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Method to Neglect Spatter Generation Effect Due to CO_2 Welding

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Abstract— In this paper the work study of spatter generation during CO_2 welding process of sheet metal product is carried out. The cargo of a truck is consider as example of sheet metal product. Cargo of a truck is a load carrying member consists of three main components i.e. left & right side panel, box floor assembly and tail gate panel. This sheet metal cargo of a truck include CO_2 welding process. CO_2 welding is welding with shielding gas utilizes the heat of an electric arc established between a continuously feed wire and the work piece. During this process the wire melts and the weld metal is transferred to the work piece. CO_2 is mainly used as shielding gas which is why the process is known as CO_2 welding. CO_2 welding offers advantages as higher efficiency, lower welding cost, and better economy. CO_2 welding has a measure disadvantage of spatter generation during welding operation. These spatters generated during CO_2 welding operation on finished sheet metal cargo part fall onto the surface and harmfully affect finishing of surface. There are various process and techniques suggested by various publishers to reduce spatter generation but it is almost impossible to completely eliminate it. So this research work proposes suitable technique to neglect the effect of spatter on finished sheet metal cargo part.

Keywords— CO_2 welding, Spatter generation, Sheet metal product, Improvement of finishing, Car manufacturing.

I. INTRODUCTION

Welding is one of the basic and foremost important processes in manufacturing of any metal product. There are many types of welding process among which CO_2 welding is widely used. CO_2 welding has many advantages over other welding processes and easy to operate. In CO_2 arc welding, the welding wire wound in coil is fed into the welding torch by the feeding motor automatically.

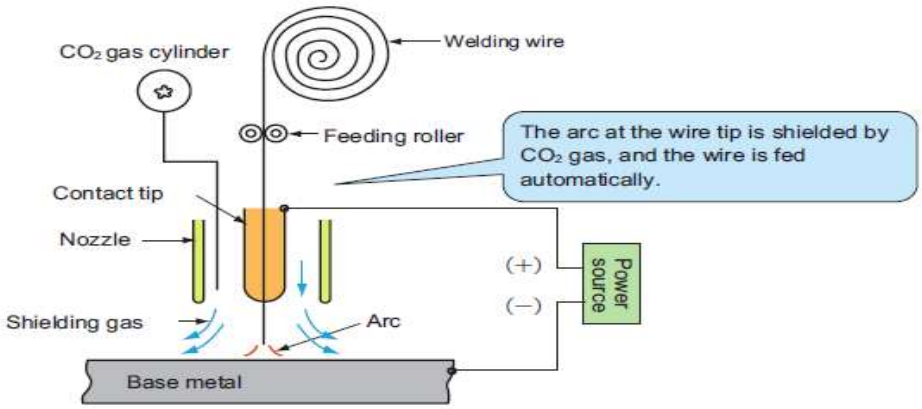

Fig.1.Schematic of CO_2 welding process

The welding wire that is electrified through the contact tip becomes the electrode to strike an arc between itself and the base metal. The arc heat melts the wire and the base metal to join two pieces of base metal. In this case, in order that the weld metal will not be affected by oxygen and nitrogen in the atmosphere, CO_2 gas is supplied from the nozzle of the welding torch to shield the weld pool. Its schematic is shown above. While carrying out CO_2 welding on any sheet metal component there is generation of sparks and spatters which scatters all over the surface and get stick

to it. In case of tail gate of cargo of a truck, these formed spatters fall on to the surface of tailgate panel which is exposed to it and get permanently stick to it. These stuck spatters create damage to the aesthetic look of finished product and lead to rejection in quality control process. Reprocessing of already finished product lengthen the manufacturing time and increase cost associated with it. There are many factors which are responsible for these spatter generation explained in subsequent section which cannot be completely controlled and eliminating spatter generation in CO_2 welding is almost impossible. Due to added advantages of CO_2 welding it is also not economical to replace the welding process. So to tackle the effect of this spatter on tailgate panel surface, a template is provided of suitable dimension and to neglect this effect.

