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(Design & Innovation)”

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Date :

SIMPLE FRICTION WELDING MACHINE

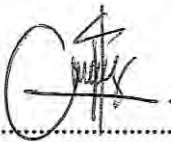
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"I hereby declaration that this report is made by myself except for summary and statement that each of it I declared the sources"

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DEDICATION

To my beloved parents, family, friends and lecturers who are never give up on me and keep on supporting during the long hours of doing and writing the PSM.

ACKNOWLEDGEMENTS

In this opportunity, I would like to express my highest gratitude to my supervisor, Profesor Madya Ir. Mustafar Bin Abd Kadir for his full guidance and considerate for all the time being that leads me to finally finish doing this Projek Sarjana Muda 1 (PSM) report. I also like to express my deepest gratitude to some of my lecturer for their advice and also for the time as they had gave me so much information and guidance during this semester. Not to forget, I also want to say thanks to all PSM committee member that have worked hard in order to enable us, the final year student of Fakulti Kejuruteraan Mekanikal (FKM) to get through this semester without having any problem.

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ABSTRACT

The project is about a Simple Friction Welding Machine. This study is carried out to show how the friction welding work out in a simple way to joint between two similar or dissimilar of a metal. It also clarifies the effect of process parameters on the mechanical properties of positioning controlled joints of metal, in the case of a round cross-section metal. In addition, the effect of geometry on friction welding will be demonstrated on a round bar using the simple machine when the machine is ready. As a result, the positioning-control processes will successfully performed and mechanical properties are almost equivalent to the conventional friction welding process when sufficient upset distance is applied. A higher upset load and longer friction time make for a sufficient contact area in the weld interface, which results in a larger upset distance eliminating weld imperfection. At the end, the Simple Friction Welding Machine will be developed in order to show and to prove the joining process using this friction concept.

ABSTRAK

Projek ini adalah tentang Mesin Kimpal Geseran Mudah. Kajian ini dilakukan bertujuan untuk menunjukkan bagaimana kaedah mesin kimpalan geseran pada dasarnya berfungsi dan beroperasi menggunakan konsep yang paling asas yang diperlukan untuk menyambungkan atau mengimpal di antara dua bahan logam samaada sama jenis logam atau berlainan. Projek ini juga akan menyatakan kesan-kesan terlibat terhadap parameter tindakbalas yang terlibat terhadap sambungan bahan ujikaji tersebut. Selain daripada itu juga, kesan-kesan terhadap process kimpalan geseran ini akan dikaji dan diuji kepada rod logam bulat menggunakan mesin kimpalan yang akan dibangunkan menggunakan prinsip asas geseran. Sebagai keputusannya, dengan menggunakan kaedah kawalan dan mekanisma yang bersesuaian terhadap binaan mesin ini, maka proses kimpalan geseran ini akan dapat dibuktikan. Mengikut teori, tindakbalas yang berlaku antara sambungan tersebut adalah hampir menyamai dengan hasil kimpalan menggunakan kaedah yang lain apabila segala ciri-ciri yang perlu, dipatuhi dan diaplikasikan. Di akhir kajian ini, sebuah mesin kimpal geseran mudah akan dibangunkan untuk menunjukkan kimpalan geseran seterusnya membuktikan bahawa proses kimpalan untuk menyambungkan dua bahan logam juga boleh dilakukan menggunakan aplikasi prinsip geseran.

TABLE OF CONTENTS

CHAPTER	TOPICS	PAGE
	ADMISSION	i
	DEDICATION	v
	ACKNOWLEDGEMENTS	vi
	ABSTRACT	vii
	LIST OF FIGURES	xii
	LIST OF TABLES	xiv
	LIST OF CHART	xv
	APPENDIXES	xvi
1	INTRODUCTION	1
	1.1 Background of Friction Welding Process	2
	1.2 General Information Concerning Friction Welding	3
	1.3 Objective	5
	1.4 Scopes	6
	1.5 Project Significance	6
	1.6 Conclusion	7
2	LITERATURE REVIEW	8
	2.1 Introduction	8
	2.2 Fact and Finding	8
	2.2.1 What is Welding?	9
	2.2.2 Types of Welding Processes	10
	2.3 History of welding discovery	12
	2.3.1 What Is Friction Welding?	17
	2.3.2 Why Friction Welding?	17
	2.3.3 The Many Advantages of Friction Welding in Industries.	18

