

# FABRICATION OF DRILLING CUM TAPPING MACHINE

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**Abstract:** Tapping and drilling are frequently used in mechanical working. Previous researches on tapping and drilling has mainly focused on cutting force variations, drill and tap wearing, and drill and tap design.

A novel performance test system of tapping and drilling for a computer numerical control (CNC) machine tool is established in recent techniques. The target of the mass production is to increase the productivity and increase the accuracy. This is done by reducing the set up cost and manual fatigue. Trial and error method is usually practiced until the axis of the hole is properly aligned with the axis of the drill. In such a situation a lot of time is being wasted to maintain the accuracy. Eventually it increases the operator's fatigue. The main aim is to locate, hold and support the work securely so that the required drilling and tapping operation can be performed.

Our machine will consist of combination of drilling and tapping operation with the help for speed reduction gear box. As drilling requires high RPM and tapping requires low RPM to perform the drill and internal threads operation. A collect is mounted vertically on the shaft of motor and gear box reduces the speed as per requirement of operation.

**Keywords:** *Drilling, Tapping*

## I. INTRODUCTION

A process for producing internal threads using a tool (tap) that has teeth on its periphery to cut threads in a predrilled hole. Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The main purpose of this machine is to perform both operation drilling and tapping on single machine. This machine will consist of combination of drilling and tapping operation with the help for speed reduction gear box. As drilling requires high RPM and tapping requires low RPM to perform the drill and internal threads. A collect is mounted vertically on the shaft of motor and gear box reduces the speed as per requirement of operation.

## II. LITERATURE REVIEW

### LOW COST AUTOMATION USING ELECTRO PNEUMATIC SYSTEM – AN ONLINE CASE STUDY IN MULTISTATION PART TRANSFER, DRILLING AND TAPPING MACHINE

This paper discusses the case study and, comparison of productivity of a component using a real time multi stationed AUTOMATED ROTARY TRANSFER LINE used for Drilling, tapping and inspecting a standard block of size 50 X 50 X 75 mm with drill size diameter 5 x 20 mm long and tapping the drill by M6 machine Tap. The clamping of the component, part transfer and feed of the drilling machine spindle is done using electro-pneumatics. The total logic of the system is based on Low cost automation with the micro controllers. The following studies are carried out 1. Time saved by component handling (loading and unloading), using pneumatic clamping, 2. Increase in productivity both qualitative and quantitative, 3. Improved repeatability and accuracy, 4. Less human intervention, indirectly reduction in operator fatigue, 5. Less rejection due to automatic controls, and 6. Minimization of production costs.

The concept of automated part transfer line fabricated as an experimental setup can be extended to an industrial application with further modification in the manufacturing and assembly process to achieve quality in the machine as per the test charts provided by leading machine tool manufacturer. On a whole, it is concluded that the automation is an inevitable process though the rate at which it should be introduced will have to be carefully planned in order to bring social justice and to accrue economic benefits .[1]

### STUDY OF MULTI-TASKING MACHINE

Special purpose machine is part of multi-tasking machine. This is new approach to increase the productivity of organization. If we compare between ordinary machine and special purpose machine in terms of time, costs, number of steps involved, etc. The multi-tasking machine is preferred choice. SPM is higher degree mechanism in which human participation is replaced by mechanical, electrical, fluid power technologies capable of doing physical effort and even mental work as in case of CNC machines. In some simultaneous SPM also demands accurate sensing, recall, memory storage, physical effort or movements requires special sensors for controlling the technologies processes

