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PERFORMANCE ANALYSIS OF FOOT OPERATED DRILLING MACHINE

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ABSTRACT

Drilling is the operation of producing circular hole in the work piece by using a rotating cutter called drill. This papers deals with design and performance analysis of foot operated drilling machine. The motor analysis is performed on aluminium and mild steel material under no load and full load condition. The value of torque is finalised based on no load and full load conditions for aluminium and mild steel material. The graph is drawn between the torque and speed for aluminium and mild steel material to judge the material characteristics under no load and full load conditions.

1. INTRODUCTION

The drilling operation is accomplished in lathe, in which the drill is held in tailstock and the work is held by the chuck. The most common drill used is the twist drill. It is the simplest and accurate machine used in production shop. The work piece is held stationary clamped in position and the drill rotates to make a hole. Drilled holes are characterized by their sharp edge on the entrance side and the presence of burrs on the exit side (unless they have been removed). Also, the inside of the hole usually has helical feed marks.

Drilling may affect the mechanical properties of the work piece by creating low residual stresses around the whole opening and a very thin layer of highly stressed and disturbed material on the newly formed surface. This causes the work piece to become more susceptible to corrosion at the stressed surface. For fluted drill bits, any chips are removed via the flutes. Chips may be long spirals or small flakes, depending on the material and process parameters. The type of chips formed can be an indicator of the machinability of the material, with long gummy chips reducing machinability. Surface finish in drilling may range from 32 to 500 micro inches. Finish cuts will generate surfaces near 32 micro inches and roughing will be near 500 micro inches. Cutting fluid is commonly used to cool the drill bit, increase tool life, increase speeds and feeds, increase the surface finish, and aid in ejecting chips. Application of these fluids is usually done by flooding the work piece or by applying a spray mist.

2. LITERATURE REVIEW

P. R. Sawant et al. developed machine which has main objective was to drilling and tapping of TATA cylinder block which has 8 drills in which 7 holes of Ø 6.75 mm and one of Ø 12 mm also linear tapping operation for Ø 12 mm and angular tapping operation for Ø 5.1 mm. It saves time for loading and unloading due to use of hydraulic clamping and increases production rate, less rejection of work due to automatic control. Manish Kale Studied on design, fabrication and analysis of SPM for reaming and drilling. In this situation study they develop SPM for riveting and drilling of the workpiece of different sizes and thickness. The SPM uses pneumatically operated cylinder for drilling and riveting operation. ANSYS is used for checking stress analysis. The case study concludes that SPM is beneficial as it reduces process time.

Nikhil J. Surwad studied on design and develop a special purpose machine capable of performing trimming and drilling operations altogether on the tail lamp bracket casting of a motor cycle. In this study the design is to trim out the flashes generated after pressure die casting process from 14 different areas of the casting and to drill 2 holes on the same casting. Chukwumuanya investigated design and develop multiple spindle drilling head for mass production of Peugeot 504 automobile brake drum. In this design they developed multi-spindle drilling head for drilling 6 holes at a time, in which 4 holes of Ø 14.5 mm and 2 holes of Ø 8.5 mm. Analysis of various gear forces theoretically was done. It concludes that mash increases production rate as compare to individual drilling operation.

A. A. Shingavi concentrated on configuration and improvement of multispindle drilling head for process duration advancement of the part and examination of efficiency of segment utilizing ordinary outspread penetrating machine and unique reason machine. It reasoned that by utilizing multispindle penetrating head profitability will increment. Probability of opening missing is killed, in light of the fact that six gaps penetrated at once. The expense per piece is diminished. M. B. Bankar studied Improvement in design and manufacturing of multiple spindle drilling attachment, in which they uses planetary gear system for drilling operation. This case study gives information about designing drilling attachment from motor selection to its gear box. This study concluded that multi spindle drilling attachment increase productivity reduces cycle of operation and perform drilling operation more accurately.

Pratik Parsania et al. studied on design for multi spindle drilling SPM. In this case study it is shown that how effectively SPM work as compare to conventional drilling machine. In conventional drilling machine it takes 8 hours for drilling 2400 pieces per day and by using it takes only 3.33 hours for drilling 2400 pieces per day hence it is largely affects the production rate. Hence this case study concludes that use of SPM is most important in small scale industries. Bajirao H. NangarePatil et al. studied design and development of gear box for multi-spindle drilling machine. This case study drilling of 26 holes of various sizes, are carried out on cylinder block. This study conclude that due to use of spur gear noise reduction, reduction in cycle time, increases production rate and also holes are drilled with required accuracy and tolerances are maintained.

