

Design and Synthesis of Multipurpose Hand Driller Machine for Various Processes

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Abstract

Multi-operation machine as a research area is motivated by questions that arise in industrial Manufacturing, production planning, and computer control. Consider a large automotive garage with specialized shops. A car may require the following work like replace exhaust system, align wheels and tune up. These three tasks may be carried out in any order. However, since the exhaust system, alignment and tune-up shops are in different buildings, it is impossible to perform two tasks for a car simultaneously. When there are many cars requiring services at the three shops, it is desirable to construct a service schedule that takes the least amount of total time. Industries are basically meant for Production of useful goods and services at low production cost, machinery cost and low inventory cost. Today in this world every task have been made quicker and fast due to technology advancement but this advancement also demands huge investments and expenditure. Every industry desires to make high productivity rate maintaining the quality and standard of the product at low average cost. Emerging technologies have provided some new growth in advanced manufacturing employment opportunities in the Manufacturing Belt in the United States. The project work is explained in brief here. For better understanding, the total project work is divided into various blocks and each block explanation is provided here. The following is the description of overall function of the module. So in this project work is proposed where a machine is designed which can perform operations like drilling, sawing, shaping, some lathe operations at different working centers simultaneously which implies that industrialist will not have to pay for machine performing above tasks individually for operating operation simultaneously. Economics of manufacturing: According to some economists, manufacturing is a wealth-producing sector of an economy, whereas a service sector tends to be wealth defense.-consuming.

Keywords: Cutting, Drilling, Grinding, Synthesis

I. INTRODUCTION

Ravi Teggin,et.al. This paper discuss about the Design and Fabrication of Multi-Purpose Wood Working Machine. Wood working is anything that performing any operation on wood in any way for some useful work. This multipurpose wood working machine has ability to perform four operations such has Planing, Venkata Phani Babu.V,et.al.In an industry a considerable portion of investment is being made for machinery installation. So in this project we have a proposed a machine which can perform operations like drilling, sawing, shaping (grinding) some lathe operations at different working centers simultaneously. Akshay Kumar,et.al.India is an agricultural country. Agriculture is demographically the broadest economic sector and plays a significant role in the overall economy of India. For the growth of Indian economy, mechanization is necessary. The main purpose of mechanization in agriculture is to improve the overall productivity and production. T.Murali, S.Perumal,et.al, six legged walking robot inspired by human locomotion is discussed.to implement the walking pateren of human a four bar linkage based coupler curve is generated for the structure and its performance is analysed. Nikalas Bhandakkar,et.al. This paper converse about the study of design of multi spindle drilling machine. In the case of mass production where variety of jobs is less and quantity to be produced is large, it is very essential to manufacture the job at a faster rate. This is not possible if we produce by using general purpose machines. M.Soundarrajan et al. have fabricates the advance welding gun for joining of two different polymers and Design a simple model of plastic welding system that joins the thermoplastics parts. This project is used to join the plastic parts by the application

of heat with the help of electric supply and spring force. This plastic welding gun is compact in design and portable. M.Soundarajan et al. have presents an extensive overview on Experimental Investigations of Resistance Spot Welding of Duplex Stainless Steel. The Main intention is to provide a depth approaching into the nature of the Resistance Spot Welding of Duplex Stainless Steel and a summary of the infinite experimental investigative effort put into it over the years. The area chosen for the work is dissimilar material welding, and failure mode analysis. The major areas of research are mechanical, electrical and thermal are growing for stainless steel manufacturing material. Although resistance spot welding is widely used it is difficult to ensure the consistency of joint quality in weld production. The confidence level of the weld is achieved by the peel of test is low due to their shortcomings such as offline and small sample to reduce the part failure manufacturers have to extra more weld than the originally designed weld. It is desirable to control weld quality immediately by adjusting the input variables when defective welds have been detected in automobile assembly line. The areas chosen for most of the works by researchers in the past have been found as process modeling and finite element analysis, dissimilar metal welding, failure mode analysis, parametric optimization and characterization of resistance spot. N.Srinivasan et al. have processed the efficient Air conditioning system for the human comfort accounts for approximately 50 % of the annual power requirement in almost all types of commercial buildings such as IT parks, Malls, office complexes, Hospitals, Hotels, Entertainment centers, Educational institute and Government establishments. The air conditioning for commercial buildings is only going to increase, with the growth in the number of buildings. Inefficient building envelopes, Unnecessary lighting, inefficient air conditioning systems all contribute to higher cooling capacity requirement which ultimately leads to high energy consumption and cost. The aim of this project is to find energy efficiency air conditioning design and find methods to reduction in the energy requirement of the AC System in a building. The sizing of air conditioning plant, Selection of chillers, cooling towers, chilled water pumps and air handling units will be studied.