The exhausted literature study has been carried out on design and fabrication for SPM. The findings of various scholars in the field of design, fabrication and analysis of SPM have been presented below: A. M. Takale et.al [5] was focused on "Design & manufacturing of multi spindle drilling head (msdh) for its cycle time optimization", This paper deals with design and development of multispindle drilling head for cycle time optimization of the component. Their attempts have to improve the productivity by reducing the total machining time and combining the operations. They have design the major components of multispindle drilling head like main spindle gear and main spindle and calculate the stress analysis. By using multispindle drilling head productivity will increase. Because with the present process one hole produces at a time requires 4 minutes for each component (because tool change takes place for drilling 5mm hole (for M6x1 tap)). i.e. 12-15 parts are produced during one hour, but by using multispindle drilling head cycle time approximately takes place 1 minute. Prof. P. R. Sawant et.al [4] had been published a paper on "Design and development of SPM-a case study in Multi drilling and tapping machine", This paper discuss the case study and comparison of productivity of component using conventional radial drilling machine and special purpose machine (SPM) for drilling and tapping operation. In this case study, the SPM used for 8 multi drilling operation (7 of  $\text{Ø}6.75$  and  $\text{Ø}12$ ), linear tapping operation of  $\text{Ø}12$  and angular tapping operation of  $\text{Ø}5.1$  of TATA cylinder block. In this paper the following studies are carried out 1. Time saved by component handling (loading and unloading), using hydraulic clamping, 2. Increase in productivity both qualitative and quantitative, 3. Less human intervention, indirectly reduction in operator fatigue, 4. Less rejection due to automatic controls, and 5. Increase the profit of company.

The main concept of this project work is to design & develop a special purpose machine, which can be used for drilling and tapping the work piece having different thickness and material on the same machine. This kind of SPM is very much required in the mechanical workshops, small scale industries, where it is essential for specific job applications. It is finding that the machine is beneficial for work shop where drilling and tapping perform simultaneously on job. This machine reduces operation as well as transportation time and cost of raw material involved in the concern. Despite our best efforts we realize that our machine is less noisy and quite stable. By using drilling and tapping spindle on the same machine the time requires for drilling and tapping operation is very less as compare to conventional method.[2]

#### **DESIGN AND DEVELOPMENT OF SPM-A CASE STUDY IN MULTI DRILLING AND TAPPING MACHINE**

This paper discuss the case study and comparison of productivity of component using conventional radial drilling machine and special purpose machine (SPM) for drilling and tapping operation. In this case study, the SPM used for 8 multi drilling operation (7 of  $\text{Ø}6.75$  and  $\text{Ø}12$ ), linear tapping operation of  $\text{Ø}12$  and angular tapping operation of  $\text{Ø}5.1$  of TATA cylinder block. In this paper the following studies are carried out 1. Time saved by component handling (loading and unloading), using hydraulic clamping, 2. Increase in productivity both qualitative and quantitative, 3. Less human intervention, indirectly reduction in operator fatigue, 4. Less rejection due to automatic controls, and 5. Increase the profit of company.

The concept of SPM fabricated as an experimental set up can be extended to an industrial application with further modification in the design that is optimization of design process to achieve quality in machine as per the operation requirement. On a whole, it is concluded that the SPM is an developing process through the rate at which it should be introduced will have to be carefully planned in order to bring social justice and to accue economic benefits.[3]

#### **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 later 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.

The field of engineering is presenting a gift day by day to the world. 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. This design is simple and compact in size. Therefore it is affordable by the small scale industries.[4]

#### **A REVIEW ON PNEUMATIC TAPPING MACHINE**

Today most of the industries are trying to make improvement in their production processes as well as relevant machinery to improve the productivity along with the automation. Tapping is one such operation which is most frequently used in small and large scale industries. Thread tapping is the method to produce the fine thread inside the drilled hole on the plate. Most of the industries uses the conventional method says hand tapping. This conventional method is very time consuming process, less accurate and includes higher labour cost, and ultimately leads to less productivity. So there is a scope to develop the machine for tapping operation which would overcome all the problems faced by the conventional process. So we are going to develop the pneumatics tapping machine which will make the use of compressed air for it operation without human involvement as which is used in hand tapping.

