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Development of Drilling Jig by Practical and Adaptive Tooling System(Part 2)

— Jig making System, Jig compnents, Jig Making and Tryout —

Sung-Bo Sim and Sung-Taeg Lee
School of Mechanical Engineering, Pukyong National University

Key Words : Jig components, Chip removing, Fitting, Tolerance, Loading and unloading

Abstract : *This is the continue paper as part 2 in this study. In order to prevent the production defects, the optimum design of product, jig and fixture and their making are very significant devision. Especially the result of tryout and its analysis become the characteristics of this paper that nothing might be ever seen before such as this type of research method on all processes.*

1. Introduction

The jig is a special device that supporting, locating, and clamping are placed on a part to be machined. It is a product tool so made that it not only locates and holds the workpiece but it also guides the drill, reamer, tap, boring tool, etc. as the operation is performed. Jigs are usually fitted with hardened steel bushings for guiding drills or other cutting tools. As a rule small jigs are not fastened to the drill press table. If, however, holes above 13mm are to be drilled, it is usually necessary to nest or to securely fasten the jig to drilling machine table. Due to small jigs are usually necessary to product manufacturing industrial. In this paper, part1 we designed one of a small jigs also production planning performed. So, this paper's goal is the accomplishment to optimization of small size drill jig design and making in practical and adaptive drilling jig with theoretical background, database, experiences, Auto Cad and window environment. Continually part 2 of this paper revealed production system, production plan, Jig making and its tryout result analysis.

2. Production System

Fig. 1 shows the chart of production system in industrial. As we see, the tool design and its making department supports to production line using the product standards, equipment specifications, methods etc. Also, the process engineering devision orders to tool design and making department with product drawing, production plan and especially related standards, anual, purchase information and whole methods of related instructions etc. There fore we can be known related department of tool design and making department.

Fig. 2 shows the outline of the jig and fixture planning of process. In this figure, we consider the jig and fixture development through the many kind if influence factors. Among those influence factors, the cost analysis and evaluation is critical event factor.[1~3]

2.1 Jig making system

Fig, 3 show the experimental production part drawing. According to this part drawing, we made production plan as Fig. 4. In Fig. 4, this study's drilling jig operation is performed at the operation Numble 5.
Fig. 5 shows the components drawing of designed experimental drill jig.

At this time, fitting tolerances are concerned with its performing situation, and them we tried to take higher accurate fitting by field exercise with hand skilling, experience and related instructions. (example: H7/h6, H6/h5, H7/m6, H6/m5, H7/m5, H6/n5, H7/p6, H7/p5 etc.)

Fig. 6 Shows the actual experimental drill jig by jig making.

