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Design and fabrication of embedded cutting and drilling machine

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ABSTRACT

We all live in a world of advancing technologies which is shifting its gears day by day such as to comfort us at every step leaving behind time at a much rapid rate. Machines are the main source of production which influences us. Thus, making the process of manufacturing efficient in all aspects increases the production rate and human resource. Considering all these aspects, our aim is to design a multipurpose device such as to make it reliable and decrease the workload. We have fabricated the device in such a way to perform no. of operations like cutting and drilling with the use of a hydraulic system using the same. The device makes sure that it reduces the time and increases productivity at a definite rate.

Keywords— *Multipurpose, Hydraulic system, Productivity, Cutting, Drilling*

1. INTRODUCTION

In the present world of advancing technologies, we are turning things from the art of paper and bringing it to live into the vision of humans. The trend-setting which has been done with the implementation of the concepts from the olden days of the civilized world.

From the early world to the present there has been a rapid growth of industries which have been initiating the zone of comfort for all. Thus being more and more perfect in our own way have been the trendsetters with the production rate of products and making things compact in our own ways.

Taking the example of the hard disk which was the achievement in the early 1970s was greater in the size and heavier to carry which now has been differentiated into so smaller sizes that can be held with the palm.

These sorts of rapid changes in all the fields have made us develop a machine which can do both cutting and drilling simultaneously with the help of a hydraulic system.

2. LITERATURE SURVEY

Before starting our work we have undergone through many research papers which indicates that for a production based industries machine installation is a tricky task as many factors being associated with it such as the capacity of the machine, time consumption and many more.

Some research papers which have led us to approach the idea of a machine which may give a solution to all these factors are as follows:

1. Heinrich Arnold 1 November 2001

Rather long re-investment cycles of about 15 years have created the notion that innovation in the machine tool industry happens incrementally. But looking at its recent history, the integration of digital controls technology and computers into machine tools has hit the industry in three waves of technology shocks. Most companies underestimated the impact of this new technology. This article gives an overview of the history of the machine tool industry since numerical controls were invented and introduced and analyzes the disruptive character of this new technology on the market. About 100 interviews were conducted with decision-makers and industry experts who witnessed the development of the industry over the last forty years. The study establishes a connection between radical technological change, industry structure, and competitive environment. It reveals a number of important occurrences and interrelations that have so far gone unnoticed.

2. Dr. Toshimichi Moriwaki, 2006

Recent trends in the machine tool technologies are surveyed form the viewpoints of high speed and high-performance machine tools, combined multifunctional machine tools, ultra-precision machine tools and advanced and intelligent control technologies.

3. Frankfurt-am-Main, 10 January 2011

The crisis is over but selling machinery remains a tough business. Machine tools nowadays have to be veritable “jack of all trades”, able to handle all kinds of materials, to manage without any process materials as far as possible and be capable of adapting to new job profiles with maximized flexibility. Two highly respected experts on machining and forming from Dortmund and Chemnitz report on what’s in store for machine tool manufacture and users.

Multi-purpose machines are the declarations of independence. The trend towards the kind of multi-purpose machining centres that are able to cost-efficiently handle a broad portfolio of products with small batch sizes accelerated significantly during the crisis. “With a multi-purpose machine, you’re less dependent on particular products and sectors”, explain Biermann.

3. PROPOSED METHODOLOGY

In this project, we will generally give the power supply to the shaft on which a tapered plane gear is mounted on it, and two tapered plane gear at a right angle to it has been mounted on a drill shaft to which a drill bit is being attached. At one end of the

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shaft is connected to power supply. Another end is the cutting of the solid metal shaft using the mechanism of punching with the use of a die by a reciprocating mechanism with the help of piston and direction control valve from the hydraulic power pack. In addition to the direction valve, cut-off valves are placed for the safety purpose which is used in order to control the operation which can be done simultaneously or as a separate work by the person operating the machine.

STUDY OF DIFFERENT RESEARCH PAPERS

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FRAMING OF PROJECT SETUP(LINE DIAGRAM OF MODEL)

