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The Effect of Cutting Speed on the Wear and Tear of Dormer A100 Brazil Drill Bit Applied to Gray Cast Iron

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ABSTRACT

Drilling is the process of making holes by pressing a rotating drill bit on the workpiece. During the machining process there is interaction between the drilling bit and the workpiece in the drill bit of the workpiece with a hole while the drill bit undergoes friction. Such a friction comes from the chipped surface that flows on the surface of the workpiece that has been cut; as a result, the tool wears out. The wear of the drill bit that occurs due to friction between the drill bit and the workpiece needs to be examined so that the extent of the wear and tear is known. The purpose of this study was to determine wear on the Dormer A100 Brazil drill bit with size (8 mm), rotation speed (260 rpm, 375 rpm and 710 rpm). Tool wear data was collected using a microscope with a magnification of 20x. Tool wear is seen three times during the drilling and the machining process. The result obtained is that the higher the cutting speed, the bigger the wear occurs.

Keywords: Dormer A100, gray cast iron, drilling process

INTRODUCTION

Several previous studies regarding the drilling process have been carried out[1] on the effect of changing the drill point on the twist drill in order to minimize the heat generated when drilling manganese steal materials. The result of changing the drill point is to increase the life of the twist drill by 33% longer than conventional drills[2]. The purpose of this study is to determine the effect of cutting speed on the wear of the Brazilian Dormer A100 drill bit which is applied to gray cast iron. The benefits of this research are:

1. to provide input to the machining/metal industry regarding the effect of cutting speed on the Brazilian Dormer A100 drill bit on gray cast iron.
2. to provide information/contribution to researchers regarding the impact/effect that occurs in tool wear when drilling uses Dormer chisels on gray cast iron workpieces.

LITERATURE REVIEW

The wear of the drill bit basically occurs due to the process of friction which causes the drill bit to heat up and the surface becomes flat due to friction where it becomes hot and the surface becomes flat due to friction which causes wear and tear on the angle of the drill bit due to the angle of the drill bit being used for processing. When drilling and friction often occurs, the life of the drill bit will quickly reach its limit and it is easily broken.

Drilling parameters greatly affect surface roughness, drill wear, material removal rate and hole diameter deviation. Liao and Lin examined the minimum requirement of cutting fluid in cutting with lubrication, extending tool life, reducing cutting forces and smoother surface roughness[3]. Ramesh has paid attention on the stability of boring tools in the turning process focusing on

material provisions that could reduce the influence of vibrations caused by the tool cutting process [4].

Seated Drilling Machine Parts

1. Base

The sitting part or base is the supporting part of all the components in the drilling machine. The base is located at the very bottom and is attached to the floor with a hole for a bolt or dyna bolt to tie so that the drilling machine when working on the workpiece vibrates that causes dampened in this base. If the installation of this base with the tightness of the bolts is not really strong, then when working on workpieces with high precision values, it is difficult to achieve them. When assembling, we must pay attention to the floor factor and the procedure for installing this base is really strong.

Figure 1. Seated drilling or base

2. Column

This column section has a cylindrical shape extending vertically upwards, with a function to support the seated drilling machine components so that other components can be assembled perfectly during drilling process. This pole is attached to the toothed groove rail functioning as a vertical movement in the work table so that we can adjust the feeding process as needed by looking at the crank rotation sleds on the table or it is really difficult to do the drilling depth or the range of movement of the drill feed handle.

Figure 2. Drilling machine column

3. Table

Table is used for placing the workbench which will be drilled and clamped using a machine vise which has previously been set and be attached to the table using a T-groove bolt. This workbench has the feature of being able to rotate 360 degrees around its axis, namely the center of the table. This drill table can be moved by the main crankshaft which is attached to the table by rotating the crank clockwise, then the table moves upwards and performs the feeding process in addition to using the drill feed handle. If we rotate the crankshaft counter clockwise, the movement of the table will drop down away from the drill bit. In order to maintain the level of precision in drilling the workpiece, we can do a clamp table or lock the table so that when drilling the table will not move around.

