

Welding Slag Removal Machine

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Abstract—Welding slag is a form of vitreous material or slag produced as a byproduct of some arc welding processes, most specifically shielded metal arc welding, submerged arc welding, and Flux-cored arc welding. Slag is the leftover remains of the weld process that is a result of the flux having done its job. Slag is formed from the flux, decomposing into either a shielding gas, or deoxidizers, which form molten compounds that cover the weld while it cools to prevent oxidation of the freshly formed weld. Welding flux is a combination of carbonate and silicate materials used in welding processes to shield the weld from atmospheric gases. When the heat of the weld zone reaches the flux, the flux melts and out gasses. The gases produced push the atmospheric gas back, preventing oxidation. Slag is great for protecting the weld while it cools, but once it has done its job, it has to be removed before the next pass. So, there are many ways to remove welding slag, but the most common method in years past was with a Chipping Hammer. But chipping hammer can damage the weld face leaving tiny marks where the weld can fail. So, The wire brush is great for general purpose welding, when combined with a chipping hammer, results are generally good. Hence there is need of a special purpose machine to remove slag from welded components.

Keywords— Weld slag,wire brush, Welding Slag Clear Machine,HP motor,Bearings

I. INTRODUCTION

A. Manual Metal Arc Welding

Manual metal arc welding (MMAW) or shielded metal arc welding (SMAW) that uses a consumable electrode covered with a flux to lay the weld. The arc is struck between a flux covered stick electrode and the work-pieces. The work-pieces are made an important part of an electric circuit, known as welding circuit. The work piece and the electrode melts forming a pool of molten metal that cools to form a joint.



FIG 1. ARC WELDING SLAG

B. Important Terminology In Welding Process

Welding: Welding is a fabrication process that joins materials, usually metals or thermoplastics, by causing fusion, which is distinct from lower temperature metal joining techniques..

Welder: Either the person who performs a weld task or the power source that provides the electricity needed to perform an arc weld. Printed materials may use both meanings of the term.

Electric Arc: The current through a normally nonconductive medium such as air produces plasma. The high temperatures generated by the arc melts the base metals get melted.

Electrode: A device used to make contact with a nonmetallic part of a circuit. In welding, the electrode also can act as the filler metal

Flux: A non-metallic material used to protect the weld puddle and solid metal from atmospheric contamination. Fluxes may have more than one function at a time.

Flux-Cored Arc Welding: It is a semi-automatic or automatic arc welding process. The process is widely used in construction because of its high welding speed and portability.

Slag: Cooled flux that forms on top of the bead. Slag protects cooling metal and is then chipped off.

Arc welding is a one of type of welding that uses a welding power supply to create an enough heat to melt metal, and the melted metals when cool result in a binding of the metals. They can use either direct (DC) or alternating (AC) current and consumable or non-consumable electrodes. The welding region is usually protected by some type of shielding gas, vapor or slag. Arc welding processes may be manual, semi-automatic or fully automated.

C. Main Function of Weld Slag

- It shields the hot metal from atmospheric contaminants that may weaken the weld joint.
- Slag can also be globules (drop) of molten metal that are expelled from the joint and then resolidify on the metal surface.
- It protects the weld (in form molten metal) from oxidation and slows down the rate at which the weld cools.
- It also helps to prevents brittleness of the metal.
- In either case, they are usually chipped away with a slag hammer.

D. Why It Is Removed?

Slag does not help to cause strength or protection of metals after the welding process; it is waste material. Removal of the slag is necessary for four reasons:

- Ability to inspect the quality of the weld area;
- Aesthetics, or ergonomically appearance;
- If a second layer or pass of welding is to be made on top of the first
- To clean and clear the unpleasant surface for coatings such as paint or oil.