	2.4 Theory of Friction Welding	19
	2.4.1 Elements of Contemporary Friction Theory	19
	2.4.2 Variations of the Coefficient of Sliding Friction	21
	2.4.3 Dependence of the Intensity of Heat Liberation on the Parameters of the Welding Process	23
	2.5 Welding Procedures and Properties of the Welded Connection	25
	2.6 Conclusion	26
3	PROJECT METHODOLOGY	27
	3.1 Introduction	27
	3.2 Project Methodology	27
	3.3 Project Schedule	29
	3.4 Project Requirements	31
	3.5 Project Design Concept	32
	3.5.1 Project Design Specification (PDS)	33
	3.5.2 Methods	34
	3.6 Requirement for Simple Friction Welding Equipment	38
	3.6.1. Operational requirement	38
	3.6.2 Design requirement	38
	3.7 Suggested of Simple Friction Welding Machine	39
	3.8 Friction Welding Process	44
	3.8.1 Applications	45
	3.9 Conclusion	46
4	PROJECT MANAGEMENT	47
	4.0 Project Management Activities	47
	4.1 Design for Manufacture (DFM)	49
	4.2 Concept Development	55
	4.2.1 Introduction	55
	4.2.2 Design Concept Selection	55
	4.2.3 Skecth Machine Concept	56

4.3	Machine Concept Development For Simple Friction Welding Machine	57
4.4	System level Design	59
4.5	Conclusion	60
5	SIMPLE FRICTION WELDING MACHINE	61
5.0	Introduction	61
5.1	Detail Design Development	62
5.1.1	Detail Drawing For Major Important Machine Part.	65
5.1.2	Design And Description of Part	66
5.2	Selecting Material	70
5.3	Machine Fabrication Process	71
5.4	Machine Design Critiques	74
5.5	Product structure tree of simple friction welding machine.	75
5.5.1	Mechanism on how the machine proposed works	76
5.6	Conclusion	80
6	DISCUSSION AND FURTHER RECOMMENDATION	81
6.0	Machine Testing	81
6.1	Testing Specimens and Discussions	82
6.2	Trouble Shooting	85
6.3	Weakness Of The Machine	86
6.4	Suggestions For Improvement	87
6.5	Conclusion For The Hole Project	88
6.6	Conclusion For PSM	89
	REFERENCES	91
	APPENDIXS	93

LIST OF FIGURES

FIGURE NO.	TOPICS	PAGE
Figure 1	Basic steps in friction welding process	2
Figure 2	Principle variations of friction welding	4
Figure 3	Friction welded steel rods showing the burr formed during welding.	4
Figure 4	Growth of welding processes since electrical energy readily available	12
Figure 5	Welding processes ordered according to heat source intensity.	13
Figure 6	General correlation between the heat effective input and the resulting weld strength	13
Figure 7	Maximum weld travel velocity, heat source spot, and interaction time as a function intensity of the heat source.	14
Figure 8	Cross section of welds performs with electron beam (left) and GTA (right). The higher heat of intensity of the electron beam create a much smaller fusion zone	15
Figure 9	Schematic of the HAZ showing the fully plasticized (Z _{pi}), partially deform(Z _{pd}), and undeformed (Z _{ud}) regions.	15
Figure 10	Comparison of angular distortion originated by electron beam welding (line EB), and GTA welding (line WIG). The more concentrated heat of the electron beam generates significantly lower distortion.	16
Figure 11	Size of the HAZ as a function of intensity of the heat source.	16
Figure 12	Friction welding process.	17
Figure 13	Dependence of the machine time on the rotation speed during friction welding.	23
Figure 14	Macrograph of friction weld specimens.	24
Figure 15	Basic simple friction welding machine diagram	32

