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# Design Parameters of Automatic Drilling & Tapping Machine

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***Abstract:*** ***This paper focuses on design of machine which can perform drilling and tapping processes together with the help of automation in order to improves production, reduce time for manufacturing and manufacture economically on a bigger scale. In regular drilling process which is the most common way to put a hole in metal or other materials, for precise hole location, good finish and accurate size automatic drilling machine is required. To cut threads on hole accurately along with the drilling process we using drill cum tapping bit. Tapping operation required to rotate the spindle in both clockwise and counter clockwise direction. So, we have made bevel gear arrangement for reversal of the spindle and also worm and worm gear is used for speed reduction as drilling requires high RPM and tapping requires low RPM to perform the drill and internal threads.***
***Keywords: Drilling, tapping & automation***

## I. INTRODUCTION

Automation - The technique of making an apparatus, a process, or a system operate automatically with indirect contact of human through programming. The programming aspects is used to control and operate the machine.
Drilling Process - The drilling machine is the most used machine tool in industry. Drilling operation is the most performed operation in industry. The holes are generated by the rotating edge of a cutting tool known as the drill which exerts large force on the work clamped on the table. The machine exerts vertical pressure to originate a hole it is also called as a “Drill Press”.
Tapping Process - Tapping is the process of cutting internal threads in a hole using a cutting tool called Tap. A tap has cutting edges in the shape of threads. When the tap is screwed into a hole it removes metal and cuts internal threads for tapping the hole drilled will be smaller than the tap size.
Tap drill size = 0.8 x( Outer diameter of the threads)

## II. OBJECTIVES OF AUTOMATED DRILLING & TAPPING MACHINE

*1)* Increase of productivity quantitative and qualitatively
*2)* Improved repeatability and accuracy
*3)* Less human intervention, indirectly reduction in operator fatigue
*4)* Less rejection due to automatic controls
*5)* Minimization of production cost.
*6)* Noiseless & smooth operation

## III. DESIGN CONSIDERATION

We should design the machine in such a case that the machine can perform operations on Ductile & Brittle Materials and the tap and drill size range up to 10 mm whatever be the mechanism or material used, the machine should satisfy the requirements.

## IV. CALCULATION

*1)* Worm and worm gear
*a)* Motor input rpm = 1320
*b)* Assume tapping rpm =170
*c)* Velocity Ratio $VR = \frac{Nw}{Ng}$ $VR = \frac{1320}{170} = 7.8$

If V .R. is in between 6-12 then teeth on the worm (No. of start) = n= 4

$$n = \frac{Tg}{VR} \quad 4 = \frac{Tg}{170}$$

Tg = 31.2 ,Say 30 as per std worm gear.

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*2)* Gear ratio = $\frac{30}{04}$

So we finalized the No. of teeth on worm and worm gear for tapping .

Tw=04 Tg= 30

PCD of gear Dg=m xTg=30m

Velocity Vp= π Dg Ng/60 x 100 = π x 30m x170/ 60 x 1000 = 0.267 m/sec

*3)* Design power, Pd= Pr* Kl (Kl=1.75)

=450 x 1.75 =787.5 Watt

*4)* Tooth load(Ft), Ft=Pd/Vp

=787.5/0.267 =2.94 x $10^3$

*5)* Beam strength, FB=So.Cv.b.Y.m

So=84 Mpa

Cv= 0.75 (Trial value)

