Design of Cooling System on Ixion BT 25 Bench Drill Machine to Reduce Cutting Heat

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Abstract- ***The drill process is a machining process in which almost all of the cutting energy is converted into heat through the friction process, between the tool and the workpiece and between the drill tool and the workpiece as well as the molecular or atomic bond destruction process in the shear plane. Cutting heat has a great influence on the life of the drill tool. Therefore, in the machining process heat has a correlation to the tool wear rate which is one of the parameters in determining the life of the drill tool. [1] In general, drill machines do not use a cooling system so that in the cutting process noise arises and the drill tool wears out quickly and eventually breaks so that it will endanger the operator. To overcome this, a cooling system is needed in the drill process on the IXION BT 25 bench drill machine in the Unsrat Mechanical Engineering Laboratory which does not use a cooling system, so a cooling system will be designed and made with the aim of cooling and lubricating when drilling the workpiece so that it will reduce the cutting heat. The purpose of this research is to design a cooling system on the IXION BT 25 bench drill machine to reduce cutting heat. The method carried out is the manufacture of cooling system products by using a pump to circulate the cooling media from the reservoir to the cutting area. This research is an alternative to develop machine tools, especially the IXION BT 25 bench drill machine using a cooling system that can overcome cutting heat.***

Indexed Terms- Design, Cooling System, Drill Machine

I. INTRODUCTION

In general, drill machines do not use a cooling system so that in the cutting process noise arises and the drill tool wears out quickly and eventually breaks so that it will endanger the operator. To overcome this, a cooling system is needed in the drill process on the IXION BT 25 bench drill machine in the Unsrat Mechanical Engineering Laboratory which does not use a cooling system, so a cooling system will be designed and made with the aim of cooling and lubricating when drilling the workpiece so that it will reduce the cutting heat.

Based on the background described above, the problem formulation in this study is whether using the cooling system designed on the IXION BT 25 bench drill machine will reduce the cutting heat compared to not using a cooling system with a variable diameter drill tool. The purpose of this research is to design a cooling system on the IXION BT 25 bench drill machine to reduce cutting heat. The benefits of this research can develop machine tools, especially IXION BT 25 bench drill machines using a cooling system, can overcome the cutting heat of IXION BT 25 bench drill machines and as a sustainable production technology to add added value to machine tools, especially bench drill machines as appropriate technology.

II. LITERATURE REVIEW

2.1 State Of The Art

Previous research serves to analyze and enrich the research discussion, as well as differentiate it from the research being conducted. In this study, several previous research concepts related to the concept of this research are included::

1. Comparative Study of Material Roughness Values in the Turning Process with Dromus Cooling Media and Sae 40 Oil on St 37 Steel. Taken from the Nozzle Journal, which was researched by Amin Nur Akhmadi and Wawan Junaidi Usman in 2014. This study aims to determine the level of material roughness of the material against the turning process using SAE 40 and Dromus oil

cooling media. . The results of the analysis show that the value of a material roughness is very influential during the machining process, to obtain a good result process in the process of working with materials using machining we should use dromus coolant because the workpiece results are smoother and the value of the roughness level is lower than the SAE 40 oil cooling media. [2]

Figure 2.1 Kiangsi Lathe Machine Tool Works Engine LatheC6127a and Surface Rouness stand Comparator [2]

2. Design of an electric motor cooling system using a flat pipe wound water jacket. Taken from the NCIET Semarang national seminar proceedings, which was researched by Rahmat Subarkah, Ghany Heryana, Fitri Wijayanti1, ArifiaEkayuliana and Irwandi in 2020. This study aims to explain the stages in the design of an electric motor cooling system using a flat pipe water jacket. The result is that the manufacturing process of this cooling system can be done using conventional machining such as lathes, drilling machines and electric welding machines. [3]

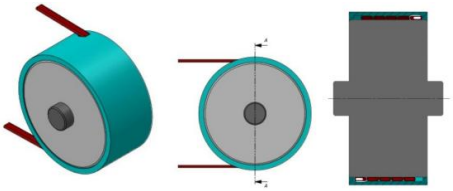

Figure 2.2 Design of Electric Motor Cooling Water Jacket with Flat Pipe Winding [3]

3. Effect of coolant flow velocity on cutting heat in cylindrical workpiece turning. Taken from the Online Journal of Mechanical Engineering Shafts, which was researched by Rumondor Michael, Rudy Poeng, and I. Nyoman Gede in 2020. The purpose of the research is to calculate the heat generated when cutting cylindrical workpieces and so that the value of the coolant flow velocity that is good and suitable for cutting can be known. The results obtained that with the use of cooling fluid, the cutting heat temperature can be reduced. At, the opening angle of the cooling valve 300 and 600 the temperature drop is not significant. At the opening angle of the cooling valve 900, the temperature dropdue to cutting has a good effect. [4]

