International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8, Issue-1, May 2019

Design and Modelling of Power Transmission System for Multipurpose Machine Tool

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Abstract*: *Machining devices are essential to fabricate any item. The significant machines are machine, Drilling and processing machines. The every individual machine costs more and consumes more space in the business and they expend part greater power and overwhelming work. Our Project is to discover an answer for the issue with respect to control transmission framework for the multi reason machine device. In this venture, we are going to structure and model a power transmission framework for the instrument referenced above utilizing Solid works. This machine device is a mix of machine, processing machine and penetrating machine and we have done to plan a typical power transmission framework utilizing single engine for the machine instrument. The machine is worked by offering drive to the primary shaft to which incline gear component is legitimately joined toward one side. These slope gears are utilized to transmit movement in the spiral heading. The fundamental motivation behind this machine instrument is to perform least of two tasks all the while, with the goal that it spares the time and power.

Index Terms*: *Power Transmission, Multipurpose machine tool, Lathe machine, Milling machine, Drilling machine.

I. INTRODUCTION

Enterprises are fundamentally implied for generation of valuable merchandise at low creation cost, apparatus cost and low stock expense. Be that as it may, to perform different activities on workpiece, distinctive machines are required which requests speculations and use. Little scale enterprises are required to put enormous sum in apparatus which cannot be moderate a few times. In perspective on this, each industry needs to accomplish a high profitability rate while keeping the quality and standard of the item requiring little to no effort. These days, everything has been made snappier and quick because of innovation headway however this progression additionally requests enormous speculations and use. We can play out any ideal activity utilizing flexible machine apparatus which is machine.. Be that as it may, a few activities are to be completed at various working focuses however if there should be an occurrence of present machine this need is wiped out because of the way that the tasks were performed all the while. The thought behind this task is to configuration control transmission framework utilizing gears for the consolidated machine instrument which keeps running on single power supply. Power transmission helps in development of vitality from its place of age to an area where it is connected to perform work. In this power transmission framework, we utilized apparatus drives. An apparatus is a mechanical part that transmits rotational power to another rigging or gadget. In this venture we have utilized both goad apparatuses and angle gears for the power transmission. We have utilized holds to draw in and separate the power transmission between the driving shaft and driven shaft.

Fig 1.power transmission

II. LITERATURE SURVEY

Before starting our work we have under gone many journals and papers published on multipurpose machine tools and by making the details of nomiclature and several things that may helps us to design the gears for this multipurposetool.we used the formule which are in different papers and PSG databook for some values of gears. Heinrich Arnold1 November 2001: Rather long re-venture cycles of around 15 years have made the idea that advancement in the machine device industry happens incrementally. However, taking a gander at its ongoing history, the mix of advanced controls innovation and PCs into machine instruments have hit the business in three floods of innovation stuns. Most organizations thought little of the effect of this new innovation.

This article gives a review of the historical backdrop of the machine device industry since numerical controls were developed and presented and examines the troublesome character of this new innovation available.

Revised Manuscript Received on 30 May 2019.

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Around 100 meetings were directed with leaders and industry specialists who saw the improvement of the business in the course of the most recent forty years[1]
Dr.ToshimichiMoriwaki concentrated on late patterns in the machine instrument advances. He led a review in perspective on fast and superior machine devices, joined multipurpose machine apparatuses, ultra-exactness machine instruments and propelled control innovations.[2]
Frankfurt-am Main states that selling hardware is an intense business. Machine apparatuses in current circumstance must be veritable "handyman", ought to have the capacity to deal with a wide range of materials, to oversee with no procedure materials beyond what many would consider possible, and be fit for adjusting to new occupation profiles.[3]
Rakesh S. Ambade, Komal D. Kotrange et.al. "Paddle operated multipurpose machine" The overview of this writing with respect to pedal driven machine are given: Dharma Chaitanya Kirtikumar was planned and built up a multipurpose machine which does not require power for a few tasks like cutting and penetrating and so forth. This is a human power machine keeps running on chain drive for the most part utilizing human exertion. In any case, in the event that we need to work this machine by utilizing electric power this machine can likewise do that. This plan is perfect for use in current creating world since, it doesn't require power and can be assemble utilizing metal base, pulley, elastic belt, chain, granulating wheel, saw, foot pedal to be worked by human exertion [4]