↓

DIMENSIONING OF FRAME SPECIFICATION FOR COMPONENTS OF MODEL

↓

ASSEMBLING OF DIFFERENT COMPONENT

↓

RESULTS AND DISCUSSION ABOUT THE ERROR IN THE CONCEPTUAL MODEL

4. CUTTING PROCESS

Cutting processes work by causing fracture of the material that is processed. Usually, the portion that is fractured away is in small sized pieces, called chips. Common cutting processes include sawing, shaping, broaching, drilling, grinding, turning and milling. Although the actual machines, tools and processes for cutting look very different from each other, the basic mechanism for causing the fracture can be understood by just a simple model called for orthogonal cutting. In all machining processes, the work-piece is a shape that can entirely cover the final part shape. The objective is to cut away the excess material and obtain the final part. This cutting usually requires to be completed in several steps – in each step, the part is held in a fixture, and the exposed portion can be accessed by the tool to the machine in that portion. Common fixtures include vice, clamps, 3-jaw or 4-jaw chucks, etc. Each position of holding the part is called a setup. One or more cutting operations may be performed, using one or more cutting tools, in each setup. To switch from one setup to the next, we must release the part from the previous fixture, change the fixture on the machine, clamp the part in the new position on the new fixture, set the coordinates of the machine tool with respect to the new location of the part, and finally start the machining operations for this setup. Therefore, setup changes are time-consuming and expensive, and so we should try to do the entire cutting process in a minimum number of setups; the task of determining the sequence of the individual operations, grouping them into setups, and determination of the fixture used for each setup, is called process planning.

Fig. 1: Image of the circular saw blade

Normally we use the blades as shown in Fig.1 for the purpose of cutting rods in the workshop or in the small scale and large scale industries. While there have been many major constraints with the extrusions and the sparks coming with the use of blades in the cutting machine. The process which we have done is considering the factor of safety as our main motto, did the research work and used punching as the mechanism for cutting the rods.

Fig. 2: Die manufactured for cutting of solid rods

We used Die as shown in figure 2 for the operation of cutting such as the die is removable and can be replaced for any set of dimensions.

5. DRILLING PROCESS

The geometry of the common twist drill tool (called drill bit) is complex; it has straight cutting teeth at the bottom – these teeth do most of the metal cutting, and it has curved cutting teeth along its cylindrical surface. The grooves created by the helical teeth are called flutes and are useful in pushing the chips out from the hole as it is being machined. Clearly, the velocity of the tip of the drill is zero, and so this region of the tool cannot do much cutting. Therefore it is common to machine a small hole in the material, called a centre-hole, before utilizing the drill. Centre-holes are made by special drills called centre-drills; they also provide a good way for the drill bit to get aligned with the location of the centre of the hole. There are hundreds of different types of drill shapes and sizes; here, we will only restrict ourselves to some general facts about drills. - Common drill bit materials include hardened steel (High-Speed Steel, Titanium Nitride-coated steel); for cutting harder materials, drills with hard inserts, e.g. carbide or CBN inserts, are used; - In general, drills for cutting softer materials have smaller point angle, while those for cutting hard and brittle materials have larger point angle; - If the Length/Diameter ratio of the hole to be machined is large, then we need a special guiding support for the drill, which itself has to be very long; such operations are called gun-drilling. This process is used for holes with a diameter of few mm or more, and L/D ratio up to 300. These are used for making barrels of guns; - Drilling is not useful for very small diameter holes (e.g. < 0.5 mm), since the tool may break and get stuck in the work-piece; - Usually, the size of the hole made by a drill is slightly larger than the measured diameter of the drill – this is mainly because of vibration of the tool spindle as it rotates, possible misalignment of the drill with the spindle axis, and some other factors; - For tight dimension control on hole diameter, we first drill a hole that is slightly smaller than required size (e.g. 0.25 mm smaller), and then use a special type of drill called a reamer. Reaming has very low material removal rate, low depth of cut, but gives good dimension accuracy; large and deep holes are made by spade drills.

In the general drilling practice, the quill with the spindle is moved down and the work-piece is drilled. But in our concept, the work table is moved up with the help of the piston cylinder. Thus, the drilling for metal or wood could be done using it.

Note – The frictional gear is used in place of spur or helical gears. The table movement has been done with the use of rack and pinion movement.

No. of teeth for the pinion– 28 (Figure 3)
No. of Slots for the rack– 14 (Figure 4)

Fig. 3: Gear used for the rack and pinion

Fig. 4: Base of the drilling

6. AUTOCAD MODEL

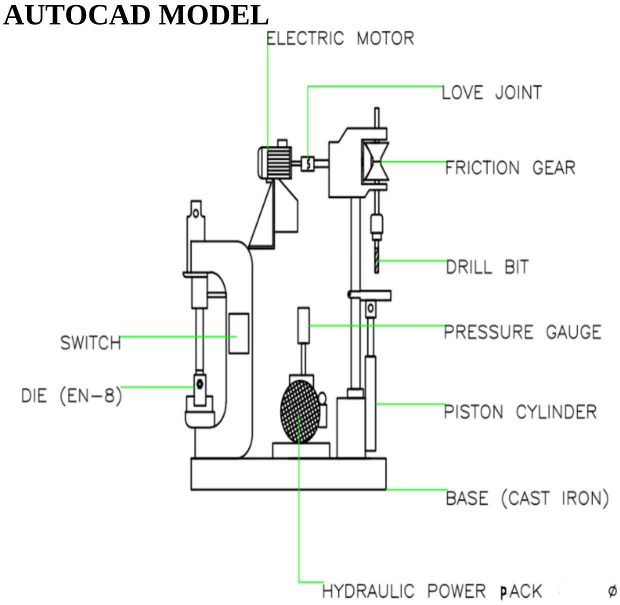

Fig. 5: Two dimensional model of the project

This figure 5 shown above is the combined structure of both drilling and cutting which was fabricated by us during the course of 44 days.