II. LITERATURE REVIEW

[1] K.Tokihiko, I.Rinsei, Y.Koichia and H.Yoshniri have investigated metal transfer phenomenon and spatter generation in CO_2 arc welding with a solid wire and developed a low spatter welding process using a high frequency pulse rectangular current. They have found that optimum condition of CO_2 arc welding is at peak current of 450–550 A and pulse frequency of 450–750 Hz. According to them this high frequency pulse currents produce droplet oscillation due to resonance between the applied pulse frequency and the natural frequency of the droplet. These droplets were transferred by reduce pulses half of conventional which reduce the size of spatter by 70%. Also reduction in large diameter spatter's size.

[2] Kei Yamazaki, Reiichi Suzuki, Hiroyuki Shimizu, Fusaki Koshiishi have claimed that the CO_2 gas-shielded arc welding process with solid wire is widely used in Japan. CO_2 welding has good weld quality, high efficiency and reasonable wire and shielding gas costs. They have claimed that the drawback of CO_2 welding is that in the globular transfer mode at a high welding current large amount of spatters and fumes are generated. They have suggested a new method in which they squeezed each droplet at its upper part in peak current duration and detached the same silently in base current duration to reduce formation of spatter and fume.

[3] American welding Society has suggested six causes of spatter generations in CO_2 welding as Causes of spatter:-

1. Incorrect settings procedures that are out of whack will cause spatter
2. Work angle too steep –pushing or dragging while CO_2 welding is the way to generate spatter.
3. Surface Contaminants rust, oil, paint and other surface contaminants create spatter.
4. Mode of Metal Transfer – Short arc and globular transfers are modes of metal transfer that produce a lot of spatter.
5. Erratic Feeding - when the wire feeder cannot feed wire at a constant speed there will be fluctuations in amperage that will drastically affect the arc causing a lot of spatter.
6. Shielding gases of low quality can affect spatter levels. 100% carbon dioxide is cheap and provides good penetration profile, but it creates a lot of spatter.

III. COMMENTS

So after this literature survey one thing that gets highlighted is spatter generation in CO_2 welding is a major problem. There are many causes which are responsible for this spatter generation which cannot be avoided completely. Many authors suggest different techniques to reduce the spatter generation in CO_2 welding by changing some operating factors like voltage, current, etc. Also process Conclude that spatter generated in CO_2 welding process is only reduced and it is highly impossible to completely eliminate it. So aim of this research work is to neglect the effect of these spatters on finished sheet metal product with a suitable technique.

IV. PROBLEM DEFINITION

Cargo part of a truck is the sheet metal part which includes CO_2 welding process in different stages of manufacturing. As we have seen that the spatter generation is a major problem in CO_2 welding of sheet metal components. Due to added advantages of CO_2 welding as mentioned

previously it is not economical to replace it by another welding process. But during the CO_2 welding of tail gate panel of a truck cargo these spatter get stick to it and create aesthetic and quality problem which lead to reprocessing of finished part. So the objective of present work is to neglect spatter generation effect due to CO_2 Welding of hinged area of tail gate of a cargo load body of a truck which get stick over tail gate panel near hinged area.

Fig.2. Stucked spatters on tail gate panel of a truck cargo.

V. PRINCIPLE

Spatter generation in CO_2 welding is major concern in a truck cargo manufacturing. So to neglect spatter generation effect due to CO_2 Welding of hinged area of tail gate of a cargo load body of a truck, we suggested to provide a covering template to cover the area exposed to spatter. This covering template of suitable dimension will act as a covering film between the spatter and exposed surface of finished tail gate panel and one can get weld without having spatters stick to it.

VI. METHODOLOGY

As we have seen from above data that CO_2 welding has one of the major problem that is spatter generation which cannot be completely eliminated. Many authors had suggest different methods of spatter reduction but nobody is able to completely eliminate the spatters, So in this paper we are suggesting one technique to neglect the effect of the spatter generation in CO_2 welding operation on finished sheet metal product. So in representing the above said process we are taking the example of tail gate panel of a truck cargo sheet metal part as shown in fig below.`

Fig.3.Sheet metal tail gate panel of a cargo

So as shown in picture above, while welding different necessary component's i.e. hinge to above tail gate panel of size 1585 x 540 x 55 (mm) using CO_2 welding process, heavy spatters generated during CO_2 welding get stick over tail gate panel near hinge area due to high thickness due to which finished sheet metal tail gate panel which has to be used for assembly of cargo of an load carrying truck looks like a unfinished surface and so this tail gate panel faces rejection while going through quality control department. So this tail gate panel has again go through reprocessing for

getting its surface finished. This reprocessing has leads to excess time, money and various resources consumption which also leads to reduction in productivity of a company as well as un-satisfaction of customer of said company.

