Combined Drilling and Tapping Machine by using Cone Mechanism

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Abstract: 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.

Keywords: Drilling .tapping, cone mechanism,

I.INTRODUCTION

DRILLING PROCESS:

The drilling machine is one of the most important machine tool. In a drilling machine holes may be drilled quickly. The holes is generated by the rotating edge of a cutting tool known as the drill which exerts large force on the work clamped on the table. As the machine exerts vertical pressure to originate a hole it is also called as a "Drill Press".

TAPPING PROCESS:

Tapping is the operation 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 * Outer diameter of the threads

To understand the application and importance of the involvement of semi automation in conventional drilling machine in manufacturing. This paper will cover up procedures for maintaining and setting up the work, proper methods of selecting tools, work holding devices to get the job done safely without causing damage to the equipment.[1]

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 Ø6.75 and Ø12), linear tapping operation of Ø12 and angular tapping operation of Ø5.1 of TATA cylinder block. In this paper the following studies are carried out.[2]

II. DEFINITION OF THE PROBLEM

Before proceeding to design, the problem should be well defined i.e. The design engineer should make it clear, what exactly is the requirement i.e. for example Design and Fabrication of Tapping cum drilling machine. The designer should design the machine in such a case that the machine can perform operations on Ductile & Brittle Materials and the tap size ranging from 0 to 6 mm whatever be the mechanism or material used, the machine should satisfy the requirements.

Base: The Base is that part of the machine on which the vertical column is mounted. The Base is made of Cast Iron. It serves as a foundation member for all other parts which rests upon it. It carries the column at one end and the motor Bracket on the other end.

Column: The column is the vertical member of the machine, which supports the table and the head containing all the driving mechanism. The Column should sufficiently, rigid so that it can take up the entire cutting

pressure. The column is made as a round section. This Column mounted on the base with the help of column support.

Table: The Table is mounted on the column and is provided with 'T' bolts for clamping the work directly on its face. The table is made as a rectangular in shape. the table moves up and down over the column of the machine. The top of the table is machined and is used for holding work pieces. It is made of Cast Iron.

Cone Housing: It is mounted on the top of the column. It consists of a lower arm and an upper arm. The two Gunmetal bushes in the arms are used as support to the Vertical Spindle. The Taper Roller Bearings in the Housing acts as support for the main driver shaft.

Table Housing: The Table Housing slides over the Column of the Machine. The up and down movements of the Table is given by Rack & Pinion Mechanism.

Main Vertical Spindle: The Spindle is mounted vertically, held between bushes and its carries two M. S. Cones one end of the spindle is attached to the drill Chuck to hold the tool. The spindle rotates in the either direction according to the engagement of Cones.

Motor Mounting Brackets: It is attached to Base with the help of Bolts and Nuts. The Motor is held in the Brackets. It is made up of Mild Steel.

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

Pulleys: The machine has step cone pulleys of A-type. The pulleys are made up of Cast Iron. There are two similar step cone pulley of which one is attached to motor and other is attached to the main Drive Shaft.

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.

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.

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.

Rack & Pinion: The function of a rack and pinion is to transform circular motion to rectilinear motion, Small gears are called Pinions and Racks are a series of teeth on a straight line.

Cones (Fiber & M.S.): There are 3 Cones. One Fiber cone is attached to main Shaft and two Mild Cones, which are attached to the main Spindle.

Gunmetal Bush: The bush is made up of Gunmetal; it is attached with the main spindle. It is used to arrest the movement of the spindle. There are 2 Bushes, which are provided on side of the main spindle in the upper arm and the lower arm.

Main Drive Shaft: It is made of Mild Steel. It gets the drive from the motor through the V-Belts. The pulleys are attached to one end of the main shaft and fiber cone is attached to the other end of the main Shaft. It is also called Cone Shaft.

Drill Chuck: The self centering 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.

Stop Screw: The Stop Screw is attached to the table housing. By adjusting the Stop screw the depth of the screw would be fixed.

