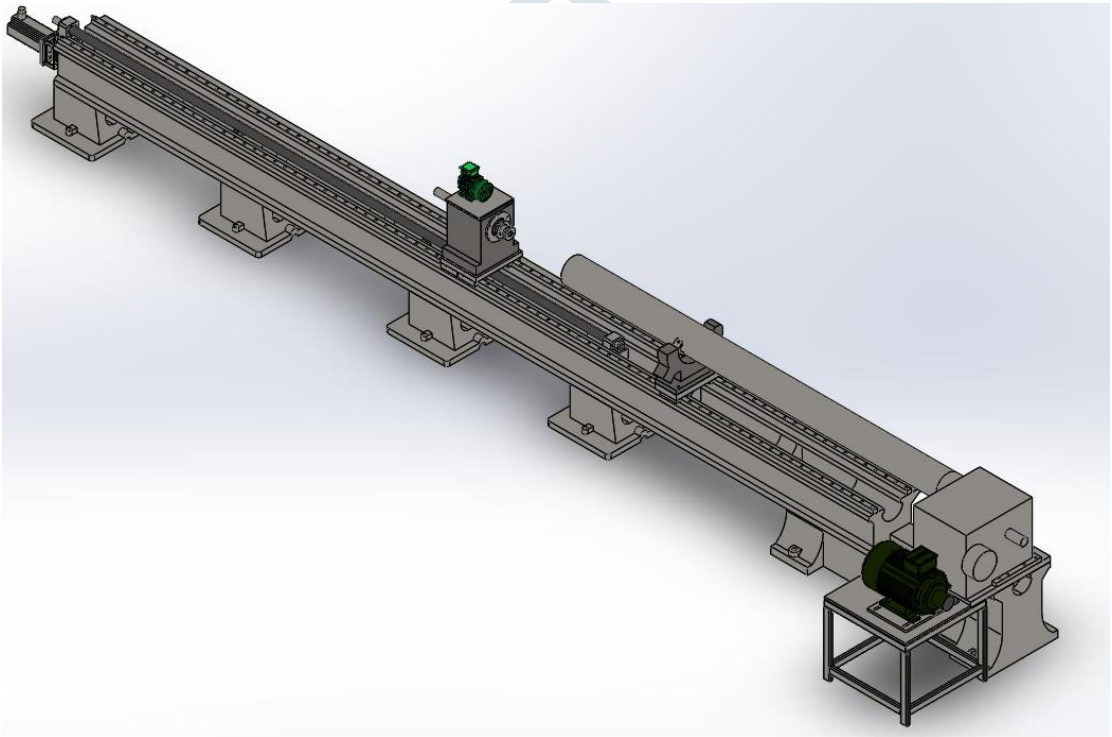

Fig. 3: Deep Hole Boring Machine

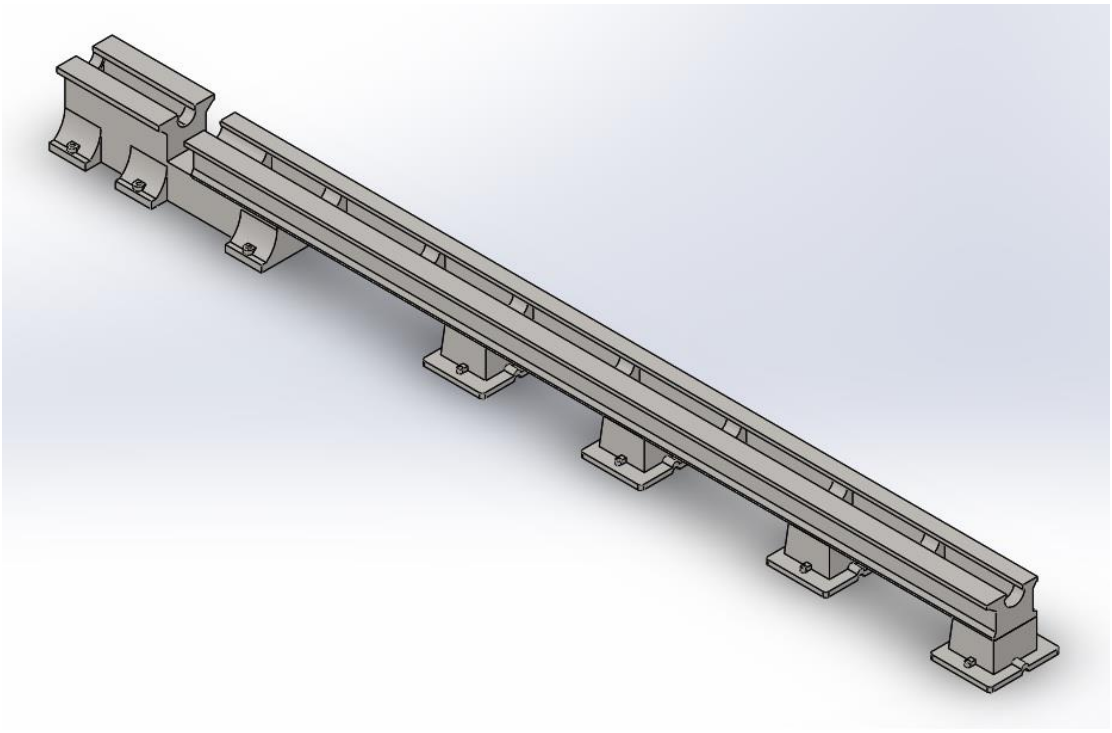

Fig. 4: Base Structure of Deep Hole Boring Machine

Fig. 5: Real Snap of Base Structure of Deep Hole Boring Machine

Conclusion

It was reflected on functional base operation likes increase chip removal rate, hole straightness, performance estimation etc.

Some research paper indicated about different types of drilling or boring machine likes single-lip deep hole drilling machine, twisted deep hole drilling machine, deep hole boring machine etc.

Some research paper indicated about process parameter of machine by using different material to improve quality and performance of hole drilling machine.

There is possibility of work in direction core component design and analysis process for effective strength and cost to improve product range of existing draw bench.

At present to collected detail of base structure of deep hole boring machine and understand different sub assembly like moving head, main head, axes design and motor selection.

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