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Multi-Operational Machining and Controlling with the Help of Electro-Magnetic Clutch

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ABSTRACT

The whole concept of multi-operational machining and controlling with the help of electro-magnetic clutch revolves around the small scale and medium scale production industries. The idea is to reduce the floor space and cost of the machineries as well as power consumption also has to be reduce for better controlling of the machine parts the electro-magnetic clutch is also provided. The proposed model is capable of sawing(cutting),drilling and grinding with the help of dc motor. In this model all the operations can be done individually as well as simultaneously. In future scope individual speed controller can also be provided with the help of programmable motherboards.

1. Introduction

The fundamental reason behind the design of this machine is that to make a fully clutch controlled, less power consuming, multi-operational machine that could perform more than one operation simultaneously as well as individually. previously such types of machines has been designed[1] but those are not capable of performing single operation individually as clutch system was not present. Due to this reason there was more power loss as we know that all the operations are not required simultaneously all the time. So, if any of the operations are not required there was no provision of stopping that operation.

2. Literature review

YEAR	AUTHOR	OBJECTIVE	CONCLUSION
2001	Arnold and Heinrich[3]	History of machine tools and recent changes.	In recent 15 years there has been increased advancement in the machine instrument industry as old models are persistently being supplanted by new ones. the joining of computerized controls innovation and PCs into machine apparatuses has influenced the business in these regions. Most organizations thought little of the effect of this new innovation.
2006	Dr. Toshimichi Moriwaki[4]	Recent trends in machine tools.	Machine device advances are studied from the view purpose of fast and elite machine devices, consolidated multifunctional machine apparatuses, high exactness machine devices and progressed and smart control advances.
2011	Frankfurt-am Main[5]	Multi-purpose machining	Machine tools nowadays must be able to handle all kinds of materials, and offer maximum flexibility. Two of the exceptionally regarded specialists on machining and shaping namely Dortmund and Chemnitz report on what's coming up for machine instrument makers and clients. The ongoing pattern requests for multi-operational machining focuses that can deal with a wide arrangement of items with little group sizes.

2014	Sharad srivastava[2]	Model conceptualization	Growing generation based ventures needed low creation cost and large production which can be achieved by the use of multi-operational working machine which consumes less power as well as time, since this machine gives working at diverse focus it truly diminished the time utilization up as far as possible.
2015	Rakesh Ambade[6]	Design and fabrication	Developing a machine which can work effectively in the remote areas where power supply is often irregular. machine can perform light operation with semi skilled workers also expert workers are not required.
2016	M. Prathyusha [13]	Theoretical explanation of multi-purpose machines.	Different developments has been explained so that multi-purpose machines can be adopted effectively and efficiently.
2018	Yashraj V. Patil [14]	Multi-purpose tool fabrication	In multipurpose tooling machine, industrialists will spend less cash on hardware when contrasted with individual machines for the same activities. Additionally the floor space required to setup this machine is additionally exceptionally less as opposed to setting up singular machines, the power utilization will likewise be decreased impressively
2018	Aquib Ahmad[1]	Model conceptualization and mathematical calculations.	Design a machine which performs activity such as cutting, grinding and drilling on various work focuses at the same time which infers that speculation isn't required for machines . Likewise, floor required to setup this machine is less when contrasted with floor required for setting up individual machines which suggests an extremely straightforward item format.

3. METHODOLOGY USED

The basic working of this project starts with a step down transformer (220V~12V) then alternating current is changed to direct current using p-n junction diode and capacitor. after this a switch is placed this controls the power supply to the DC motor (12V & 1000 rpm) the three switches is connected to the three different electro-magnetic clutches. these clutches controls the three different mechanical operations namely cutting(sawing),drilling and grinding.

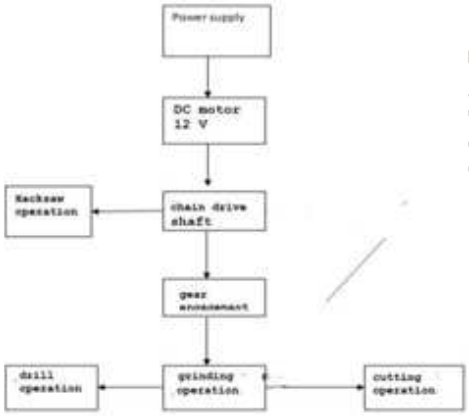

FIG. 1 FLOW DIAGRAM THE PROCESS[1]

FIG. 2 CONCEPTUAL MODEL

A. SAWING

The sawing operation draws the power as the electro-magnetic clutch engages the power is then transferred to a gear assembly with the gear ratio of (54:32) in order to reduce the speed and increase the torque output. The torque generated uses the scotch - yoke mechanism and changes the rotational motion into the linear cutting operation.