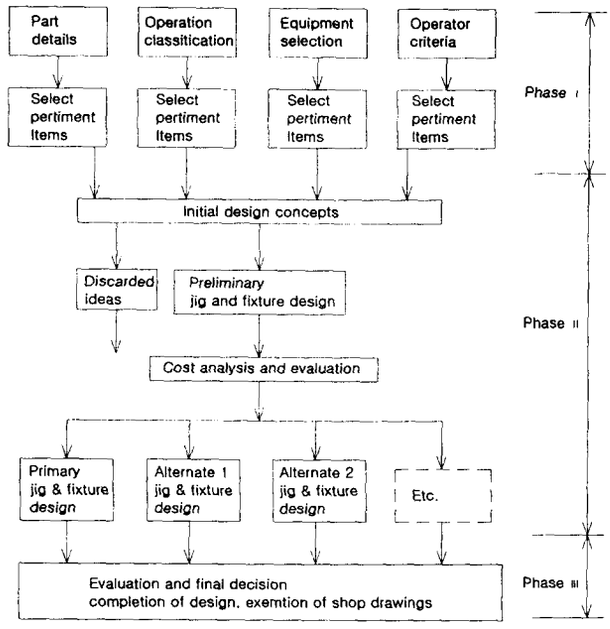


Fig. 2 Outline of the jig and fixture planning of process

From this actual jig, we took drilling experiment them checking the actual production part. Locator and jig bushing is main part in jig making, In this study, we decided the size of locator and jig busing depending on data base, theoretical back ground and our own field experiences. The machining of locator and bushing can belong to the precision machine tool working, continually raw material cutting, milling, turning, drilling, profiling and then heat freating, jig grinding, honning, especially, CNC machining and mirror machining. On the accuracy of each fitting components, the first factor is Drill bushing and locator's