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"Drilling and Tapping Machine: A Review"

P. G. Mehar[1] , V. D. Dhopte[2], C. D. Meshram[3]

Assistant Professor, Department of Mechanical Engineering Design; KDK Collage of Engineering, Nagpur – 440009 MH, India

Assistant Professor, Department of Mechanical Engineering Design; KDK Collage of Engineering, Nagpur – 440009 MH, India

M.Tech, Department of Mechanical Engineering Design; KDK Collage of Engineering, Nagpur – 440009 MH, India

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Abstarct :-

This paper presents the fabrication analysis of the drilling and tapping process within an semi automated machine system, aimed at improving precision, efficiency, and reliability in machining operations. The analysis focuses on evaluating the critical aspects of material selection, tooling, machining techniques, and assembly methods involved in the fabrication of the drilling and tapping components. It examines the effects of material properties, cutting forces, and machining accuracy. Additionally, the paper addresses the optimization of the fabrication process by evaluating boundary conditions such as spindle speed, feed rates, and tool geometry to minimize errors, enhance surface finish, and extend tool life.

The paper also outlines the key parts involved in the fabrication of the drilling and tapping system, including the spindle assembly, feed mechanism, tool holders, motor, and structural frame.

Key Words :- Drilling, Tapping, Material, Measurement , Construction

1. Introduction:- The topic "Design & fabrication of Drilling and Tapping Machine" is about creating a machine that can drill holes and cut threads (tapping) in one setup. The design process involves creating the machine's structure, including the spindle, base, and tool holders, ensuring they can handle the forces during drilling and tapping. Key design factors include material selection for durability, optimizing the geometry to reduce weight while maintaining strength, and ensuring smooth tool alignment for precision. Advanced CAD software is used for 3D modelling.

1.1 Drilling Process:- The drilling process is a systematic method used to create holes in materials by removing material using a rotating cutting tool. It involves stages such as selecting the appropriate drill bit, aligning the workpiece, and applying controlled force and speed to achieve precise and efficient results.

1.2 Tapping Process:- The tapping process is a machining operation used to create internal threads within a pre-drilled hole using a tool called a tap. It involves precise alignment of the tap with the hole, controlled rotation, and to ensure accurate threading and avoid damage to the tool or workpiece.

2. . Literature Review :-

2.1 FABRICATION OF COMBINE DRILLING AND TAPPING MACHINE:

Tapping and drilling are essential in mechanical working, mainly studied for cutting force variations, tool wear, and design. A novel CNC-based system improves productivity and accuracy by reducing setup costs and operator fatigue. Traditional trial-and- error alignment wastes time and increases fatigue. Our machine integrates drilling and tapping using a speed reduction gearbox, adjusting RPM as needed. A collet mounted on the motor shaft ensures precise operation.

2.2 COMBINED DRILLING AND TAPPING MACHINE BY USING CONE MECHANISM:

In the present market the combined drilling cum tapping machine is not available. For tapping we need either a manual process or a tapping attached in a drilling machine. The former one consumes lot of time the latter is quite costlier. For tapping operation, we need to rotate the spindle in both clockwise and counter clockwise direction. In our machine we have made bevel gear arrangement for auto reversal of the spindle. Thus, based on the functional and economical aspects we have fabricated a unique machine.

2.3 AUTOMATED DRILLING MACHINE BASED ON PLC:

This paper presents the design and fabrication of a PLC-based automated drilling machine for cubic workpieces (3 cm × 2 cm × 3 cm) with 8mm deep holes. The cycle starts when the switch is pressed, positioning the drilling head and rotating the disk to align the workpiece. Drilling begins upon sensor detection and stops automatically after completion, followed by a quarter-cycle disk rotation to remove the drilled piece. The PLC controls sensors and motors, achieving an autonomous drilling rate of three objects per minute.

2.4 AUTOMATION OF DRILLING PROCESS USING ELECTRO- PNEUMATICS SYSTEM:

This paper presents Automation enhances production, reduces manufacturing time, and enables cost-effective mass production. Drilling, a key process, requires automation for precision and efficiency. Conventional drilling ensures accurate hole placement and finish, while an electro-pneumatic circuit automates the process. Compressed air from a screw-type compressor provides the necessary pressure for operation.