Figure 16	Power transmission diagram	34
Figure 17	Elements of a basic pneumatic system	36
Figure 18	Diagram of Basic Pneumatic System	37
Figure 19	General view of the machine	41
Figure 20	Pneumatic system of the machine	42
Figure 21	Principle electric schematic diagram of the machine.	43
Figure 22	Machine concept design	56
Figure 23	Machine basic skecthing digram	56
Figure 24	Machine basicmecanism skecthing	59
Figure 25	Bill of Material for The Machine	64
Figure 26	Machine Size Dimension	64
Figure 27	Machine Isometric View	65
Figure 28	Machine Exploded View	65
Figure 29	Product structure tree and parts quantity	75
Figure 30	Frame Machine Holder	76
Figure 31	AC Motor 180watt/240v	76
Figure 32	Rotation Chuck Body	77
Figure 33	Mechanism at inner side of control panel	77
Figure 34	Rotation Chuck Body	78
Figure 35	Mechanism at inner side of control panel	78
Figure 36	Rotation Chuck Body	79
Figure 37	Machine exploded drawing for the new simple friction	79
Figure 38	Cable Plug connector	81
Figure 39	Sample of Mild Steel Failure to Weld	83
Figure 40	Cross section of welds performs	83
Figure 41	Mild Steel Rod	83
Figure 42	Aluminum Rod	84

LIST OF TABLES

TABLE NO.	TOPICS	PAGE
Table 1	Welding Procedures for Friction Welding	26
Table 2	Project Schedules	29
Table 3	Design Specification (PDS)	33
Table 4	Operation of the welding machine	39
Table 5	Basic characteristics of simple friction welding machine	40
Table 6	Friction welding process	44
Table 7	Project Management Schedule	47
Table 8	Specification of simple friction welding machine	62
Table 9	Characteristics of simple friction welding machine	63
Table 10	Design and Description of Part	66
Table 11	Troubles shooting shows during running the machine	85

LIST OF CHART

CHART NO.	TOPICS	PAGE
Chart 1	Waterfall Model	28
Chart 2	Project flow process	30
Chart 3	Project Management Activities	48

APPENDIXES

APPENDIX	TOPIC	PAGE
A	Picture of simple friction welding machine and The exploded drawing.	93
B	Detail drawing each part of simple friction welding machine	94

CHAPTER I

INTRODUCTION

Friction welding is one of the solid-state welding processes that use friction heat to join members. Friction welding has superior characteristics for mechanical properties and production performance. However, this process is limited to joining only round bar materials due to the lack of positioning-control capability. Actually, the method of joining circular components by using friction heat has been developed already. For example, there is linear motion friction welding that joins members by causing frictional heat because of the orbital motion, and linear motion friction welding by frictional heat because of the linear motion. However, in these joining methods, there are weak points, such as the inability to stop at an arbitrary main spindle rotation stop position, and the device for joining becoming complex.

The purpose of this study is to clarify the effects of process parameters on the mechanical properties of positioning-controlled joints of a round cross-section metal. In addition, the effect of geometry on friction welding is shown and will be briefly explain through this report.

1.1 Background of Friction Welding Process

Friction welding is a completely mechanical solid-phase process in which heat generated by friction is used to create the ideal conditions for a high-integrity welded joint between similar or dissimilar metals. In its simplest form, friction welding involves holding two components in axial alignment. Friction welding is a method for making welds in which one component is rotated relative to, and in pressure contact, with the mating component to produce heat at the faying surfaces. The weld is completed by the application of a forge force during or after the cessation of relative motion.

Principle of Friction Welding

Figure 1 shows the principle of basic friction welding.

(1) One side of the materials to make it join is fixed, and the other material is rotated by rotational speed N .

(2) The material is touched by friction pressure P_1 with the other material rotated, and frictional heat is caused at the weld interface. The temperature of the material rises, transform becomes possible axially by the frictional heat, and the flash is formed. At this time, the oxide film and the pollutant on the friction surface are exhausted outside the joint area with the flash.

(3) The rotation is stopped with the brake after friction time t_1 passes, upset pressure P_2 is given during upset time t_2 , and a joint completion is effected.