Figure 3. Drilling machine table

4. Drill

This drill bit is a core tool used as a cutter or hole in the efficient workpiece; the shape of this drill bit has a spiral groove that is well designed for drilling. This spiral groove can be used when ingesting the workpiece to create chips or grams of dirt resulting from

drilling can automatically rise to the surface of the workpiece without worrying about scraping the diameter of the perforation. If the drill bit is felt to be worn out or not sharp anymore, we can re-sharpen it according to the angle we want without reducing the diameter of the drill bit itself. In terms of material, the drill bit can vary according to the workpiece to be drilled, for example, drill bits for wood, iron, and stainless steel workpieces. The use of a drill bit must be properly adjusted to the workpiece being worked on so that the drilling results are good and as expected.

Figure 4. Drill

5. Spindle

This part of the spindle is useful for clamping the drill bit so it does not come off easily when the drill machine's rotation is turned on and feeding. On the spindle there is usually a locking hole and serrations that are used to lock the drill bit with a special spindle key. To lock the key is done by inserting it into the hole and rotated clockwise and to release the drill bit, do the reverse movement.

6. Spindle Head

This section is the home of the construction of the sitting drill machine spindle section.

Figure 5. Spindle head

7. Drill Feed Handle

As the name implies, the drill feed handle is used by drill machine operators to feed the workpiece. To operate it, the operator holds the drill feed handle and is moved to press down, the lower the operator presses, the deeper the drilling occurs. Usually also in this section there is a depth measurement or the movement of the handle feed, so that drilling can be measured.

Figure 6. Drill feed handle

8. Electric Motor Parts

This part can also be called the heart of the machine because we know that without this motor the drilling process cannot take place. The drill motor is in the form of a dynamo driving the drilling machine in which the rotation is connected by a van belt tied to the pulley. There are several diameter sizes that are used to adjust the speed of the drill bit rotation and can be adjusted according to the type of workpiece and the diameter of the drill bit used. Usually, there is a table of acceleration calculations according to the formula. This motor must be equipped with an on/off switch, power cable, fuse and indicator light.

Figure 7. Electric motor parts and acceleration count according to rum

9. Drill Bit

A drill bit is a tool for making holes in certain objects such as wood, metal, glass, walls (walls) and plastic. There are various types and sizes of drill bits to make holes with different types of drilling machines, of course, different functions. Because every basic material or material that we are going to drill holes with using a drill must have different strengths, of course this cannot be done using the same type of drill bit. Therefore, every manufacturer designs and manufactures various drills and drill bits so that they can be used according to predetermined criteria, but you need to remember that each drill bit has its own advantages and disadvantages. We can see the types of drill bits in Fig. 8.

Figure 8. Kinds of drill bits

10. Influence on Napless

The wear of the drill bit basically occurs due to the process of friction which causes the drill bit to heat up and the surface becomes flat due to friction.

11. Drill Bit Field

It is the active surface of the drill bit; each drill bit has an active area according to the number of cutting edges. Two active areas of the drill bit are 1) furious field, and 2) the main/major plane facing the transient surface of the workpiece.

Figure 9. Drill bit field

12. Drill Bit Angle

In determining the apex angle of the drill bit, uniformity of cutting edges is required and the size of the angle formed at the end of the drill bit corresponds to the corners of the drill bit. The formation of the drill bit, at the apex angle of the drill bit, is to get the sharpness of the cutting edge. From this basis, the angles of the drill bit are useful for determining the appropriate angle with the aim of producing a workpiece (strut) with a level of smoothness and precision. So, the result of forming the apex angle of the drill bit, the bit must be symmetrical to get a truly round strut hole. To get good service the drill bit must be good too. The angle of the drill bit must be right and in accordance with the material to be drilled. The usual drill bit angles in commercial drilling are 118°, 130°, 135°, which is convenient for mild steel, brass and materials in general.

Figure 10. Drill bit angle

13. Temperature

As in general metal operations, the energy generated in drilling operations is converted into heat, which in turn will increase the temperature in the drilling area, and as the cutting speed increases, the heat generated will automatically increase. Almost all of the drilling energy is converted into heat energy/heat rate as indicated by the drilling power through the process of friction between the chip and the drill bit and between the drill bit and the workpiece. The higher the rotational speed of the main spindle of the drilling machine does, the greater the percentage of heat carried by the drill will do. Knowledge of temperature rise needs to be considered because an increase in temperature can cause unwanted things, including:

1. able to affect the strength, hardness and wear on the drill bit.