7. FABRICATED MODEL

Fig. 6: Fabricated model of the project

8. COMPONENTS REQUIRED

1. Hydraulic power pack.
2. Mild steel sheets of 10mm Thickness.
3. Oxyacetylene gas.
4. Arc welding.
5. 0.25 HP Motor.
6. Love joint.
7. Spindle.
8. Piston-cylinder (2 Nos).
9. Cast Iron.
10. EN08 material.
11. Taper shaped Gear.
12. Two-way switch (2 Nos).
13. Pressure Gauge.
14. Hoses of different lengths.
15. Direction Control Valve.
16. Cut-off Valve (4 Nos).
17. Hydro Oil.
18. Rack and Pinion.
19. Fasteners.
20. Male and Female couplings for hoses.

9. DESIGN OF COMPONENTS

Fig. 7: C-frame of the project

The Figure 7 represents the Isometric view of the C-Frame.

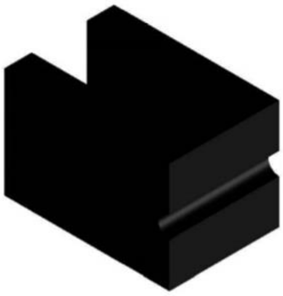

Fig.8 Model of the Die used in cutting

The figure 8 shows the design of the Die used in the fabrication which is used for cutting the solid rod of max 10mm thickness.

10. CALCULATIONS

Diameter of cylinder (d) = 50mm

Pressure (P) = 60 kg/cm^2

Area (A) = 0.785 x d^2
Area (A) = 0.785 x $(.05)^2$
Area (A) = 19.625 x 10^{-4} m^2

Force (F) = Pressure x Area
Force F = 60 x 10^4 x 19.625 x 10^{-4}
Force (F) = 1177.5 kg

Multiply by 9.81

F = 1177.5 x 9.81
F = 11551.275 N
F = 11.55 kN

This amount of Force is required to cut a 6mm solid mild steel rod with the help of the machine designed.

11. EXISTING SCENARIO

The main idea of this approach is to satisfy multiple aspects in a more convenient way altogether.

1. Compact.
2. Versatile.
3. Reliable and cost-efficient.
4. Provides stiffness and support.
5. Die is removable.

12. CONCLUSION

In the existing scenario, enormous machines are involved in the industries, our approach is to contribute a change in the INDUSTRIAL REVOLUTION by an INNOVATIVE idea for designing the machine performing versatile tasks.

13. REFERENCES

[1] https://pdfs.semanticscholar.org/f46b/205294b1eaa624be26f8972cd688992987a2.pdf
[2] http://www.ntnglobal.com/en/products/review/pdf/NTN_TR74_en_P002.pdf
[3] http://www.geartechnology.com/issues/0111x/multi.pdf
[4] https://books.google.co.in/books/about/Elements_Of_Workshop_Technology_Volume_1.html?id=8U2CRAAACAAJ
[5] https://docs.google.com/file/d/0B7OQo6ncgyFjbW53VEJEclZuSzQ/edit
[6] www.me.nchu.edu.tw/lab/CIM/www/courses/Manufacturing%20Processes/Ch21-MetalCuttingTheory-Wiley.pdf
[7] Heinrich Arnold1"The recent history of the machine tool industry and the effects of technological change "University of Munich, Institute for Innovation Research and Technology Management, November 2001.
[8] Dr Toshimichi Moriwaki "Trends in Recent Machine Tool Technologies" Professor Department f Mechanical Engineering Kobe University, NTN Technical Review No.74(2006).
[9] T. Moriwaki "Multi-functional machine tool", Department of Industrial and Systems Engineering, Setsunan University, Neyagawa, Japan CIRP Annals - Manufacturing Technology DOI: 10.1016/j.cirp.2008.09.004.
[10] Frankfurt is Main "Multi-purpose machines ensure enhanced ", 1 January 11.
[11] "Selecting and Planning the Process of Manufacture: Dr Pulak M.Pandey. http://paniit.iitd.ac.in/~pmpandey
[12] Wikipedia.
[13] Fadooengineers.com.
[14] www.Scribd.com.