V.J.Khot,et.al. The growth of Indian manufacturing sector depends largely on its productivity & quality. Productivity depends upon many factors, one of the major factors being manufacturing efficiency with which the operation /activities are carried out in the organization. Productivity can be improved by reducing the total machining time, combining the operations etc. Which implies that industrialist have not to pay for machine performing above tasks individually for operating operation simultaneously. Edge forming, Cutting, and Drilling on a single machine. All the four tools driven by single motor. Before starting every project its planning is to be done. Planning a project is a very important task and should be taken up with great care as the efficiency of the whole project largely depends upon its planning. While planning a project each and every detail should be worked out in anticipation should be carefully considered with all the relative provisions aspects. The capacity of the project must be decided considering the amount of money which can be invested .The availability of material and machines and usefulness of the project. Having decided about the project to be manufactured at must be designed. Design work should be done very considering all the relevant factors. After design the project detailed drawing are prepared. Detailed specification for raw material and finished products should be decided carefully along with the specification of the machine required for the manufacture. The list of material required for manufacture is prepared form the drawing. The list is known as Bill of materials availability of these materials is surveyed and purchase from the market. Next work of planning is to select the best method manufacture the product, so that the wastage of materials, labor, machines and time can be eliminated by considering various methods. The best method is to be selected for fabrication and other works. The proper method and proper person and the purpose of operation, necessity operation, proper machine planning. The best method is the developed and is applied to fabricate the project. While planning proper care should be taken to find the machining time for the operation as correct as possible. So that arrangement of full use of machines can be made and the machine loading program can be decided.

It is difficult to manufacture all the components needed for the project in the machine shop. In each case, we should decide to make or buy about a particular item. It is decided during the planning after making a complete study of relative merits and demerits.

II. EXPERIMENTAL METHODOLOGY

A. Driller:

Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool, often multipoint. The bit is pressed against the workpiece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the workpiece, cutting off chips (swarf) from the hole as it is drilled.

B. Grinding Wheel:

A grinding wheel is a wheel composed of an abrasive compound and used for various grinding (abrasive cutting) and abrasive machining operations. Such wheels are used in grinding machines. The wheels are generally made from a composite material consisting of coarse-particle aggregate pressed and bonded together by a cementing matrix (called the bond in grinding wheel terminology) to form a solid, circular shape. Various profiles and cross sections are available depending on the intended usage for the wheel.

C. Wood Cutter

A circular saw is a power-saw using a toothed or abrasive disc or blade to cut different materials using a rotary motion spinning around an arbor. A hole saw and ring saw also use a rotary motion but are different from a circular saw. Circular saws may also be

loosely used for the blade itself. A circular saw is a tool for cutting many materials such as wood, masonry, plastic, or metal and may be hand-held or mounted to a machine. In woodworking the term "circular saw" refers specifically to the hand-held type and the table saw and chop saw are other common forms of circular saws. "Skill saw" has become a generic trademark for conventional hand-held circular saws.

D. Steel Cutter

Cutting is the separation of a physical object, into two or more portions, through the application of an acutely directed force. However, any sufficiently sharp object is capable of cutting if it has a hardness sufficiently larger than the object being cut, and if it is applied with sufficient force. Even liquids can be used to cut things when applied with sufficient force.