In this paper, we are mainly concerned with the study of tapping operation and have recommended a pneumatic technique for tapping which would overcome the problems faced by conventional method. This new technique will be helpful for better quality of tapped holes, improve the productivity as well as, reduce the time required for the tapping operation. Thus it would be helpful in

overcoming the problems faced by the hand tapping process and such a model could be much useful for the small scale industries for mass production.[5]

### **DESIGN AND MANUFACTURING OF SPECIAL PURPOSE SUBSYSTEMS FOR DRILLING AND TAPPING OPERATIONS**

The growth of mechanical industries depends on its productivity & quality. The decision making of company is largely based on the motives of improving traditional manufacturing practices to result in to major advantages like, reduced manufacturing lead times, fool-proofing of methods of processing & consistent results on a long run. In case of mass production where job variety is less and quantity produced is large, it is very important to produce faster job production. This paper includes case study and comparison of component using traditional radial drilling machine and SPM for drilling and tapping operations. The special purpose machine is used for drilling two holes of  $\text{Ø}5$  and M6x1 tapping for those two holes. The following studies are carried out 1. Time saved by component loading and unloading on indexing unit, 2. Increase qualitative and quantitative productivity, 3. Minimum human intervention, 4. Minimum rejection due to automatic control, 5. Enhance the profit of organization.

The few conclusions are based performance of newly developed SPM are as follows:

- 1) Due to reduced cycle time, rate production increased with improved quality. In new improved machining method time saved is almost 76.65 %.
- 2) The cost per component is reduced.
- 3) The rejection level in older method was higher than new method therefore cost of rejection was reduced.[6]

### **III. OBJECTIVES**

This project deals with Design and Fabrication of Automatic Tapping and Drilling Machine. 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 later 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.

### **IV. WORKING PRINCIPLE**

#### **TAPPING PROCESS**

The tapping process is activated using a multi point cutting tool called "TAP". The Tap is held in the main spindle with the help of collect Chuck / Drill chuck. The spindle gets its drive power from the motor by means of the V-belt. The travel of the "TAP" over the entire thickness of the work piece is obtained by Rack and Pinion arrangement. In this machine the friction cone mechanism is employed. This consists of three cones one fiber cone and two mild steel cones. They are in such a way that two cones engage at a tune. The fiber cone is held in the main drive shaft and two MS cones are held in main vertical spindle.

In the initial stage the upper MS cone is engaged with fiber cone due to its self weight. As the power supply is given the spindle rotates in the anti clockwise direction. The component to be tapped is placed in the table and it is aligned accordingly. Slots are provided for holding the work piece accurately. When the work piece is loaded on the tool, the lower MS cone engage with the fiber cone and simultaneously upper MS cone disengages, and thus clockwise rotation of the spindle is obtained. The speed required for tapping is around 100rpm. After the component is being tapped loading is stopped, the table assembly is brought down engaging upper cone with the fiber cone and hence the tap reverses, finishing the operation. If the material is hard the cone slips and breakage of the tap is avoided which is the salient feature of this machine.

#### **DRILLING PROCESS**

The drilling process is activated using a multi point cutting tool called "Drill". The Drill is held in the main spindle by a collate Chuck / Drill Chuck. The Spindle gets its drive power from the motor by means of 'V' Belt. The travel of the "Drill" over the entire thickness of the work piece is achieved by the movement of the Rack and Pinion. In this machine we made use of reversing switch in order to attain the anti – Clockwise Rotation of the spindle. Initially, the upper cone is engaged with Fiber cone. Thus rotating in clockwise direction as the work piece is loaded the lower cone engages with the fiber cone and hence, the Anti – Clockwise rotation of the spindle is obtained. The spindle speed requires for the Drilling operation is around 1000 rpm.