3. DESIGN OF DRILLING MACHINE

Fig. 1 shows the dimensions of foot operated drilling machine. The drilling process must have some provisions for tolerance because of the over sizing that naturally occurs in drilling. Drilled holes are always slightly oversized, or slightly larger than the diameter of the drill’s original designation. For instance, an l/4-inch twist drill will produce a hole that may be several thousandths of an inch larger than 1/4-inch. Over sizing is due to several factors that affect the drilling process: the actual size of the twist drill, the accuracy of the drill point, the accuracy of the machine chuck and sleeve, the accuracy and rigidity of the drilling machine spindle, the rigidity of the entire drilling machine and the rigidity of the work piece and setup. Field and maintenance shop drilling operations allow for some tolerance, but over sizing must be kept to the minimum by the machine operator.

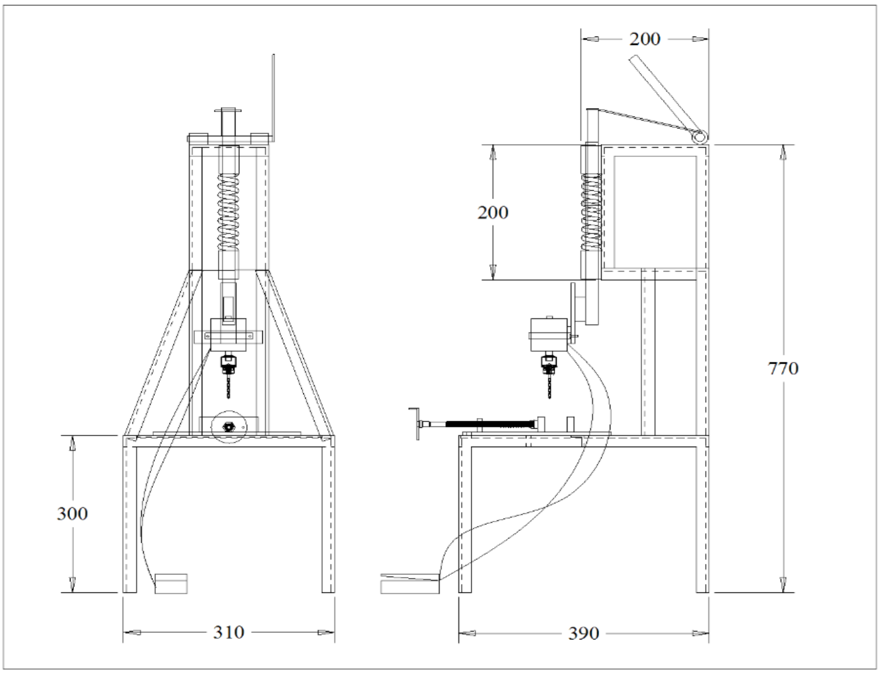

Fig. 1: Dimensions of Foot Operated Drilling Machine

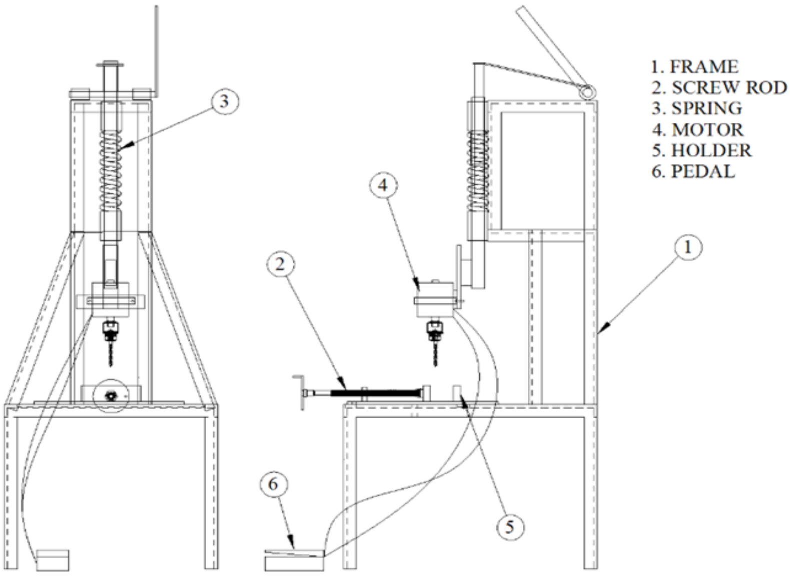

Fig. 2: Parts of Foot Operated Drilling Machine

Fig. 2 shows the parts of foot operated drilling machine. The motor is used for drilling operation and the speed of the motor is controlled by the setting of key which is controlled in the control unit. Control unit it is nothing but the small chip called microcontroller it's already programmed and feed in the chip for working of our project. Here the drill bits are fitted in the motor shaft. To avoid the frictional moment here it is attached with the spring arrangements at top of the spindle. By using the handle through the top of the spring arrangement for fixing the motor with the help of holding clamper with moves up and down movement for the purpose of drilling the work piece.