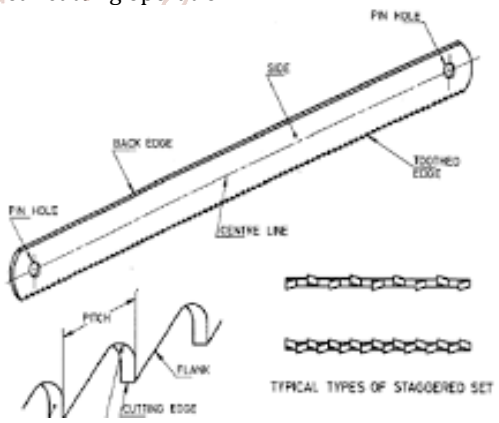

FIG. 3 SAWING DIAGRAM.[15]

FIG. 4 SAWING OPERATION

1. ELECTRO-MAGNETIC CLUTCH

Electromagnetic grasps work by means of an electric activation yet transmit torque precisely. At the point when current moves through the grasp curl, the loop turns into an electromagnet and produces attractive lines of transition. This motion is then exchanged through the little hole between the field and the rotor.[7]

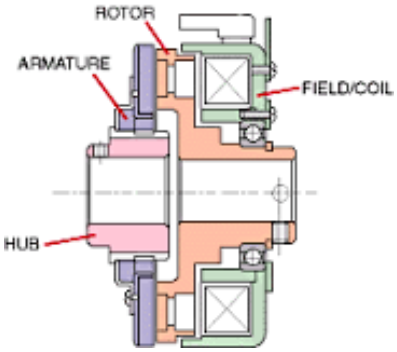

FIG. 5 ELECTRO-MAGNETIC CLUTCH(DIAGRAM)[7]

FIG.6 ELECTRO-MAGNETIC CLUTCH

2. SCOTCH-YOKE MECHANISM

Scotch-yoke mechanism in our project is used to convert the torque generated by the gear-box assembly into to and fro (linear) motion of the hacksaw. In previous work [1] single slider mechanism is used but we are using scotch-yoke mechanism as it has further benefits like more than one hacksaw can be used in the future.

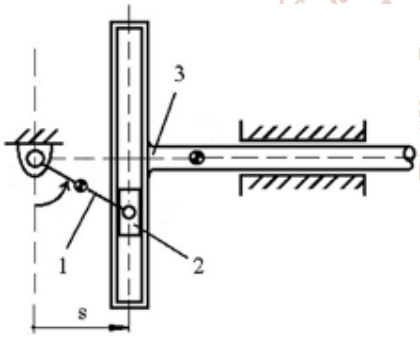

FIG.7 SCOTCH-YOKE MECHANISM [9]

Here,

1. Crank pin
2. Slider
3. Reciprocating part(Piston)

B. DRILLING

Nowadays drilling is one of the most common practice in industries. it is the process of making holes of the desired size. The drill bit is held in the shank and tip of the tool rotates. the chips comes out with the help of flute which are grooved in the drill bit.[10]Drills are regularly utilized in carpentry, metalworking and development. Uncommonly planned drills are additionally utilized in drug, inter-planetary missions and different applications. A velocity regulator will be placed in order to change the speed of the drill-bit according to the material in future versions of the machine.

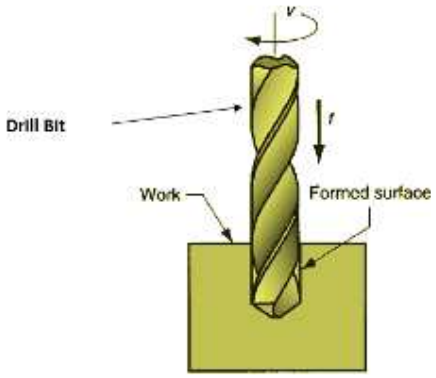

FIG.8 DRILLING (DIAGRAM) [11]

FIG.9 DRILLING

C. GRINDING

Grinding is a machining procedure that utilizes an instrument made up of grating powder. Fundamental point of grinding process isn't to evacuate material; however to accomplish or control measurements inside close resilience; or to accomplish great surface completion which is generally hard to accomplish by conventional material removing machines.In our project we are using low to medium speed grinding which varies from 0.3 m/s to 10 m/s.Low speed grinding can be used for harden gear materials and medium speed can be used for grinding purpose.

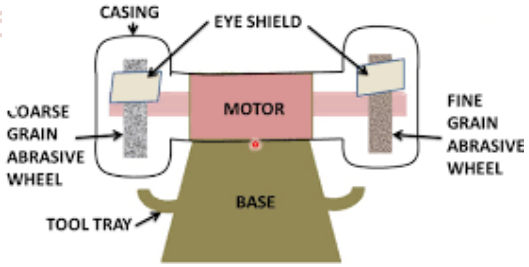

FIG.10 GRINDING (DIAGRAM) [12]

4. COMPONENTS USED

Sr.	Equipment	Quantity
	Capacitor 1000uf for filter voltage	1
5	Wood	1
6	Clamp	4
7	Transformer	1
8	Dc motor	1
9	Drill	1
10	Diode	4
11	Wire	1
13	Electromagnetic clutch	3
14	Metallic Screw	6
15	Switch	4

5. CONCLUSION

We can clearly see that with growing demand and competition in the market we need to move towards the machines which are efficient, less power consuming as well as multi-purpose. Here, is the idea of making such machines with the introduction of Electro-magnetic clutch that will provide better control to each of the components and saves power where it is required. The electro-magnetic clutch turns of the power supply when the machine is not working. The system is designed for performing three machining operations. which uses DC power supply (it means that it can be used in those areas where is lack of power supply with the help of batteries).It is more power efficient as compared to those of the previous versions as the power is supplied to only those component which requires power. It is cheaper than conventional machines and requires less floor area.

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