III. OPERRATIONS CARRIED OUT BY THE MULTI-PURPOSE MACHINE:

Lathe machine: A machine is a machine that pivots a workpiece around a hub of revolution to perform different activities, for example, **cutting, sanding, knurling, penetrating, disfigurement, confronting, and turning,** with devices that are connected to the workpiece to make an item with symmetry about that hub.
Drilling Machine: Drilling is a metal cutting process carried out by a rotating cutting tool to make circular holes with threaded in solid materials. Operations like **Reaming Boring, Counter boring, counter sinking, Spot facing, tapping**on this Drilling machine.

Milling machine:The processing machine is a machine which can expel metal and shape workpiece as our ideal shape by utilizing turning shaper known as processing shaper. Operations like **Angular milling, Face milling, Saw milling ,Sidemilling, Form milling, Profile milling, Straddle milling** can be done on this milling machine.

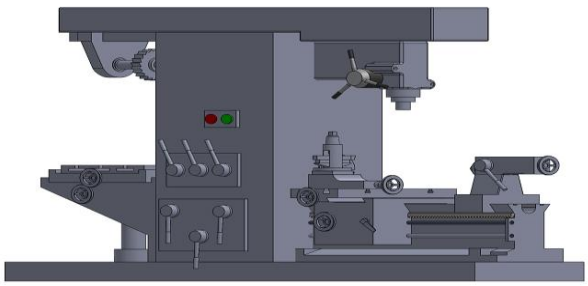

Fig 2. Multi purose machine tool

IV. WORKING OF A MULTI PURPOSE MACHINE TOOL:

1.The entire hardware will keep running by utilizing single DCshunt engine, since it keep up consistent speed.
2.At the point when the machine is turned on , we need to choose which apparatuses should need to work.
3.In this multipurpose machinine device, We can work two machine instruments at same time.Either it will be machine and processing tasks or it will bore and processing activities all the while.
4.There is a clasp to draw in and withdraw the power transmission shaft to the machine and different shafts.
5.In this multipurpose machining device, for power transmission , We are utilizing spurgears , slope riggings, shafts and clutch.We are utilizing goad gears since it can give more effective than some other apparatuses because of the full contact of teeth.
6.Slant gears are utilized to transmit control from vertical to level heading or converse course, as per geometric area of the riggings.
7.In this multipurpose machine apparatus, we have utilized 1500 RPM DC shunt engine with 2HP.Because when machine gets turn on, barring all power misfortunes we can get required speed from engine to machine device.

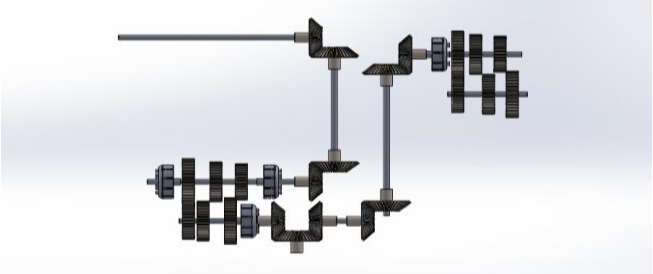

Fig 3. Power transmission system

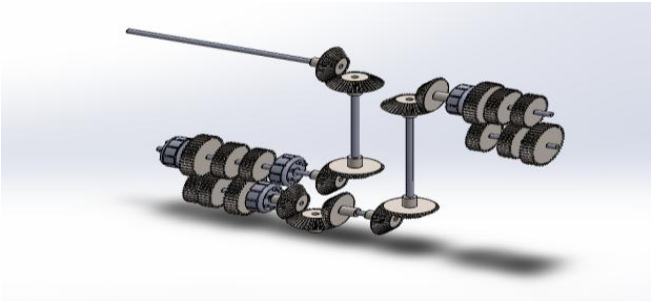

Fig 4.Isometric view

Lathe speeds:

Operation	m/min	Dia of tool(mm)	Rpm range
Turning	25-31	15.9	500-620
Thread cutting	9-10	15.9	180-200
Drilling	28-35	15.9	560-700
Reaming	10-15	15.9	200-300

Milling:

Operation	SFPM range	Dia of tool(inch)	Rpm range
Side milling	30-45	1''	120-180
Face milling	40-50	1''	160-200
Plain milling	30-45	1''	120-180
Form milling	30-45	1''	120-180

Drilling:

Operation	SFM	Dia of tool	Rpm range
Drilling	50-150	0.5''	400-1200
Reaming	20-30	0.5''	160-240
Tapping	15-25	0.5''	120-200
Screw cutting	30-40	0.5''	240-320

Calculations:
Average speed is taken from the operations

Lathe & drilling	milling
250 rpm	200 rpm
400rpm	250 rpm
1000rpm	300 rpm

Spur gear: using psg data book

$$i=\frac{Z2}{Z1}=\frac{N1}{N2}$$

Now take N2=400 rpm,
N1=1500 rpm
Theni=3.75 ≅4
Z1=23 then Z2=92

Lewis form factor:

$$Y=\pi y$$

$$y = 0.154-\frac{0.912}{Z}$$

Module:

$$m = 1.26 * \sqrt[3]{\frac{[Mt]}{Y1*[\sigma b1]*\phi_m*Z_1}}$$

$$P=\frac{2\pi NiMt}{60}$$

[Mt] = Mt * k_bk
m=3
Dimensions of gears (mm):
Ref Dia d=Zm =69,276
Tip Dia = d+2*m =75,282
Root Dia=d-2.5*m =62,269
Pitch=πm =9.5
Tooth depth= 2.25m =9
Thickness=P/2
Centre distance a=$\frac{d1+d2}{2}$ =173

Design of shaft

$[M_t] = \frac{\pi}{16}[d_s]^3 * \tau$

$$\frac{ds2}{ds1}=\sqrt[3]{i}$$

Ds1=20
Ds2=32

Design of bevel gears:

transverse module R = 0.5 * mt * $z_1 * \sqrt{i^2+1}$

$$m_{t=}m_m+\frac{b*sin\delta_1}{z_1}$$

m_t =3

$$\sigma_c=\frac{0.72}{(R-0.5b)}*\sqrt[2]{\frac{\sqrt{(i^2+1)\hat{}3}}{i*b}}\ E*[M_t]$$

σ_c = 757.85 N/ mm^2

$$R=\varphi\sqrt{i\hat{}2}*\sqrt[3]{\left(\left(\frac{0.72}{(\varphi-0.5)(\sigma c)}\right)^2\right)\left(\frac{E[M_t]}{I}\right)}$$

R = 55.18 mm

V. ANALYSIS

The model is completed in solid works and the file is saved in igs format. For the analysis we have taken spur gears separately and also bevel gears. The gears in igs format and the analysis is done in ansys. The static structural analysis is done on the gears. The model is imported into ansys through geometry and the specifications like material and all details are given to the gears after that model edit. By selecting the gears in concentric and mesh in fine element size. By giving the fixed support to gear2 and frictional support to gear1 after that momentum to gear1 at required range. Solving the model and finding equivalent stress, max principle stress, total deformation.