Column Support: The Column is mounted on the Base with the help of Column support. This Column support is made up of Cast Iron. Four holes are drilled radically so as to fasten it to the Base.

Selection of Mechanism:

The selection of a proper mechanism for the machine part is usually decided by the purpose for which the part is to be designed. Considerations are given to strength wear, accuracy of relation efficiency and cost speed reduction in our case is obtained using belt drives.

Selection of Materials:

Strength, Rigidity, Cost, Corrosion resistance, Machinability & Surface finish are the primary consideration in the selection of materials for the machine member. In our case except base all other elements are made up of mild steel for easy fabrication.

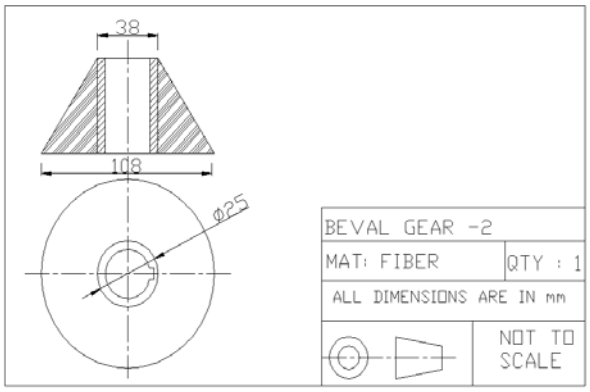
Preliminary design:

After selecting suitable materials and mechanism, the working stress and design stress can be determined. The dimensions of machine members are fixed by strength consideration, keeping the stress below the Design stress. The dimensions are rounded to the nearest to the standard values.

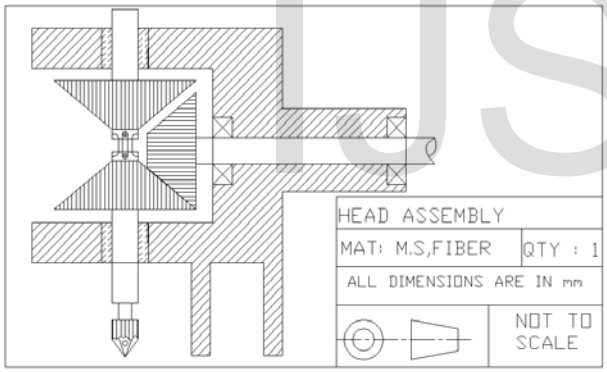
Revising the Design:

After making the preliminary design, the design should be revised to suit the following requirements.

- Ease of manufacturing.
- Ease of assembling.
- As far as possible standard components are used
- Safety of operations, adjustment for wear, appearance is some of factors to be taken into consideration while revising the design.

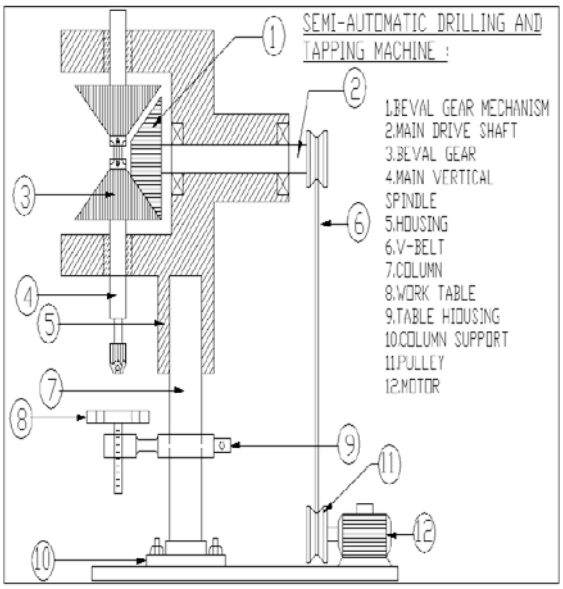


BEVEL GEAR



HEAD ASSEMBLY

III.FABRICATIONAL ASPECTS



Based on the design and drawings made, the fabrication is done. Considering the production aspects i.e. manufacturing criteria the tapping cum drilling machine is fabricated. The raw materials are purchased and the machining operation is performed. The various parts fabricated are as follows.