fitting tolerance H7, H6, H5(hole) and m6, m5, m4, n6, n5, n4, p6, p5, p4(shaft)for a tight fitting with a minor interference. The second factor is whole of hinges pin's fitting tolerance as a minor allowance for slide fitting tolerance H7, H6, H5(hole) h6, h5, h4(shaft). These fitting tolerances are very careful factors for jig making that the cause is whole jig assembling method must be within accurate central and parallel activities for production part tolerance.[4~7]

3. Try out

Fig. 6 shows the result tryout for experimental production part. Also we checked every dimension of production part with tolerance control. We could find the

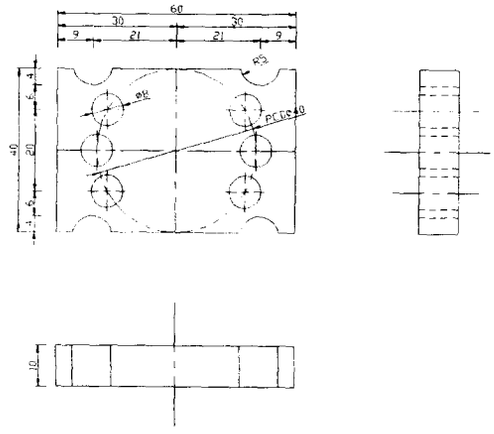
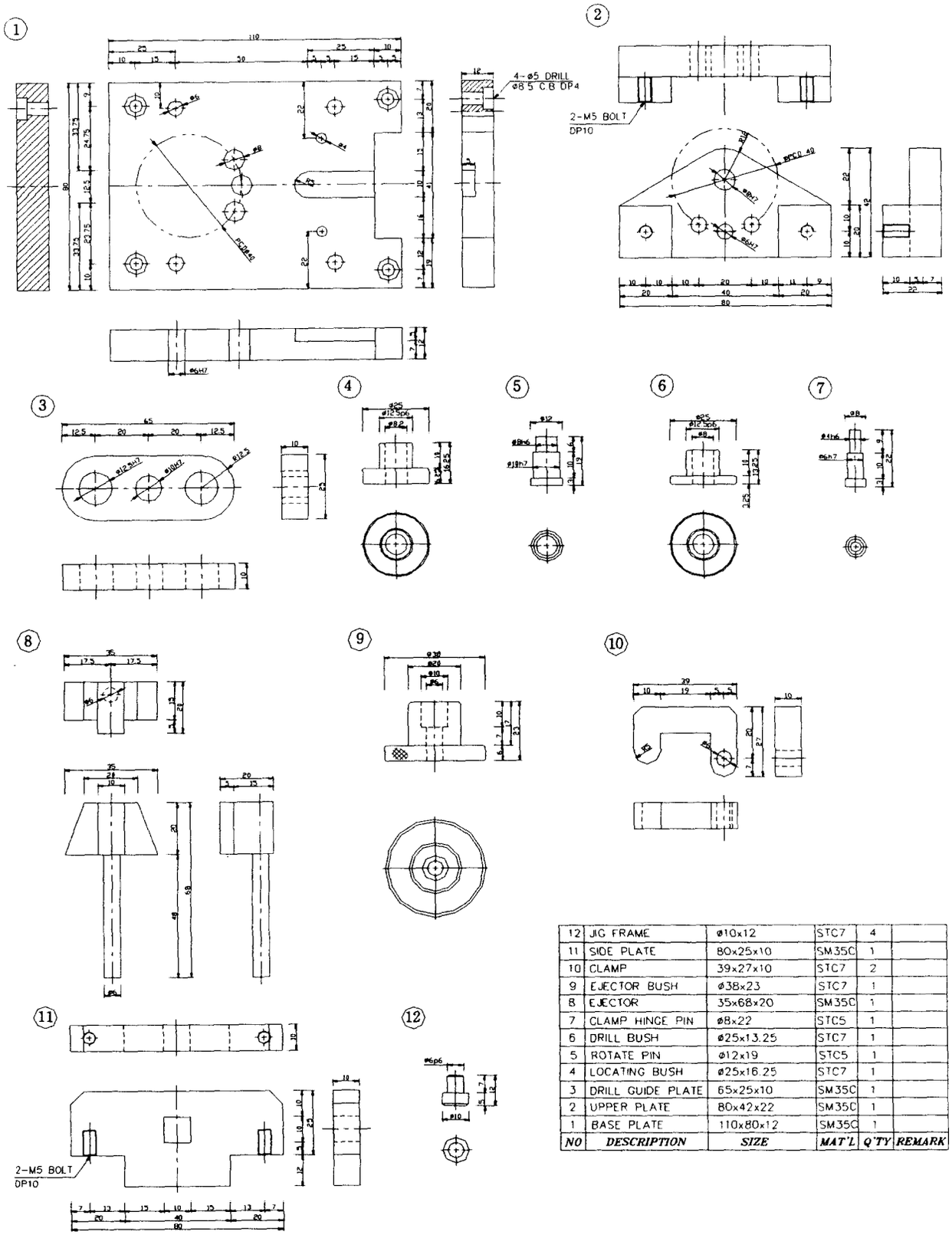