2.5 FABRICATION AND AUTOMATION OF DRILLING MACHINE BY USING ARDUINO:

Precision manufacturing requires good dimensional accuracy and surface finish. Traditional drilling, punching, and tapping rely on expensive CNC machines, which are costly for small manufacturers. This study proposes a low-cost alternative with CNC-like functionality for efficient production. Manual drilling often leads to errors in depth estimation, making an automatic drilling machine essential. This system ensures precise drilling depth, improving quality and productivity.

3. Construction :-

The drilling and tapping machine consists of a mild steel frame and base for stability and vibration absorption. A spindle mechanism, driven by an electric motor via a belt holds and rotates the drill bit or tap at controlled speeds. The power transmission system uses pulleys to regulate speed and torque. A vice or fixture securely holds the workpiece, while a automated feed mechanism controls the spindle's downward movement. The control system includes manual switches for operation adjustments. For tapping, a reversible motor ensures smooth thread cutting. The machine is designed to be compact, durable, and efficient

4. Working :-

The drilling and tapping machine operates by securely clamping the workpiece in place. The electric motor drives the spindle, which rotates the drill bit to create a hole. The electric motor power is used via gears to move Bit in upward or downward motion for depth of hole. After drilling, the tapping begins without repositioning. The spindle reverses rotation to cut internal threads smoothly, assisted by reversing mechanism to prevent thread damage. The control system adjusts speed and feed for precision by worm and worm gear, enhancing efficiency by combining both operations in a single setup.

5. Components :-

I. Motor*:* It is a 3 Phase 0.5 H.P. Motor and runs at 720 rpm & is mounted on the bracket.

II. Table*:* The table is drilled and bored at the centre for a dia of 30mm and threaded. Four slots are cut on the table for clamping the work piece. A groove 14 x 14 mm near the30mm dia shaft for a length of 190mm. The square rack of

length 150mm is placed on the groove and welded.

Material:- Cast Iron.

III. Base: The Base is that part of the machine on which the vertical column is mounted. Four holes are drilled and tapped for ½" M.S. bolt to mount column support.

Material :- Cast Iron.

IV. Column: The column is of dia 45mm and length 500mm. One end of the column is filled to the column support while the other end is inserted in the cone housing.

Material :- mild steel

V. V-Belts: A single V-Belt of A-Type cross section is used. It is used to transmit the power from Motor Pulley to Spindle Pulley with help of step cone pulley.

VI. Cone Housing: Initially a square bar of 80mm x 80mm of length 280mm is machined. A drill of 45mm is made on one side for a depth of 75mm. A cylindrical bar of dia 80mm and length 100mm is welded to the square bar at a distance of 64mm from the top. A bore of 90mm is drilled axially along the cylindrical bar against the square bar, and bearing rating of 52mm dia is taken at the ends of the bore to a depth of 22mm. A rectangular flat is taken at the ends of the bore to a depth of 22mm.

Material :- mild steel

VII. Worm and worm gear : It consist of Worm with 4 teeth and Worm gear with 30 teeth.

VIII. Table Housing: A collar of inner dia 45mm , outer 55mm is machined and it is cut on one side alone the axis and two flats are welded. In which hour are drilled and tapped to as to fix collar at any position on the column.

Material :- mild steel

IX. Main Vertical Spindle: The shaft is machined to a dia of 22mm. By using end mill cutter, a flat of 10 mm thick, 50mm length is taken radially on four side of the shaft in order to grip the screw. At the lower end of the shaft a step of dia 15 mm is given for a length of 10mm. A taper is given for a length of 30mm such that the larger end is of dia 22mm and smaller end is of dia 20mm in order to hold the chuck.

Material :- mild steel

X. Bearing: Two taper roller bearings are used to support the Shaft. Axial movement of the bearing is arrested by means of collar nuts and bolts. This bearing is arrested by means of collar nuts and bolts. This bearing is used to take both axial load and thrust load.

XI. Drill Chuck: The self-cantering 3 jaw chuck is particularly adapted for holding tools having straight shanks. The chuck is tightened and loosened by rotating a bevel key meshed with bevel teeth of the sleeve.

XII. Bolts & Nuts: It is used to fix the motor with Base, to fix the column support to the base. The Grub screw to fasten the M.S. Cones to the vertical Spindle.

XIII. Pulleys: There are two similar step cone pulleys of which one is attached to motor and other is attached to the main Drive Shaft.