Figure 2.3 Turning Process of Test Objects and Temperature Measurement [4]

2.2 Research Roadmap

Researches that have been conducted by the proponent of machine tool development related to the roadmap of this research:

1. In 2021, the proposer has conducted independent research on the Effect of Cutting Speed Variations on the Heat Carried by the Grind on the HERCUS CF 7264 Freis Machine. The purpose of this research is to predict the effect of cutting speed on the heat carried by the slurry on the HERCUS CF 7264 freis machine. The results obtained that by varying the cutting speed by increasing the rotation can predict the increase raises the heat carried by the snarling on the HERCUS CF 7264 freismachine.. [5]

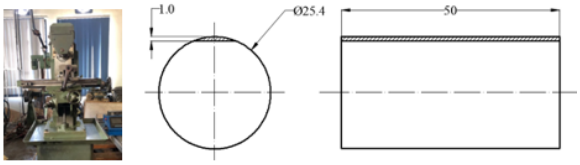

Figure 2.4 HERCUS CF 7264 Freis Machine and Test Piece Dimensions [5]

2. In 2022 the proponent has conducted independent research on the Effect of Dry Lathe Machining on Electric Motor Power by Varying Spindle Rotation. The purpose of this research is to obtain the effect of dry lathe machining on electric motor power by varying the spindle rotation. The results

of this study indicate that the spindle rotation is increased from 300 rpm to 1600 rpm, then the electric motor power increases from 1216 W to 1794 W. This shows that dry lathe machining affects the use of electric motor power with varying spindle rotation. [6]

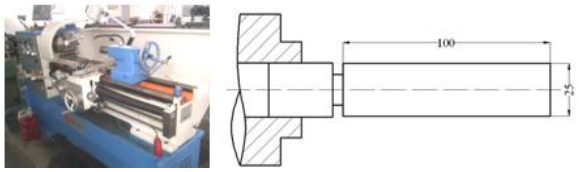

Figure 2.5 KNUTH DM 1000 A Lathe and Object Dimensions [6]

From the research that has been done, the proposer proposes research with the title "Designing a Cooling System on the IXION BT 25 Bench Drill to reduce cutting heat", where the research road map is as described in the following figure.

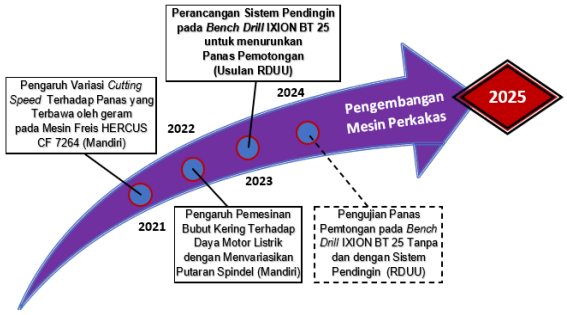

Figure 2.6 Research Road Map

III. RESEARCH METHODS

This research has been carried out with the following procedures:

1. Literature Study

At this stage, a literature study is carried out - literature related to the research topic.

2. Observation on IXION BT 25 Bench Drill Machine

The observation process was carried out on the IXION BT 25 bench drill machine in the Unsrat Mechanical Engineering Laboratory.

3. Data and Size

From the observations made, data and sizes of cooling components are obtained which will be used as input for this research.

4. Design

The cooling system design process is carried out on the IXION BT 25 bench drill machine so that technical drawings are obtained.

5. Material Selection

Conduct a process of selecting materials that can be used in the components of the cooling system on the IXION BT 25 bench drill machine, locally and online.

6. Is the Design Strength Less than the Material Strength?

If the design strength is not less than the material strength, then redesigning is done. If the design strength is less than the material strength, then proceed with the cooling system manufacturing process.

7. Manufacturing of Cooling System

The process of making the cooling system on the IXION BT 25 bench drill machine according to the technical drawings.

8. Was the Manufacturing Process Successful?

If the manufacturing process of the cooling component is unsuccessful (damaged), then it is remade. If the manufacturing process of the cooling component is successful (Optimal), then continue with the IXION BT 25 bench drill machine using the cooling system.

9. Bench Drill Machine IXION BT 25 Cooling System

IXION BT 25 bench drill machine that can be used to perform the cutting process by using a cooling medium that can reduce cutting heat, which is the output of this research.