So to tackle above mentioned problem regarding to rejection of sheet metal tail gate panel we used special template cover to cover the affected area of tail gate panel such that this template cover can be removed after the CO_2 welding operation. Now spatter generated during CO_2 welding operation get stick to the removable template cover instead of finished sheet metal tail gate panel as takes place in conventional methodology. So after the operation this removable template is removed and can be used for welding another tail gate panel and we get finished sheet metal tail gate panel without having a spatter generated stick to it.

VII. BUILD PROCEDURE OF REMOVABLE TEMPLATE

By measuring the dimension of tail gate panel i.e. 1585 x 540 x 55(mm) accordingly we made the template cover such that only the area which is to be weld is exposed to CO_2 welding operation while rest of the area of the tail gate panel remained covered till the welding operation gets finished.

For that we make a template cover of dimension 1590 x 545 x 50(mm) i.e. slightly larger than dimension of sheet metal tail gate panel. Also we attached two handles to the template cover for the ease of removal of template cover after the CO_2 welding operation is done. Cold Rolled Annealed sheet of CR2-D grade is the material which we have used to make template.

The material used have the following Advantages as:-
1) Superior workability.
2) Superior surface quality and dimensional accuracy.
3) Excellent formability and minimal deviation in mechanical properties.
4) Superior strip flatness.

With the use of available dimensions of tail gate panel by considering dimensional tolerances, the drawing is made in Auto-CAD 2016 software to make covering template. The drawing of template is as shown in fig.

