Apparatus for Welding Training Program

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Abstract: Welding has continued to grow in importance since the Industrial Revolution. Thanks to a global boom in industrial manufacturing, skilled welders are in greater demand. Today’s construction practices demands high quality workers with the ability to join metals when creating most structures, this demand has made welding a highly sought after trade. Therefore, it is important to train qualified welders. With such a great need for these skilled labourers, finding quicker and more efficient ways to train new welders while maintaining a high level of quality has become a necessity. The purpose of this invention was to enhance the welding training in technical colleges, post-secondary institutions, and industry to prepare certified welders. With a high demand for certified welders, training programs need efficient methods of training. This apparatus is a new element in welding training program that had never being used before this. The result showed improved welding quality for beginner welder trainee.

Keywords: welding training, qualified welders, technical colleges, post-secondary institutions

1. Introduction

During a welding process, a welding apparatus in one hand or both hands of a welder is applied to the seam to be welded. As the welding process proceeds, a serpentine run of the welding apparatus or a deviate of the seam may occur due to hand shake, thereby possibly adversely affecting the weld.[1-5]

Some hand welding apparatus is suitable of used to steady hand of the welder and thus facilitate the welding operation. However, it does have shortcomings. For example, US 4161643 A discloses an auxiliary handle has a radiation and contact shield attached to a main handle of a welding apparatus by means of a circumferential clamp to provide a contact insulating portion which permits the welder to place the heel of his hand against the work piece being welded [6-8]. However, it is quite difficult to obtain a uniform and high quality needed for the weld to which the welding apparatus is held by free hand movement since a totally steady hand or uniform movement is virtually impossible [8-10].

The need arises for a device that to limit the hand movement of the welder during the welding process.

2. Background

Welding is a joining process that produces coalescence of materials by heating it to the welding temperature, with or without the application of pressure or by the application of pressure alone, and with or without the use of filler metal. In other words, welding is the fusion of two pieces of material by heating the materials to the point of melting and flowing together. Welding is a specialized task that usually requires training and certification of abilities before a welder can work in industry [11-15].

3. Effect of welding results

3.1 Arc length

Arc length is the distance between the tip of electrode, to the surface of a work piece. In a normal arc weld, the weld has a consistent profile and minimal spatter. Too great a distance between the rod and the work will increase the voltage resulting in a flat and wide weld with a great deal of spatter. It also makes the arc unstable, and the slag will be difficult to remove from the edges of the weld. Sectioning this weld reveals undercutting to the left side. When arc length is too short, the surface of the weld is uneven where it has been dragged along by the rod, and the weld will be low on power and contain slag inclusions. Usually to obtain good welding results, recommended arc length is between 2 to 3 mm.

Figure 1: The photo shows a comparison of the too close arc length (left), too high (right)
3.2 The electrode angle

Tilt angle is formed between the electrodes to the surface in the direction of motion bendakkerja electrodes. Angular incorrect will cause a ripple moldings to be elongated or oval and make the look not beautiful moldings.

![Correct weld angle](image1)

Figure 2: Correct weld angle

3.3 Travel speeds

Travel speed is the speed of movement of the electrode arc moving towards the end of the finish welding. This speed is usually dependent on the rate of liquid electrodes. Beginner welders tend to move the rod too quickly. Normally, when the welding speed is correct, it will produce bead fairly consistent bead and the ridges in the weld are semi-circular.

Excessive speed results in a thin, weak bead. The ridges in the weld are elongated and triangular. Had the current been increased to compensate for the speed the ridges would still remain elongated. Meanwhile, welding too slowly results in a wide tall build up of weld. The shape of the weld is not consistent as the weld pool has built up and then collapsed into the crater. The poor control of the weld pool can result in cold joints and slag inclusions.

![Welding results from difference travel speeds](image2)

Figure 3: Welding results from difference travel speeds

4. Barriers to welding trainee

4.1 Maintain three elements simultaneously

For new students, keeping the three elements described above is difficult. This is because the electrode becomes shorter during welding process. It is important for students to maintain an electrode angle, arc distance and travel speed to get the desired results. An adequate practical exercise is necessary, and it involves psychomotor, cognitive and effectiveness factors also contributes to the results of skills training.