FIG 2 FLUX CORED WELDING SLAG

Welding slag is in a manner that is usual gray, brown, or a charcoal black in color. It can be mainly of determiner different oxides and it differs according to manufacturer. It can be thick or it can be paper thin. Some will release easily, and others will cling to the weld until it is etched with chemical or driven off by unpleasantly rough mechanical means. Slag is great for protecting the weld (heating surfaces) while it cools, but once it has done its job; it has to be removed before the next pass. So, there are many former ways to remove welding slag, but the most familiar type in years past was with a chipping hammer. A chipping hammer is a pencil like structure hammer that uses a flat surface blade on one end and on the other end, it forms a point. But the problem with using a chipping hammer presents is that it can damage the weld face leaving tiny marks or impact where the weld joint can fail. The chipping hammer is great for general purpose welding when combined with a wire brush, results are generally good. Hence there is need of a special purpose machine to remove slag from welded components.

II. WHY WE ARE USING WIRE BRUSH?

A wire brush attaches to your drill. The bristles are made of stiff wire and as the drill spins, these bristles clean rust and paint off of metallic objects. A wire brush works moderately quickly, a wire brush will work on surfaces that aren't flat (unpleasant) and can be best when you have to clean areas of intricate metal work. This is because a wire brush can be forced into nooks and crannies that a needle gun wouldn't be able reach. The size of the wheel also makes it more flexible for small areas. Depending on what you're stripping, a wire brush can be an excellent complement to a needle gun. The chipping hammer is great for general purpose welding when combined with a wire brush, results are generally good. Hence there is need of a special purpose machine to remove slag from welded components.



FIG 3 WIRE BRUSH

III. WELDING SLAG CLEAR MACHINE

A. What Is To Be Developed?

The machine comprises of basically five sub-assemblies, namely; 1. Wire Brush Rotational Head: It comprises of a variable speed motor of 100 watt, 0 to 4000 rpm, connected to a single stage gearbox to get required torque amplification. This is a single unit assembly and it is mounted on the brush feeder mechanism. 2. Brush Feeder : Brush feeder makes the rotating brush to move to and fro with respect to the work-piece. The assembly comprises of a linear guide at the bottom, wire brush feeder bar. The wire brush rotational head is mounted on to the brush feeder bar. 3. Slide Arrangement: The slide is provided with the view to center the job, to accommodate various sizes and shape of work-piece. When the hand wheel rotated, it will rotate the screw and nut will

1. Slide to move the work-table thereby adjusting the work-gap between the wire brush and work-piece.

2. Work-piece Indexing: The work-piece indexing mechanism is an innovative concept for indexing various shapes and sizes of work-piece for slag removal applications. It comprises of the top work table that primarily holds work-piece – fix Turing can be done using single bolt at center. Table is mounted on the spindle that carries the four bar linkage output at its lower end. The four bar linkage is used to index the work-piece to the required angle. This mechanism takes into account the fact that in a four bars linkage if we change the crank length the degree of oscillation of the output link changes. Hence the crank is slotted in the above mechanism to vary the crank length. Mechanism is operated using a pneumatic cylinder. This makes indexing fast and accurate.

This linkage mechanism replaces the servo DC motors with encoder and de-coder arrangement used in the automatic machines to carry out the same indexing activity. Thus makes a considerable saving in budget for machine.

IV. CONCLUSION

The linkage mechanism replaces the servo DC motors with encoder and de-coder arrangement used in the automatic machines to carry out the same indexing activity. This makes a considerable saving in budget for machine. A wire brush will work on surfaces that aren't flat and can be best when you have to clean areas of intricate metal work. This is because a wire brush can be forced into nooks and crannies that a needle gun wouldn't be able reach. The size of the wheel also makes it more flexible for small areas. Depending on what you're stripping, a wire brush can be an excellent complement to a needle gun. A wire brush works fairly quick. This machine requires less space, hence most suitable for small industries. It is semi-automatic machine giving more accurate results. It requires less skilled persons and provides more safety to human when comparing chipping hammer.



FIG 4 WELDING SLAG REMOVAL MACHINE

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