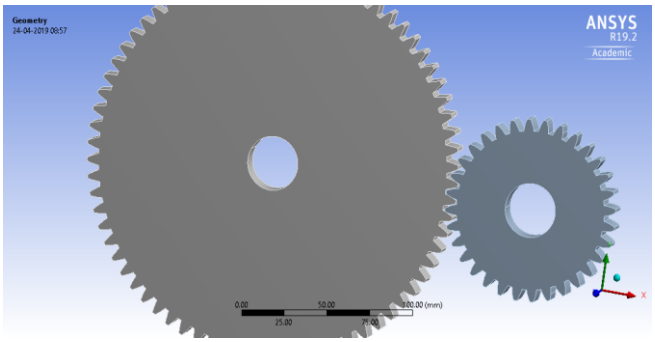

Fig 5. Spur gear

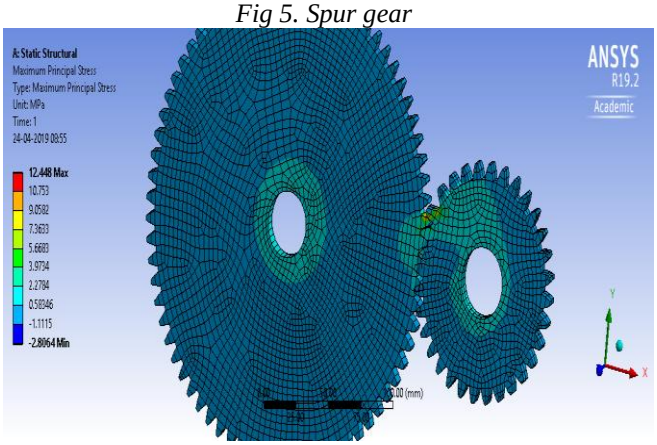

Fig 6. Spur gear analysis

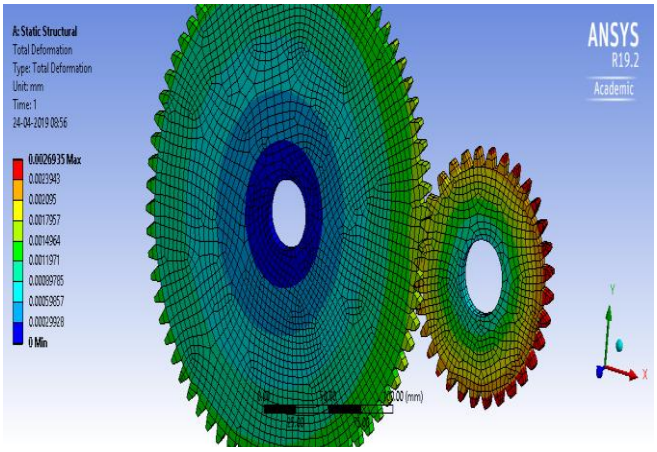

Fig 7. Spur gear deformation

VI. ADVANTAGES:

• The machines depend upon well considered structures which enable the client to switch starting with one capacity then onto the next capacity effectively.
• The primary motivation behind the machine device is to perform least of two activities at the same time, so it spares time and furthermore control moreover.
• In this undertaking we have utilized a solitary engine to run the transmission framework which spares the power.
• In this power transmission framework we utilized apparatuses, so it can give substantial scope of speed and torque for a similar info control.
• Using apparatuses can give increasingly precise planning, less grinding misfortune and less loud while performing activities.
• One vital thing for the generation of these machines is space sparing.
• A blend machine consumes considerably less space than the comparable separate machines.
• Even however the mix machines can be very costly, there ordinarily is a cost sparing over individual machines of same quality.
• Flexibility to perform different distinctive tasks in a solitary machine device utilizing diverse cutting apparatuses in a machining focuses.

VII. FUTURE SCOPE:

The mechanization of rigging framework in machine instrument may helps the work and diminish labor in workshop.
The machine apparatus can be made increasingly convenient and decrease the workspace and simple upkeep of work.
There might be plausibility to transmit capacity to all the three instruments at same time utilizing single engine.
Configuration changes can be made to accomplish wanted speed of the machine for the handling of materials.

VIII. CONCLUSION:

We have structured the power transmission framework for this multipurpose machine apparatus in which we can perform two tasks at same time (drilling& processing) or (machine and processing). Power from single engine is conveyed to the machine for various instruments for the handling of materials and by this power utilization can be diminished .It additionally lessens workspace for machines as the riggings of the entire framework encased in a solitary box. The paces of the two instruments might be same or distinctive according to tasks at same time. Performing two tasks at same time on the machine will spare time. It additionally expands profitability.

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