4.2 Anxiety

One aspect of welding training programs that previous studies have not examined is the cognitive obstacles trainees encounter during training programs. Anxiety is a negative effect that is closely related to fear. When a person experiences anxiety, it comprises several components and is more of a process than a categorical event that occurs or does not occur. Therefore, finding a training method or strategy to reduce the effect that anxiety has on trainees may reduce the amount of time needed to train qualified welders.

![A model of anxiety](image3)

Figure 4: A model of anxiety. From Anxiety, by S. Rachman, 2004.

4.3 Dexterity

Dexterity is the skill of using one’s hands and body, which addresses the quickness or the coordination of sight and other senses with muscles. The welding literature has indicated that welders need manual dexterity, good eyesight, and good hand-eye coordination. Giachino and Weeks (1985) suggested that welders needed to be able to concentrate on detailed work, be free of disabilities that would prevent working in awkward positions, and be able to lift up to 100 pounds.

5. Apparatus or Simulations

5.1 Assessing Existing Skill via Virtual Reality Simulations

Trainees have shown the ability to learn basic psychomotor skills necessary to perform job related tasks within technical fields through the integration of virtual environments. Training with virtual environments increased memory retention and reduced human error in trainees; this is because the trainees can perfect their skills and gain a deeper understanding of the work environment before actually being put into a real-life job situation. Virtual reality environments work well when trainees are learning skills for the first time. The virtual reality simulation offers potential as an evaluation tool because every interaction within the simulated environment can be monitored and recorded to facilitate assessment. Simulations can be used with both young and old. Virtual reality simulations have been focused primarily to train novices and interns, but currently virtual reality has been utilized for continuous training and evaluation of experienced workers.

5.2 Apparatus For Welding Training Program (Welder Arm)

This apparatus (Welder Arm), generally relates to a device for preventing arm movement. More particularly, the present invention relates to a device that limits movement of the elbow joint of a welder. As the welding process proceeds, a serpentine run of the welding apparatus or a deviate of the seam may occur due to hand shake, thereby possibly adversely affecting the weld. Some hand welding apparatus is suitable for steady hand of the welder and thus facilitate the welding operation. However, it does have shortcomings. For example, US 4161643 A discloses an auxiliary handle has a radiation and contact shield attached to a main handle of a welding apparatus by means of a circumferential clamp to provide a contact insulating portion which permits the welder to place the heel of his hand against the workpiece being welded. However, it is quite difficult to obtain a uniform and high quality needed for the weld to which the welding apparatus is held by free hand movement since a totally steady hand or uniform movement is virtually impossible. The need arises for a device that to limit the hand movement of the welder during the welding process. Is to suggest, can be replace the use of simulators on new welding trainee at a much lower cost.

Figure 6: US 4161643 A which provides device for easier handling of the welding tool joint of a welder.

Figure 7: Presents apparatus relates to a limits movement of the elbow

Below show analyze comparisons between conventional techniques compared to the use of Welder Arm. Where we find it can save time, electricity power, impressive result of the welding quality and as the students have mastered the welding techniques, also skills more quickly.

Figure 8: Time comparison chart

Figure 9: Electrode usage chart
6. Conclusion

Apparatus for welding training (Welder Arm), is a new aids in welding training method. Based on analysis was done, this aids can accelerate the process of teaching and learning for TVET students in training institution, especially in welding field. Also we find it is suitable for them who were in different field that need re-training, also for industry application. In additional, it also help to savings in term of cost, time, training materials and electricity usage. This paper focused on the performance analysis of Welder Arm.

This paper has presented the performance analysis of Apparatus for Welding Training (Welder Arm) in welding training program. However, there are several Welder Arm features that can be implement and test. For the propose future works is to compare different data methods which is directly to body positioning movement usage.

References