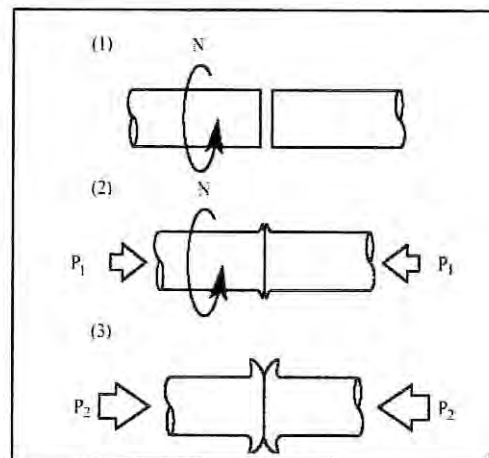


Figure 1 : Basic steps in friction welding process

1.2 General Information Concerning Friction Welding

The idea of utilizing the heat generated by friction for welding is not new. In the metal working industry many cases have practice in which shavings have been welded to the cutting tool or the tailstock of the lathe to the material being worked on, etc. There have also been successful attempts to butt weld metal rods on lathes. Such isolated events, however, have frequently been regarded as technical curiosities and of no practical significance. Only recently, a high quality butt weld between two steel rods can be obtained by utilizing heat generated by friction.

As is known, all existing welding methods are divided into two basic types:

- 1) Fusion welding
- 2) Pressure welding

In fusion welding, the edges of the pieces to be welded are incited and the clearance between them is filled with metal; the fused connection is formed after cooling and crystallization of the metal. This is applicable to gas, thermal, electric arc, and other types of welding.

Pressure welding (by plastic deformation) takes place without melting of the metal. The fused connection is achieved by drawing the pieces to be welded so closely together that, under certain conditions, a strong bond between the two surfaces is created. One of the necessary conditions is a high plasticity of the metal at the surface of the pieces being welded. Plastic metals can be welded by pressure under normal circumstances, even at room temperatures (cold welding). Other metals are usually heated locally to achieve an increased degree of plasticity (pressure gas welding), flash welding, etc.

Friction welding is a variation of the pressure welding method: the welded connection is formed without melting the metal, by joint plastic deformation of the pieces to be welded with heat resulting from friction (Fig 2).

Several arrangements are possible for friction welding. A very efficient and economic utilization of the heat introduced into the welded area is possible with some of the schemes because of the strictly localized heat generation on the surfaces to be welded. In other words, in friction welding it is possible to induce heat only in those areas of the pieces where it is needed for welding.(Fig.3)

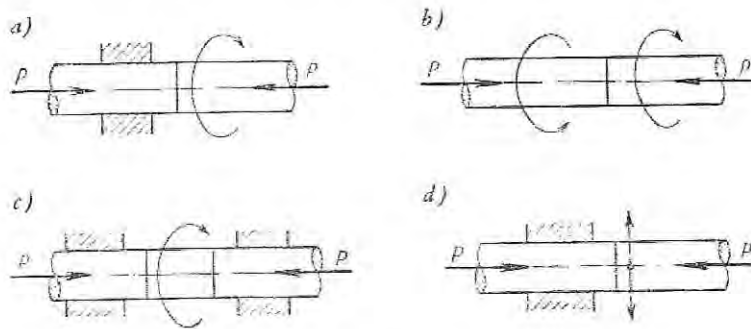


Figure 2: Principle variations of friction welding.

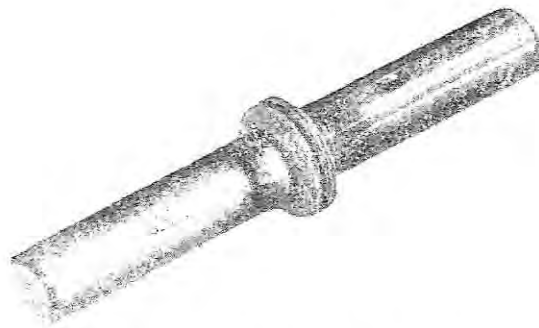


Figure 3: Friction welded steel rods showing the burr formed during welding.

1.3 Objective

This is a case study to explain about the concepts of Simple Friction Welding Machine and further the knowledge about how the machine work basically and to show the principle that involved in develop this machine. I also would like to approaches about the process thought identical actually are different from other welding process. The objectives of developing this Simple Friction Welding Machine are as below:

- a) To learn the meanings and concepts of Simple Friction Welding Machine and how the approaches are different in the way they functions with other welding process.
- b) To recognize the true working procedure in order to design and develop the working model of the Simple Friction Welding Machine.
- c) To evaluate and to prove that using the principle of friction, the similar or dissimilar between two metals can be joint together in friction welding process.