2. to cause a change in the dimensions of the workpiece, so it will be difficult to obtain increased accuracy.
3. able to affect damage so that it will affect the service life of the tool/drilling machine.
4. able to affect the life of the drill bit, so that the use of the drill bit is not efficient.

14. Chisel Variations in Drilling

The drill bit is an efficient tool for making holes or grooves, various sizes, and, therefore, drill bits are divided into several types, including, in inches, in fractions from 1/64 "to 3/8" and so on. The units of millimeters with each increase of 0.5 mm, with numbers from 80-1 with sizes 0.0135 - 0.228, with letter markings A to Z with sizes 0.234 - 0.413. There are several things that we must pay attention to when choosing a drill bit, namely:

1. hole size
2. workpiece to be drilled
3. the corners of her lips

The size of the hole determines the size of the center line of the drill bit, each drill bit will produce a hole that is larger than the center line, the spiral angle and lip angle depend on the workpiece to be drilled. Angler tool is used to check the corner of the lip, the blunt side of the cut will cause the surface of the hole to be rough, this happens if the distance between the angle of the chisel and the side of the cut is 55, to reduce the bad side of the cut, the distance needs to be shortened by grinding the drill bit big[5].

MATERIALS AND METHODS

The research materials are Dormer A100 Brazil Drill Bit and the mechanical properties used should have standard length 12.00 mm, elongation (%) = min 8 %, calculated mass carbon 0.60-0.80, calculated tensile strength (min) = 880 n/mm2, calculated yield point (min) = 440 n/ mm^2. The gray cast iron is also used in the research. The mechanical properties might include tensile strength, ultimate 115-700 mpa; tensile strength, yield 65.5-420 Mpa; elongation at break 1.0-15 %; modulus of elasticity 62.1-162 Gpa.

RESULT AND DISCUSSION

Drill Bit Wear Test Results

The results of the wear level test show that there are differences in wear that arises due to the use of various parameters in the drilling process. namely cutting speeds of 260, 375, and 710 rpm resulted in tool wear as follows: 7 mm, 8 mm, and 15 mm, with cutting times of 6.53 (m/min), 9.42 (m/min), and 17 .83 (m/min). So, the higher the cutting speed is, the higher the yield (m/min) is obtained.

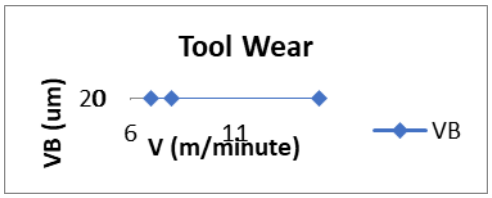

Figure 11. Results of drill bit wear

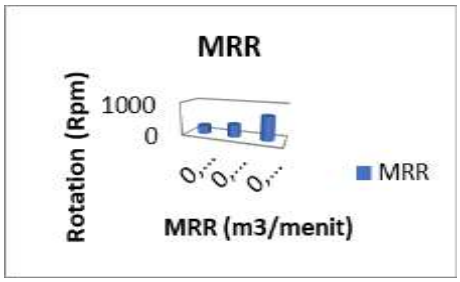

Figure 12. Results of MMR (material removal rate)

The Fig. 12 shows that the higher the engine speed does, the higher the resulting MRR value achieves.

CONCLUSION

From the research that has been carried out, it can be concluded that the higher the cutting speed rotates when using the Brazilian A100 Dormer drill bit on gray cast iron, the higher the wear and tear is achieves, namely the cutting speed is 6.53 (m/min), 9.42 (m /minute) and 17.83 (m/minute) with spindle rotation of 260 (rpm), 375 (rpm) and 710 (rpm), with a drilling time of 15 minutes the tool wear was obtained as follows: 7 µm, 8 µm, 15 µm.

It is suggested that testing and measuring the wear level of the drill bit in this study was only carried out on one side of the drill bit, so it is necessary to carry out further research by testing and measuring all sides of the drill bit so that the research is more specific and accurate and that at a high feedrate, the condition of the drill bit tends to wear out. Under these conditions, further research is needed to determine the longevity of the cutter in the machining process.

Declaration by Authors
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