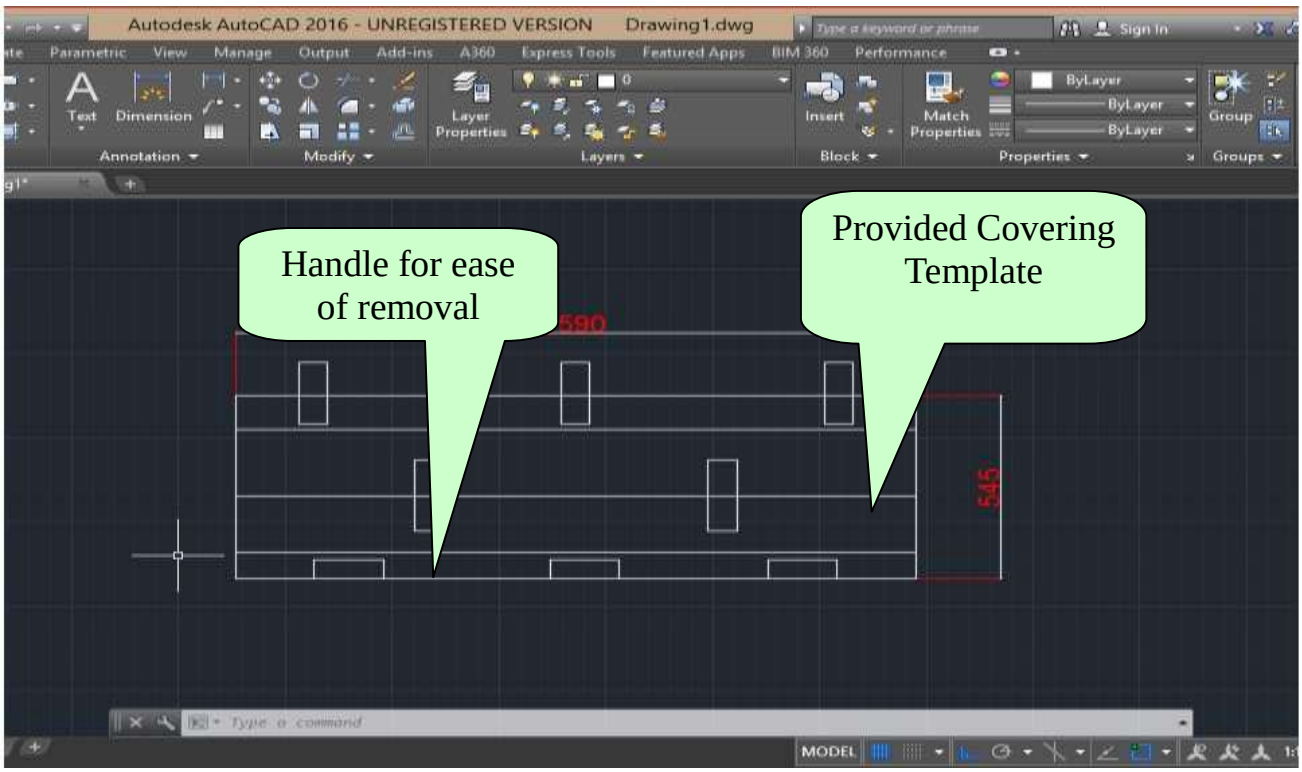

Fig.4. Auto-CAD drawing of covering template.

Material Summary:
Material used- Cold Rolled Annealed Sheet
Grade- CR2-D
Thickness- 0.950 mm
Width-575.00 mm

Template Summary:
Length- 1590 mm
Width- 545 mm
Thickness- 50mm

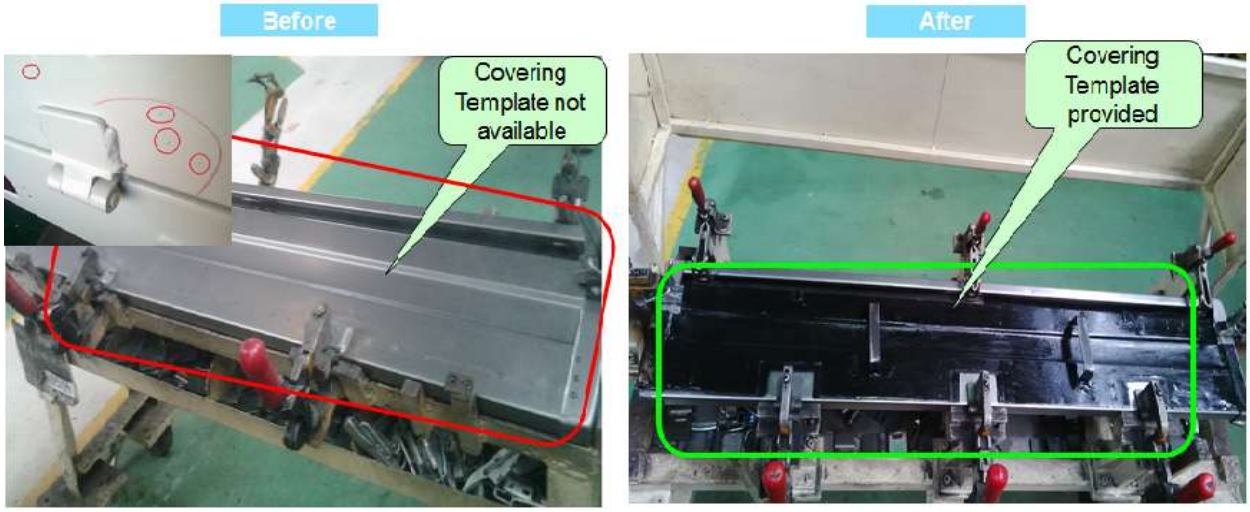

Fig.5.CO_2 welding procedure before and after placing template

VIII. CONCLUSION

So from this research work we came to conclusion that spatter generation in CO_2 welding cannot be eliminated but it can be controlled up to certain extent by suitable adjustment. Solution which is generated by this research work is that by providing the covering template on the surface of original component we can easily neglect the effect of spatter generated due to CO_2 welding on any sheet metal component. Tail gate panel of size 1585 x 540 x 55 (mm) was suffering from the spatter generation problem during CO_2 welding process. To overcome this problem Cold Rolled Annealed sheet of CR2-D grade material is used to prepare the covering template of size 1590 x 545 x 50(mm), which is slightly larger than dimension of sheet metal tail gate panel. Also handles are provided to the template for the ease of handling. This template acts as a barrier between tail gate panel and spatter generated during CO_2 welding process and hence it saves the tail gate panel from any damage to its aesthetic look by these spatters.

Hence, from this research work one can say that, in any spatter generation problem during CO_2 welding process, use of template of Cold Rolled Annealed sheet of CR2-D grade material as a barrier is the best and economical solution.

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