V. EXPERIMENTAL SETUP

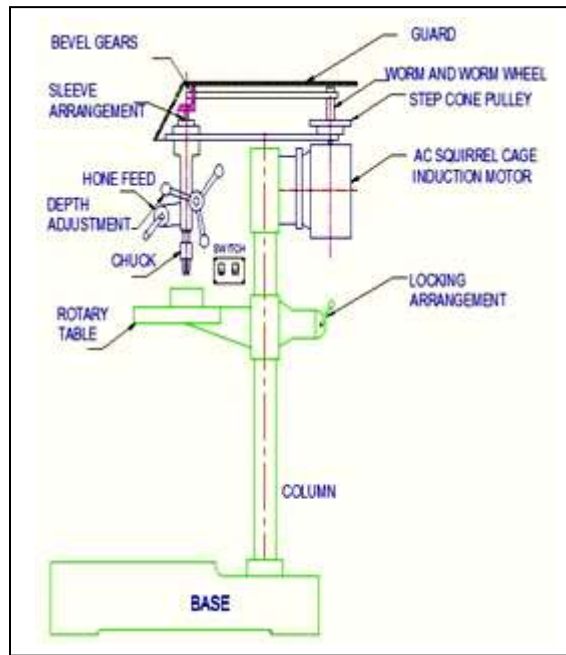


Fig.1 Drilling cum Tapping Machine

VI. COMPONENTS AND SPECIFICATION

Table 6.1 Specification Table

Sr.No.	Name Of Component	Specification
1.	AC Squirrel cage induction motor	0.5 hp, 420 watt
2.	Motor RPM	1320
3.	Step cone pulley	As per standard
4.	Belt drive	V-Belt Drive
5.	Bevel gears	Tg=14
6.	Worm and worm wheel	Tg=4 Tw=48
7.	Planetary 3 jaw chuck	self-centering chuck
8.	Vertical shaft with key way 3 x 2 mm	Dia = 12 mm
9.	Bearings	Anti-frictional roller ball Bearing
10.	Sleeve and dog clutch arrangement.	Sleeve dia 12 mm

VII. CONSTRUCTION AND WORKING:-

The head containing AC Squirrel cage induction motor, stepped cone Pulleys, sleeve arrangement which transmit the motion to drill spindle at number of speeds. worm and worm wheel is attached so as to reduced the speed of tapping tool upto 100 RPM.

Spindle is made up of alloy steel it rotates as well as engaged and disengaged in a sleeve. A bevel gear engaged onto sleeve to provide vertical up and down motion of spindle so that the feed can be fed into workpiece.

While drilling operation, sleeve is in disengaged mode and speed of the motor through bevel gear is transferred to spindle directly. Spindle speed or drill speed is changed with the help of stepped cone pulley. Drill chuck is held at the end of drill spindle to hold drill and tap tool.

Adjustable table is supported on the column of drilling machine. It can moved both vertically and horizontally. Tables are generally having slots so that the vise or the workpiece can be securely held on it.

While tapping operation, motor shaft speed is reduced to 100 RPM with worm gears and sleeve is engaged onto spindle shaft to reduce the speed as tapping requires very low speed for operation.

## VIII. CONCLUSION

In this project, we are mainly concerned with the study of tapping operation and have recommended a new attachment of sleeve and dog clutch for tapping which would overcome the problems faced by conventional method. This new technique will be helpful for better quality of tapped holes, improve the productivity as well as, reduce the time required for the tapping operation. Thus it would be helpful in overcoming the problems faced by the hand tapping process and such a model could be much useful for the small scale industries for mass production.

The benefits of machine are as given below.

- 1) The time required for component loading and unloading is saved.
- 2) Due to optimization of cycle time productivity improvement is done.
- 3) Because of less human interaction during process results into less operator fatigue

## SUMMARY

- Sleeve and dog clutch arrangement is provided for drilling and tapping operation.
- A pair of bevel gear is provided so as to transmit the power of worm gear drive at 90 degrees.
- For drilling upto 660 rpm can be achieved.
- For tapping 100 rpm can be achieved.

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