1.4 Scopes

The main tasks for this project are to understand the meaning, concept, function and feature for Simple Friction Welding Machine. Thus, a basic and small prove is needed in order to accomplish the tasks.

In the study for “Simple Friction Welding Machine“, the scope is for educational scope only where we can know the method and how it working, learn the similarity and differences between the other welding process and lastly figure out that using this method we also can do the joining process.

As friction can be implemented on welding platforms, I will prove how it works. Therefore, in defining and explaining the concept Simple Friction Welding Machine, the approach is definitely not only in a statement but to complete and giving the solution as will finish the project. This friction welding will show us that they have their own advantages and important in the industrial field.

1.5 Project Significance

As in the “Simple Friction Welding Machine “, the significance of the project is to build and develop a simple machine that we can use for welding process for metals. And the focus here is to show this welding process will work using friction.

It is a common sense that safety is a most important issue in everything working procedures. When it comes to produce this Simple Friction Welding Machine, all facts that involved need to be considered and giving full attentions. Therefore, it is important issue when the user wants to use this machine, it is save and functional. In other word, the joining process will be done and can be prove using this friction principle.

Besides that, the project significant is mainly to distinguish this Simple Friction Welding Machine is one the better way to weld by having the most advantages and least disadvantages during the process and how it effect to this principle.

1.6 Conclusion

In the introduction (Chapter 1) the meanings and concepts of Simple Friction Welding Machine already been explained. The purpose and objectives is clearly been declared to full fill this project task. However, in order to conclude the best option for developing this project, it is important to study, understand and state the detail involve during this project.

The main purpose of this project is to study, understand, analyze and develop the Simple Friction Welding Machine. The expected outputs from this project are to understand the meaning and the concepts of this process also to see how it works. By doing the observation on how it function, it will be easier to design and then to develop the machine. The expected output of this project may show us the simple friction welding is successful and proved.

Research will make acquainted with the basic concepts and technologies used in the literature review (Chapter 2), project methodology (Chapter 3). The analysis phase (Chapter 4) the environment or context in which the problem occurs will be analyzed. The following phases are design and discussion (Chapter 5), and implementation and the testing process (Chapter 6), which will describe the activity and testing strategy to be adopted and whether it finally fulfill the specification of project or otherwise. Finally, observation and conclusion will be making towards the project.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

In continuing the report for project “Simple Friction Welding Machine”, literature review is important in order to study the basic about the subject of the project. Literature review is a process to search, collect, analyses and concluded all debates and issues raised in the work that been done in the past. It also provide the examples, case studies and other relevant work that be done by other people in the past. It gives the chance to investigate and read the subject that user may not have thought about before. The literature review focuses on the various theory and basic knowledge used in the project.

2.2 Fact and Finding

There is lot of techniques used to gather information that related to the project through internet, book, journal, etc. These initial documents will provide some valuable information to determine the basic view for the project. The theory and concept from the passed research, references, case study, and other can be applied in order to understand the thesis.

2.2.1 What is Welding?

Welding is the most economical and efficient way to join metals permanently. It is the only way of joining two or more pieces of metal to make them act as a single piece. Welding is vital to our economy. It is often said that over 50% of the gross national product of the U.S.A. is related to welding in one way or another. Welding ranks high among industrial processes and involves more sciences and variables than those involved in any other industrial process.

There are many ways to make a weld and many different kinds of welds. Some processes cause sparks and others do not even require extra heat. Welding can be done anywhere, outdoors or indoors, underwater and in outer space.

Nearly everything we use in our daily life is welded or made by equipment that is welded. Welders help build metal products from coffee pots to skyscrapers. They help build space vehicles and millions of other products ranging from oil drilling rigs to automobiles. In construction, welders are virtually rebuilding the world, extending subways, building bridges, and helping to improve the environment by building pollution control devices. The use of welding is practically unlimited. There is no lack of variety of the type of work that is done.