4. ANALYSIS OF MOTOR

NO LOAD:

Current supply = 0.45 A

Speed = 9220 rpm

Voltage = 220 V

FULL LOAD:

(a) ALUMINIUM:

Current supply = 0.65 A

Speed = 6400 rpm

Voltage = 220 V

(b) MILD STEEL

Current supply = 0.60 A

Speed = 6200 rpm

Voltage = 220 V

CALCULATION OF HORSE POWER:

Horse power = 145/0.746*1000

= 0.194 HP

CALCULATION OF TORQUE:

NO LOAD:

Output = 2ΠNT/60
145 = 2*Π*9220*T/60
T = 0.15 N m

(a) LOADING CONDITION FOR ALUMINIUM:

Output = 2ΠNT/60
145 = 2*Π*6400*T/60
T = 0.216 N m

(b) LOADING CONDITION FOR MILD STEEL:

Output= 2ΠNT/60
145 = 2*Π*6200*T/60
T = 0.223 N m

S. No.	Condition	Torque (N-m)	Speed (rpm)
1	No Load	0.15	9200
2	Full Load	0.216	6400

Table 1: Torque and Speed for Aluminium under No Load and Full Load Condition

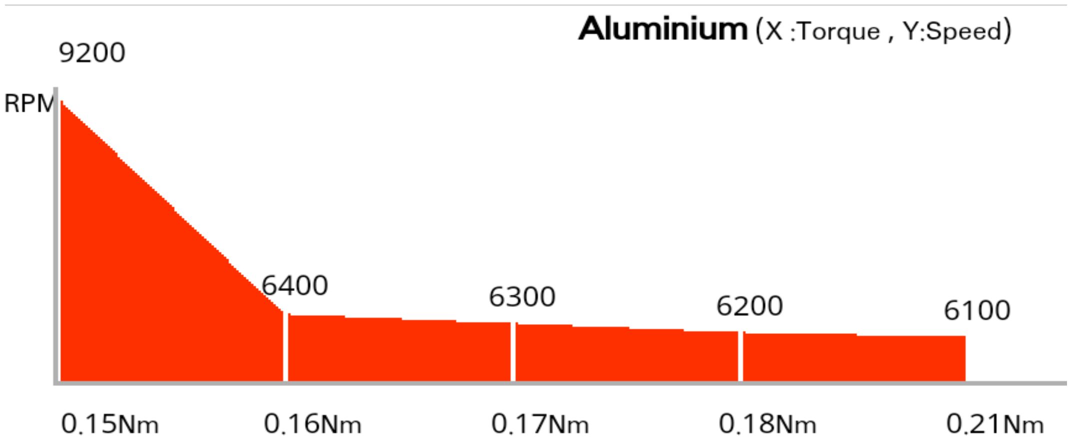

Fig. 3: Torque Vs Speed for Aluminium

S. No.	Condition	Torque (N-m)	Speed (rpm)
1	No Load	0.15	9200
2	Full Load	0.223	6200

Table 2: Torque and Speed for Mild Steel under No Load and Full Load Condition

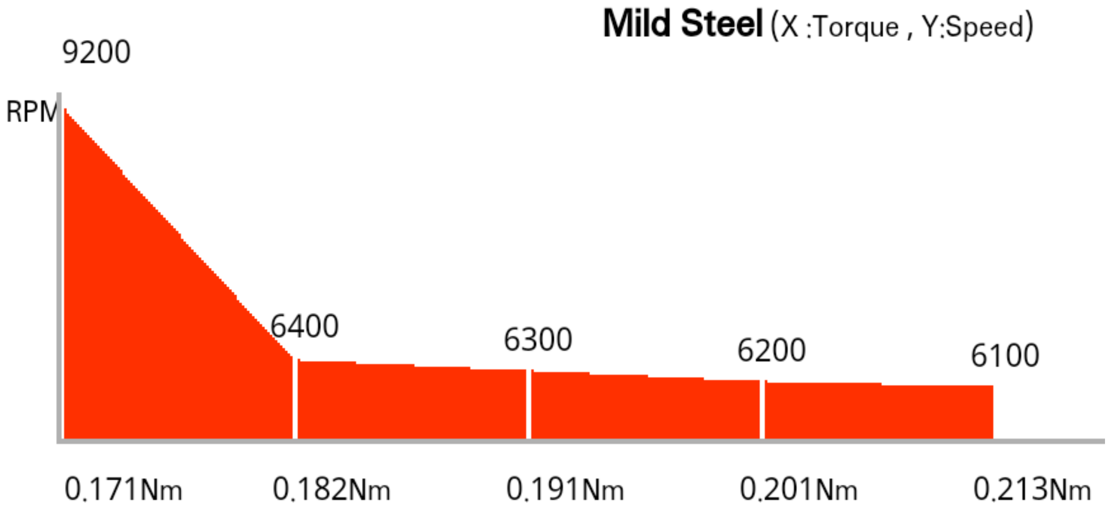

Fig. 4: Torque Vs Speed for Mild Steel

5. CONCLUSION

This is carried out to make an impressing task to produce the holes where it wants on the work pieces. It uses variable speed. It is very useful for the industries to produce the various shapes of operation on work piece. This project has been fabricated to perform the entire requirement task, which has also been provided.

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