E. Concrete Cutter

A concrete saw is a power tool cutting concrete ,masonry ,brick, asphalt, tile, and other solid materials. It can be a small hand-held cut-off saw, a big walk-behind saw or other styles, and it may be powered by gasoline, hydraulic or pneumatic pressure, or electric motors.

The saw blades used on concrete saws are often diamond saw blades to cut concrete, asphalt, stone, etc.

F. Specification of parts;

- 1) Shaft dimension
Dia of shaft = 9mm
- 2) Grinding wheel dimension
Outer diameter = 100mm
Inner diameter = 17mm
- 3) Wood cutter dimension
Outer diameter = 126mm
Inner diameter = 16mm
- 4) Steel cutter dimension
Outer diameter = 123mm
Inner diameter = 26mm
- 5) Concrete cutter dimension
Outer diameter = 106mm
Inner diameter = 22mm
Bush diameter = 22mm
- 6) Frame dimensions
Length of the frame = 150mm
Width of the frame = 31mm
- 7) Bevel gear dimensions
No of teeth in driven gear =16
No of teeth in driving gear =12

G. Description of Bevel Gear

Bevel gears are used to transmit power between two non-parallel shafts. The shafts may be intersecting or non-intersecting. Bevel gears can be described as conical gears as they are cut on conical blanks (tapered). They are not interchangeable and always designed in pairs.

The commonly used bevel gears are:

- 1) Straight bevel gear
- 2) Spiral bevel gear
- 3) Hypoid bevel gear

1)Types of Gear Their Geometry

DESCRIPTION	TYPES OF BEVEL GEAR		
	Straight	Spiral	Hypoid
Tooth surface	Straight	curved	Curved
Pitch surface	Cone	Cone	Hyperboloid
Shafts	Intersecting	Intersecting	Non-parallel & Non-intersecting

III. WORKING PRINCIPLE

Portable driller using main part of component.it had been connected additional component like bevel gear and operation tools. First of all the bevel gear using to through power transmission due to change desire direction like horizontal to vertical direction. And the tools are fixed in both edge of the surface. But it's easily to attached and dismantled. Whatever we want operation did this

done. The DC power is transmitted through the bevel gear. Its act on change direction power transmitted in function of tools like grinding, drilling and cutting.

A. Fabrication of the Machine

- Drilling
- Cutting
- Grinding

B. Drilling:

Drilling machine can be defined as an instrument which is used to drill holes. Drilling machine plays an important role in mechanical workshops. The purpose of this project work is to get hold of complete information pertaining to drilling machines. A drilling machine comes in many shapes and sizes, from small hand-held power drills to bench mounted and finally floor-mounted models. Today the Industrial growth is purely depends up on latest machines; therefore the subject of drilling machines is extended too widely, because today wide varieties of drilling machines are designed for various applications. The machine used for drilling is called drilling machine.

- The drilling operation can also be accomplished in lathe, in which the drill is held in tail stock and the work is held by the chuck.
- The most common drill used is the twist drill.
- It is the simplest and accurate machine used in production industries.
- The work piece is held stationary i.e., clamped in position and the drill rotates to make a hole.

C. Cutting:

A hacksaw is a fine-tooth hand saw with a blade held under tension in a frame, used for cutting materials such as metal or plastics. Hand-held hacksaws consist of a metal arch with a handle, usually a pistol grip, with pins for attaching a narrow disposable blade. A screw or other mechanism is used to put the thin blade under tension. blade can be mounted with the teeth facing toward or away from the handle, resulting in cutting action on either the push or pull stroke.



Fig. 1: Diagram: Fabrication of multi-purpose hand driller

On the push stroke, the arch will flex slightly, decreasing the tension on the blade, often resulting in an increased tendency of the blade to buckle and crack. Cutting on the pull stroke increases the blade tension and will result in greater control of the cut and longer blade life.

D. Grinding

The shaping machine is used to grind flat metal surfaces especially where a large amount of metal has to be removed. Other machines such as milling machines are much more expensive and are more suited to removing smaller amounts of metal, very accurately. A shaper is a type of machine tool that uses linear relative motion between the work piece and a single-point cutting tool to machine a linear tool path.