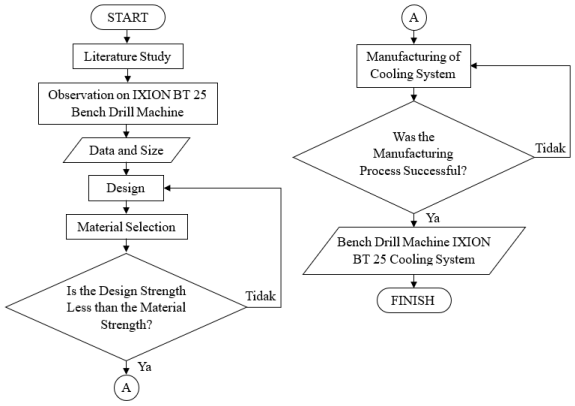

Figure 3.1 Research Flow Chart

Based on the IXION BT 25 bench drill machine that does not use a cooling system, a cooling system will

be designed to reduce the cutting heat, as shown in Figure 4.2.

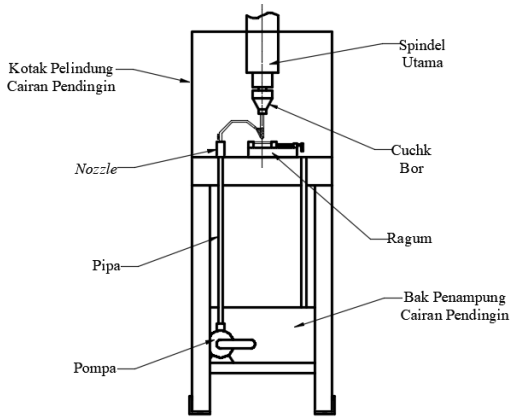

Figure 3.2 Schematic Drawing of IXION BT 25 Bench Drill Machine Design Cooling System

The results of the manufacture of cooling system components on the IXION BT 25 bench drill machine designed as the output of this research as shown in Figure 3.2.

Figure 3.2 IXION BT 25 Bench Drill Machine Cooling System

IV. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The result of this study is that the manufacturing process starts from identifying working drawings and identifying components using existing tools or machines, ordering and procuring from the market for other components. Thus a cooling system can be produced to reduce cutting heat on the IXION BT 25 bench drill machine.

5.2 Suggestions

1. It is hoped that the manufacture of this cooling system can be further developed on other machine tools.
2. Production cost analysis can be done, so that the price or cost of making a cooling system on machine tools is known.
3. Can be done testing the performance of the IXION BT 25 bench drill machine from the designed cooling system.

REFERENCES

[1] Rochim, T,–Klasifikasi Proses Gaya dan Daya Pemesinan, Institut Teknologi Bandung, , 2007.

[2] Amin Nur Akhmadi dan Wawan Junaidi Usman, –Studi Komparasi Nilai Kekasaran Bahan Pada Proses Pembubutan Dengan Media Pendingin Dromus Dan Oli Sae 40 Pada Baja St 37, Jurnal Nozzle 3.2 : 32-36, 2014.

[3] Rahmat Subarkah, Ghany Heryana, Fitri Wijayanti1, Arifia Ekayuliana dan Irwandi, –Rancang Bangun Sistem Pendingin Motor Listrik Menggunakan Water Jacket Lilitan Pipa Pipih. Prosiding Seminar Nasional NCIET 1.1 : 59-66, 2020.

[4] Rumondor Michael, Rudy Poeng, and I. Nyoman Gede, –Pengaruh kecepatan aliran pendingin terhadap panas pemotongan pada pembubutan benda kerja silindris, Jurnal Poros Teknik Mesin Unsrat 9.2 : 149 -160, 2020.

[5] Ulaan Tertius, Rudy Poeng dan I Nyoman Gede, –Pengaruh Variasi Cutting Speed Terhadap Panas yang Terbawa oleh geram pada Mesin Freis HERCUS CF 7264, Penelitian Mandiri Jurusan Teknik Mesin Unsrat, 2021.

[6] Ulaan Tertius, Rudy Poeng dan I Nyoman Gede, –Pengaruh Pemesinan Bubut Kering Terhadap Daya Motor Listrik dengan Menvariasikan Putaran Spindel, Penelitian Mandiri Jurusan Teknik Mesin Unsrat, 2021.

[7] Neyland Johan S, C, Poeng Rudy, Gede I Nyoman, –Effect of Machining Parameter Variance toward Turning Machine Machinability, IRE Journals Volume 5 Issue 6: 154-158, 2021.

[8] Sularso dan Suga, K, –Dasar Perencanaan dan Pemilihan Elemen Mesin, Pradnya Paramita, Bandung, 2008.

[9] Rochim, T, –Klasifikasi Proses Gaya dan Daya Pemesinan, Institut Teknologi Bandung, 2007.