Fig. 3 Production part drawing

PRODUCTION PLAN			
Part No.		Part name : Precision bracket	
Operation No.	Description	Department	Machine tool
1.	Cut off-ⓣ×ⓦ stock to ⓛlength with cutting allowance	#○○ Cut off room	Abrasive cut off saw #○○-○○
2.	Drill-ØD hole thru	#○○ Drilling	Drill press #○○-○○
3.	Mill- t×w×L Two side of length direction.	#○○ Milling	Horiz. Mill #○○-○○
4.	Drill-ØD₂	#○○ Drilling	Drill press #○○-○○
5.	Deburr	#○○ Finishing	Tumbler #○○-○○
6.	inspect-visual and dimensional		None
Operation No.	Tool description	Size	Spec. Tool
1.	Cut off wheel	○×○×○㎜	None
2.	Drill	ØD₁ mm	#J-○○○-1 Jig
3.	Milling cutter(2)	w×t×d	#F-○○○-1 Fixture
4.	Drill	ØD₂ mm	#J-○○○-2 Jig
5.	Plug gage(2)	ØD₂	#G-○○○-1

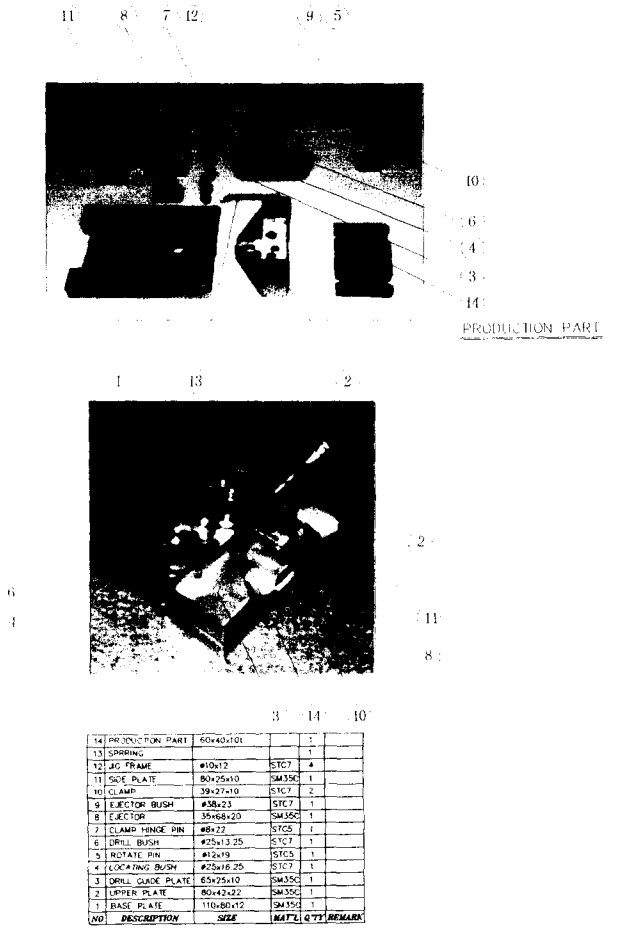
Fig. 4 Production plan

jig assembling function was minimized problems about the loading and unloading. This problem was improved into the passing zone by trouble shooting of jig component's repair and our own experience. Furthermore, the production part from tryout was so fine into the production part tolerances.



NO	DESCRIPTION	SIZE	MAT'L	Q'TY	REMARK
12	JIG FRAME	ø10x12	STC7	4	
11	SIDE PLATE	80x25x10	SM35C	1	
10	CLAMP	39x27x10	STC7	2	
9	EJECTOR BUSH	ø38x23	STC7	1	
8	EJECTOR	35x68x20	SM35C	1	
7	CLAMP HINGE PIN	ø8x22	STC5	1	
6	DRILL BUSH	ø25x13.25	STC7	1	
5	ROTATE PIN	ø12x19	STC5	1	
4	LOCATING BUSH	ø25x16.25	STC7	1	
3	DRILL GUIDE PLATE	65x25x10	SM35C	1	
2	UPPER PLATE	80x42x22	SM35C	1	
1	BASE PLATE	110x80x12	SM35C	1	

Fig. 5 Components drawing of experiment drilling jig



NO	DESCRIPTION	SIZE	MAT'L	Q'TY	REMARK
14	PRODUCTION PART	60×40×101		1	
13	SPRING			1	
12	JIG FRAME	ø10x12	STC7	4	
11	SIDE PLATE	80×25×10	SM35C	1	
10	CLAMP	39×27×10	STC7	2	
9	EJECTOR BUSH	ø38x23	STC7	1	
8	EJECTOR	35×68×20	SM35C	1	
7	CLAMP HINGE PIN	ø8x22	STC5	1	
6	DRILL BUSH	ø25x13.25	STC7	1	
5	ROTATE PIN	ø12x19	STC5	1	
4	LOCATING BUSH	ø25x16.25	STC7	1	
3	DRILL GUIDE PLATE	65×25×10	SM35C	1	
2	UPPER PLATE	80×42×22	SM35C	1	
1	BASE PLATE	110×80×12	SM35C	1	

Fig. 6 Actual assembling of jig and its component by jig making

4. Conclusion

In order to prevent the defect of jig design and making, this study developed the practical and adaptive drill jig and performed tryout and checked experimental production part result. This study could be carried out by the theoretical back ground, data base and our own field experiences. The results of study are as follows

1. The actual production part could be reviewed in adaptable tolerance to field application for assembling function.

2. The structure of drilling jig could be accomplished to field by database and author's experience.

3. The tryout of drilling jig could be checked on the site of structure, assembling function and outer-view.

4. The result of tryout of experimental drilling jig could be possible to use in field as a passing the inspection of producted part.

References

1. Edward G. Hoffman, Jig and Fixture Design, Van Nostrand Reinold Co.1980.

2. Ewald L. Witzel, Jig and Fixture Design, Delmar Publishers.

3. Erik K. Heriksen, M.Sc., Jig and Fixture Design Mannal, Industrial Press Inc., 1973.

4. Herman W.Pollack, Tool Design, Reston Publishing Co., Inc., 1976.

5. D.F.Eary, G.E.Johnson, Process Engineering for Manufacturing, Prentice -Hall, Inc., 1962.

6. Frank W. wilson, Handbook of Fixture Design, ASTME, 1962.

7. Oliver R. Wade, Tolerance Control in Design and Manufacturing, Industrial Press Inc., 1967