1. Mild steel cone, Fibre cone

Material :- Cast Iron.

6. Conclusion:-

Our attempt through this Automating drilling and tapping machines makes production faster, more accurate, and cheaper. It reduces mistakes, cuts down on manual work, and improves safety. This design is simple and compact in size. Therefore it is affordable by the small scale industries .

7. References:-

1. N.U. Kakade1, Piyush Bhake2,Sumit Dandekar2 ,Rohan Kolte2 , Sumit Selokar2 "**FABRICATION OF COMBINE DRILLING AND TAPPING MACHINE "**
International Research Journal of Engineering and Technology, Volume: 04 Issue: 03 | Mar - 2017

2. V. B. Vaidya1 , Akshay Dukhi2 , Chirag Meshram3 , Hemant Chaudhray4 , Mayank Gurve5 , Sahil Rangari6 **"FABRICATION OF AUTOMATIC DRILLING & TAPPING MACHINE"** International Journal for Research in Applied Science & Engineering Technology , *Volume 11 Issue IV Apr 2023*

3. N.VENKATESH1 , G.THULASIMANI2 , S.NAVEENKUMAR3 , S.K.MALATHI4 , S.PALANISAMY5 , M.KARTHIKEYAN6 "**COMBINED DRILLING AND TAPPING MACHINE BY USING CONE MECHANISM**" International Journal of Scientific & Engineering Research, Volume 7, Issue 5, May-2016

4. G. Niranjan, A. Chandini and P. Mamatha, **"AUTOMATED DRILLING MACHINE WITH DEPTH CONTROLLABILITY,"** International Journal of Science and Engineering Applications, Volume 2, Issue. 4, Aug-2013

5. Mohammad Nasir Khan1 **"FABRICATION AND AUTOMATION OF DRILLING MACHINE BY USING ARDUINO"** IOP Conference Series: Materials Science and Engineering, **DOI** 10.1088/1757-899X/1224/1/012007

6. Teodoriu, C.[1]; Bello, O.[2] **"AN OUTLOOK OF DRILLING TECHNOLOGIES AND INNOVATIONS: PRESENT STATUS AND FUTURE TRENDS."** Energies 2021, 14, 4499. https://doi.org/10.3390/en14154499

7. Nikhil G Lokhande[1], Vyankatesh B Emche[2], Vikas M Khanke[3] Pravin B Raut[4] Pramod N Jagtap[5] **" FABRICATION OF DRILLING CUM TAPPING MACHINE"** International Journal of Creative Research Thoughts Volume 5, Issue 4 October 2017

8. Prof. P.R. Sawant[1], Mr. R. A. Barawade[2] **"DESIGN AND DEVELOPMENT OF SPM- A CASE STUDY IN MULTI DRILLING AND TAPPING MACHINE"** International Journal of Advanced Engineering Research and Studies E-ISSN2249-8974

9. Akshay R Mahendrakar **"AUTOMATION OF DRILLING PROCESS USING**

ELECTRO -PNEUMATICS SYSTEM" International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Impact Factor (2012): 3.358

10. Keval Malaviya[1], Jay Bhatt[2] **"DESIGN AND DEVELOPMENT OF FLEXIBLE DRILLING AND TAPPING MACHINE "** International Research Journal of Engineering and Technology Volume: 08 Issue: 03 | Mar 2021

11 Yousef M. Abueejela[1] , A. Albagul[2] , Ibrahim A. Mansour[3] Obida M. Abdallah[4] "**Automated Drilling Machine Based on PLC**" IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 3, March 2015

12 Pisit Phokharatkul[1] , Supachai Phaiboon[2], Sanchaiya Phasomkusolsil[3] , Nathum Koetsam- ang[4] Chom Kimpan[5] **"SEMI-AUTOMATIC TAPPING MACHINE CONTROL USING MICROCONTROLLER"** Kasem Bundit Engineering Journal Vol.10 No.2 May-August 2020

13. S. Kamalakkannan[1], J. Lavanya[2] "**Automatic Drilling and Tapping Machine Monitoring using NodeMcu**" Research Article Vol 2 Iss 1 Year 2020

14 A.S.Udgave[1] ,Prof.V.J.Khot[2] "**Design & Development Of Multi Spindle Drilling Head (Msdh)**" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN: 2278- 1684, PP: 60-69