Base: The base is made up of cast iron. The base is grinded at the top so as to mount the column. Four holes are drilled and tapped for ½" M.S. bolt to mount column support. On the rear end of the base motor bracket is fastened.

Column Support: The material used for column support is cast iron. A cast iron flange is primarily turned and faced. A hole is drilled at the center of the flange of dia 144.995 mm. So that a press fit is made with the column of dia 45mm. Four holes are drilled radially to clamp it with the base.

Column: The column is made up of mild steel. 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. A drill is made on the cone housing. A plug is inserted through their drilled hole to as to keep the cone housing in position.

Table Housing: The table housing is made up of mild steel. A collar of inner dia 45mm wnr 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. A flat strip is welded to the collar on the other end of the strip another collar is welded, so as to support the table with the rack. On this collar two flats have been welded and holes are drilled on it, a shaft placed in this holeacs as a support to

the pinion. The pinion is provided with a handle in order to rotate the pinion, thereby lifting the rack.

Work Piece Table: The work piece table is made up of cast iron the table is machined to get a flat surface. 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 the 30mm dia shaft for a length of 190mm. The square rack of length 150mm is placed on the groove and welded. The upper end of the shaft is threaded. The shaft with the rack is fastened to the tables.

Cone Housing: The cone housing is made up of mild steel. 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. A rectangular flats of 45 x 45mm, length 150mm is welded at the middle of the upper end of the square bar. A similar rectangular flat is welded in line with the upper arm at a distance of 130mm between the arms.

Cones: There are two types of cones in this machine. They are

1. Mild steel cone
2. Fibre cone

Mild steel cone: There are two Mild steel cones which are placed vertically in the main spindle the diameter of the cone at larger end is 108 mm and at lower smaller end is 28mm and a cylindrical portion of dia 28mm for a length of 10mm is machined. A hole is drilled axially for a dia of 22mm through the cones.

Fiber Cone: The fiber cone is machined in such a way that larger dia is 108mm and the smaller dia is 38mm. The height of the cone is 35mm. A steel bush of outer dia is 35mm is pasted to the fiber cone. A key way of 4 x 4mm is been cut.

Main Vertical Spindle: This is made up of mild steel. 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.

Main Drive Shaft: This is made up of mild steel. This is a stepped shaft of dia 19mm for a length of 45mm and of dia 25mm. The shaft is machined for a dia of 25mm. The shaft is machined for a dia of 25mm. The shaft is machined for a dia of 25mm of a length 75mm and a 6 x6 mm key way is cutted for a length of 50mm

IV. ADVANTAGES

The following are the advantages of this machine:-

1. Minimum number of components, so the maintenance of the machine is easier.
2. No skilled operators are required.
3. Enables high production rate.
4. The machine is less expensive.
5. Consumes less floor area.
6. Breakage of tool is avoided by slipping of cone.
7. The machine is auto reversible
8. Noiseless and smooth in operation.

IV. COST ESTIMATION

S. No.	Description	Material	Qty.	PRICE
1.	BASE	C.I	1	300
2.	COLUMN	M.S	1	500
3.	CONE HOUSING	M.S	1	300
4.	CONE	M.S	2	200
5.	CONE	FIBER	1	300
6.	TABLE	C.I	1	200
7	RACK & PINION	M.S	1	300
8.	VERTICAL SPINDLE	M.S	1	300
9	TAPPER ROLLER BEARING	-	2	100
10.	MOTOR (0.5 HP)	-	2	1000
11.	BOLTS	M.S	8	100
12.	V-BELT	-	1	150
13.	PULLEYS (2.5", 3.5" , 4.5")	C.I	2	50
14.	FABRICATION COST	---	---	1800
15	TOTAL COST			6000

VI. CONCLUSION

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.

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