b= 2.38 Pc+6.25 =2.38 (π x m)+6.25 = 7.47m+6.25

*6)* Lead angle =$\lambda=\tan^{-1}(Ng/Nw)^{⅓}$=26.79º

*7)* Pressure angle= Φn=25º

*8)* Modified Lewis Factor,

Y=0.314+0.0151($\Phi_n$-14.5) =.314+0.0151(25-14.5) =0.472

$F_b$=84*0.75*(7.47m+6.25)*0.472*m=222.56 $m^2$+186.06m

Now, Fb = Ft

222.56 $m^2$+186.06m=2949.44/m

*9)* module (m)=2.11≈ 3 mm

Dia.of gear= 30 x m=30 x 3

Dg=90mm

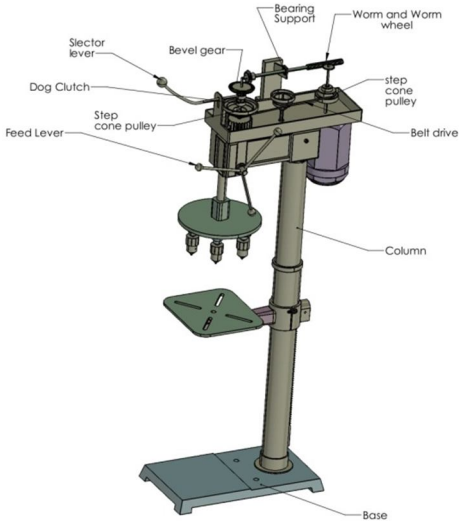
Dia.of worm=2.4 x Pc+27.5

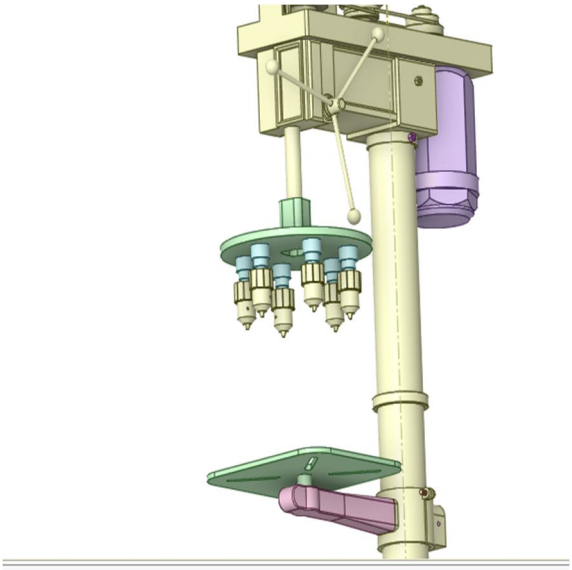
=2.4 x π m+27.5

Dw= 50mm

## V. CAD DESIGN & PARTS OF MACHINE

Here we use SOLIDWORKS for 3D modelling and assembly of automated drilling & tapping machine which consist of following parts – Base, Column Table ,Cone Housing, Table Housing, Main Vertical Spindle, Motor Mounting Bracket ,Motor (0.5 H.P) ,Pulleys, Bearings, Bolts and Nuts V-Belts, Rack & Pinion Cones (Fibre & M.S.), Gun Metal Bush ,Main Drive Shaft (Cone Shaft), Drill Chuck, Stop Screw & Column Support.



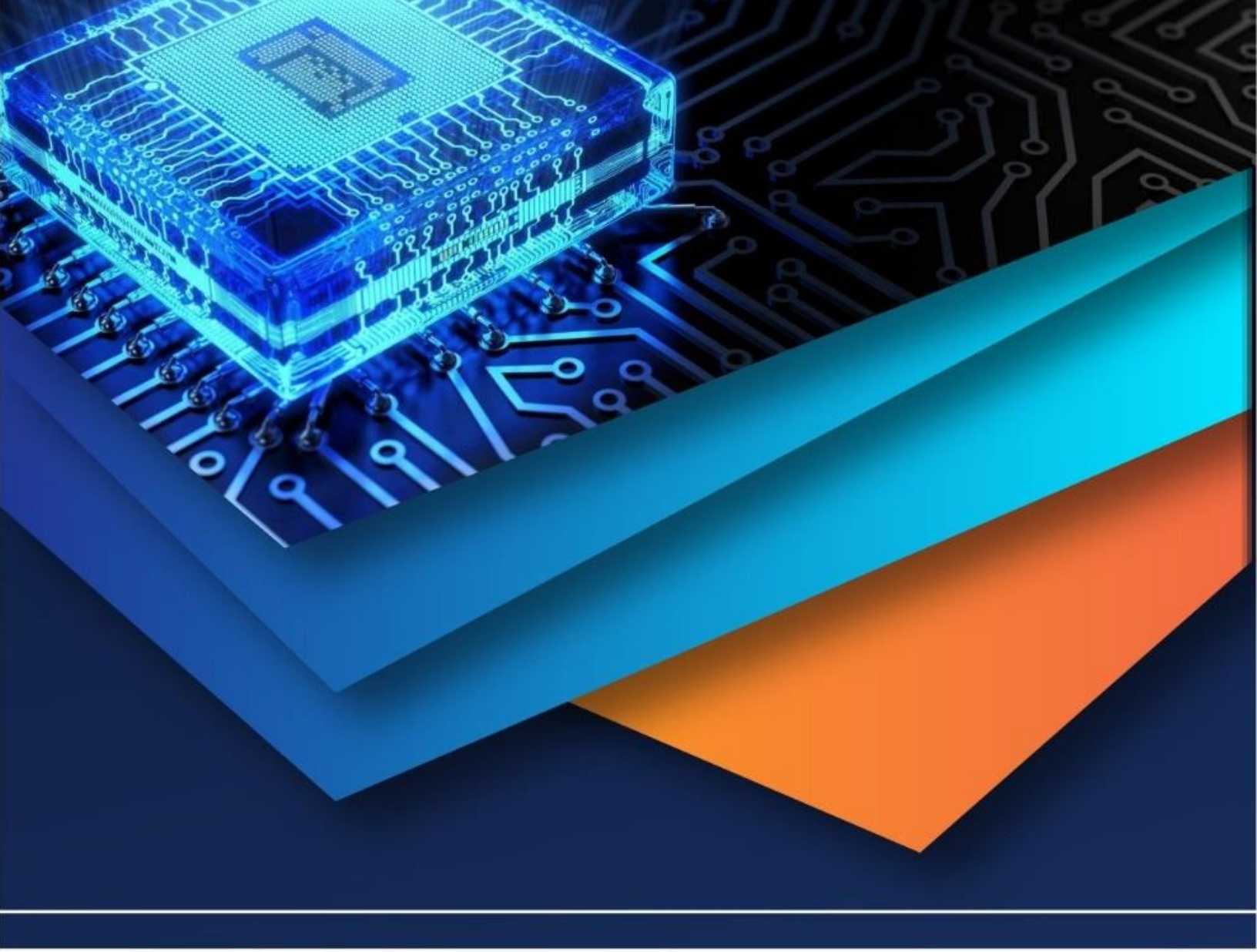
## VI. CONCLUSION

This paper presents and approach which could be used for designing automatic drilling & tapping machine and our attempt is small in the whole of the Engineering world, but it can do better than any other machine for the same purpose with less cost, high accuracy and precession. This design is simple and compact in size. Therefore, it is affordable by the small-scale industries.

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