Development of Universal Portable Spray Stand for Touch-Up Process in The Automotive Paintshop

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Abstract. A spray stand is a custom-made tool used to hold the automotive body parts as well as the devices used to facilitate the operator during the Touch Up process in Paint shop production. This paper discusses about the development of Universal Portable Spray Stand (UPSS) as a tool to hold various types of automotive body parts and model of car during the painting process. The main objective of this study is to determine the effective application of UPSS at the International College of Automotive (ICAM) and also in the automotive industry. This will be helpful to add features to the current spray stand in ICAM and to add value to the spray stand based on selected criteria which are universal, portable and cost saving. In addition, study in the UPSS is also expected to bring reduction in cycle time during the touch up process, in the paint defects and in the ergonomics issues among the operators.

Keywords— Universal Portable Spray Stand, Touch Up Process, Paint shop

1. Introduction

In metal and woodworking, a spray stand is a custom-made tool used to control the location and motion of spray part as well as devices used to facilitate production work, making interchangeable pieces of work possible as a cost-saving in production. Its primary purpose is to provide repeatability, accuracy and interchangeability in the spray process. Spray stand have been known long before the industrial age. Some are made to increase productivity through consistency, to do repetitive activities or to do a job more precisely. Spray stand may be well made for frequent use or may be improvised from scrap for a single project; depending on the task. Nowadays, there are several designs of spray stands exist based on their functions such as hood spray stand, bumper spray stand, door spray stand, fender spray stand, and spoiler spray stand as shown in Figure 1.
Based on the analysis that we have done in ICAM, it had been found that part of car is place on the floor while spraying and the painters need to bend their body while spraying due to position of part car (Figure 2).

This had developed ergonomic issues among the operators and they were uncomfortable while spraying the part. Also it has produced other issues such as low paint quality of paint and the appearance of part become poor. The chances of getting paint defects such as paint run flow on the part; orange peel, sanding mark, and dust in the paint are also more when it is on the floor. Hence the percentages of rejection of the parts were more.

Typical and related issues were also observed when using plate spray stand at ICAM or using any other regular stands in the automotive industry. The weakness and effects encountered in the usage of above mentioned stands is illustrated in the Table 1. Similar weakness was observed in the conventional spray stands used at HICOM Automotive Manufacturing (HAM). These are tabulated in Table 2 and shown in Figure 3.

Table 1 Weakness and effects of conventional spraying at ICAM

| Stand Type                      | Weakness                                      | Effects                                                      |
|--------------------------------|-----------------------------------------------|--------------------------------------------------------------|
| Spraying on the floor          | The position of the part urges the student to bend for spraying | Long run will cause back pain to the students and limit the quantity produce at one time |
|                                | Part was placed on the spray booth floor       | Dust and dirt from the floor will stick to the part and create paint defect |
|                                | Difficult to spray other surface of the part   | Increase the cycle time to spray the whole part              |
| Spraying using Plate Spray Stand| The stand able to hold one plate only at one time | Limited usage for training purposes                          |
|                                | The stand base is static and fixed             | Not portable and limited movement                            |
|                                | Fixed plate holder                             | Increase the cycle time to spray the whole part              |
2. Development of Universal Portable Spray Stand (UPSS)

UPSS Features
The main objective of developing the UPSS is to overcome the shortcomings and weakness of spray stands used in ICAM and elsewhere and hence to improve the productivity so that the spray stands will be Universal, Portable and Cost effectiveness.

The salient features of UPSS are:
- Wide wheel base provides stability and manoeuvrability
- Extension bar provides extra area for spraying large or additional parts
- Adjustable hook provide multiple hold positions
- Easy to use handle operating locking system allowing positioning from horizontal to vertical
- Wide angle of part positioning
- Easy to assemble and disassemble

The constructional details of UPSS are illustrated in Figure 4.

Table 2 Weakness and Effects of Spray Stand at HICOM Automotive

| Weakness                  | Effects                                      |
|---------------------------|----------------------------------------------|
| The size of the spray stand is big | Limit the quantity of part sprayed in the spray booth |
| The spray stand is heavy   | Difficult to move the spray stand and need more space to maneuver |
| Fixed plate holder         | Increase the cycle time to spray the whole part and limit the angle of freedom for painter |

Figure 3 (a) and (b) Spray Stands at HICOM Automotive
In term of universal application, the UPSS can fit all type of parts, with different size and types of car model. This flexibility is due to its upper hook and lower hook. These two hooks have been designed to hold various types of car parts. It will remain stable and maneuverable even with the largest panels. The universal nature of UPSS is shown in the Figure 5 which exhibits its various applications.

It is also portable and possesses good money value based on the comparison with available spray stands in market (Figure 6 and 7). Moreover, it is also suitable for training purpose. Students and new technicians can easily acquire and apply the basic spraying skills with the actual part on the spray stand. The wide wheel base of the spray stand allows doing preparation of job such as sanding, polishing and wiping on the spray stand itself. The flexibility UPSS will reduce the ergonomics issues of normal painter such as back pain and wrists pain.

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Table 3 shows the cost involved in UPSS development and its comparison with REDASHE EST2 stand, other spray stand available in the market. A total cost saving of RM 915.50 can be achieved by using UPSS.

Table 3 Cost involved in Developing UPSS

| Material                  | Cost (MYR) |
|---------------------------|------------|
| Steel (Bar, Hollow, Plate) | 85         |
| Wheel                     | 55         |
| Handle lock               | 20         |
| Bolt, Nut, Washer         | 10         |
| Workmanship               |            |
| • Grinding                | 20         |
| • Welding                 | 20         |
| Miscellaneous             | 40         |
| **Total Cost**            | **250**    |

**REDASHE EST2** | **UPSS**

|                |             |
|----------------|-------------|
| €259 x 4.5     | MYR 1165.50 |
|               | MYR 250.00  |

Saving cost = MYR 1165.50 – MYR 250.00 = **MYR 915.50**
3. Effectiveness of Application

The effectiveness of application of UPSS when compared with other conventional stands used at ICAM and elsewhere can be assessed by its influence in cycle time and in the number of defects encountered during the spraying process.

A. Reduction in Cycle Time

One of the main functions of spray stand is to speed up the touch up process in automotive manufacturing. The part will be detached from the car and fixed to the spray stand for touch up purpose. It will eliminate the masking activity which consumes a lot of time. A set of data were taken at ICAM spray booth to prove the reduction of cycle time. Four different types of car parts were sprayed in three different conditions. Data analysis shows that the UPSS have reduced the cycle time to spray the parts by 26% on average. Figure 7 shows the reduction in cycle time by UPSS.

![Figure 7(a) Cycle Time (in sec) Using Conventional Stands](image)

![Figure 7(b) Cycle Time (in sec) Using UPSS](image)
B. Reduction of Painting Defect

Paint problems include a wide range of defects that can be found before or after painting. To maintain repair quality and satisfy customers, the defects should be detected and corrected efficiently. When painting in even the cleanest paint booth, tiny particles of dust, dirt, hair, and so on can sometimes fall or blow into the paint. A set of data were taken at ICAM spray booth to prove the reduction of cycle time. Four different types of car parts were sprayed in three different conditions. Data analysis shows that the UPSS has reduced the defects in the parts by 62%.

![Figure 8(a) Painting Defects on Conventional stand using Pallet](image)

![Figure 8(b) Painting Defects on Conventional stand using Wooden Box](image)

![Figure 8(c) Painting Defects using UPSS](image)
4. Acknowledgment

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