Its cut is analogous to that of a lathe, except that it is (archetypal) linear instead of helical. (Adding axes of motion can yield helical tool paths, as also done in helical planning.) A shaper is analogous to a plane, but smaller, and with the cutter riding a ram that moves above a stationary work piece, rather than the entire work piece moving beneath the cutter. The ram is moved back and forth typically by a crank inside the column; hydraulically actuated shapers also exist.

E. Calculation of Bevel Gear

1) Secondary Gear Speed (N_2)

$$\text{Gear ratio } i = Z_2/Z_1 = 12/16$$

$$i = 0.75$$

$$i = N_1/N_2 = 2650/N_2$$

$$N_2 = 2650/0.75$$

$$N_2 = 3533 \text{ rpm}$$

2) Gear Pitch Angle (δ_1 & δ_2)

$$\tan \delta_2 = i$$

$$\delta_2 = 0.75$$

$$\delta_2 = \tan^{-1}(0.75) = 36^\circ.86'$$

$$\delta_1 = 90 - \delta_2 = 53^\circ.13'$$

3) Virtual Number Of Gear Teeth (Z_{v1} & Z_{v2})

$$Z_{v1} = Z_1/\cos \delta_1 = 16/\cos(53^\circ.13') = 26.66$$

$$Z_{v2} = Z_2/\cos \delta_2 = 12/\cos(36^\circ.86') = 14.99$$

4) Torque (M_t)

$$P = 2\pi N_2 T / 60$$

$$T = 550 * 60 / 2\pi * 3533$$

$$M_t \text{ or } T = 1.486 \text{ N-m}$$

5) Tangential Load (F_t)

$$V_1 = \pi D_1 N_1 / 60 = \pi * 40 * 2650 / 60$$

$$V_1 = 5.55 \text{ m/s}$$

$$F_t = (P/V) * K_O$$

$$\{\text{Assume } K_O = 1.25\} \{P = 0.550 \text{ kw}\} = (0.550/5.55) * 1.25$$

$$F_t = 0.123 \text{ KN}$$

6) Pressure Angle (α) = 20°

7) Module Or Transverse Module (m_t)

$$d_1 = m_t * z_1 \{d_1 = 40 \text{ mm} \ \& \ d_2 = 32 \text{ mm}\}$$

$$m_t = 40/16$$

$$m_t = 2.5 \text{ mm}$$

8) Cone Distance (R)

$$R = 0.5 * m_t * z_1 (i_2 + 1) 0.5$$

$$= 0.5 * 2.5 * 16 (0.72 + 1) 0.5$$

$$R = 25 \text{ mm}$$

9) ADDENDUM $h_a = m_t = 2.5 \text{ mm}$

10) DEDENDUM $h_f = 1.12 * m_t = 2.80 \text{ mm}$

11) ADDENDUM ANGLE (ϕ_a) = $\tan \phi_a = 0.1$

12) DEDENDUM ANGLE (ϕ_f) = $\tan \phi_f = 0.12$

IV. CONCLUSION

The portable driller is made and its advantages and disadvantages are discussed. Its motion characteristics are studied. It is concluded that this mechanism is a good choice to convert rotating motion into reciprocating motion because of fewer moving parts and smoother operation. It can be used in direct injection engines like diesel engines, hot air engines. In this project report we provide an overview of the issues concerning different aspects of multipurpose machine using portable driller. The paper focused on the principle of portable driller, type of tooling and machining parameters and process performance measure, which include cutting speed, depth of cut, material removal rate with different type of equipments which can be run simultaneously and fabricate the work piece in multipurpose machine has been presented. The presented results can help to plan the machining of work piece with expected tolerance. The following major conclusions may be drawn from the study. Multipurpose machine is derived from turning lathe which has been a well-established industrial processes offering attractive capabilities for handling work piece of various length to be used at micro level.

We have presented the development of multipurpose machine in various modes by which it can be actively adopted. We have explained the various parts and components of multipurpose machine using scotch yoke mechanism. Different types of attachments and tools which can be implemented on multi-purpose machine have been discussed.

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