CO_2 WELDING - PAST, PRESENT AND FUTURE

By Dr. Placid Rodriguez - President, IIW,
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Dear Friends :

It is my pleasure and privilege to be present among you today on the occasion of the one-day National Welding Meet on CO_2 Welding organized by the Bangalore Branch of the Indian Institute of Welding. At the outset, I must place on record my hearty congratulations to the Organizers of the Bangalore Branch for reviving the National Welding Meet after a gap of eight years and selecting a topic immense importance to the Indian Welding Industry. In my capacity as the President of IIW and on behalf of the National Council, I .convey my sincere best wishes for the success of this Meet.

It will be appropriate on this occasion to look at the historical development of the CO_2 welding process and where we stand today with respect to its exploitation and application in our industry. Therefore, in my brief address, I would first like to trace the historical trail of CO_2 welding, right from its invention, and then spend some time in describing the new developments in the field which have an inportant bearing on the Indian welding scene in the coming years and lastly, a few words about its international and national status.

Gas Metal Arc Welding (GMAW), as it is known today, was invented after the second world war at Airco Research Laboratory in New Jersey and the patent was taken in the US on April 18, 1950. The inspiration for the development of the concept came from two welding processes widely in use at that time : the first one was the Gas Tungsten Arc Welding (GTAW) process which was invented in 1920's but commercialized during the period of second world war; the second was a hand-manipulated submerged arc welding process with mechanized wire feeder. The key to successful development of GMAW was the amalgamation of the two different concepts into a single viable unit. To quote one of the three-co-inventors of GMAW, Mr. Glen J. Gibson, "I became enamoured with the smooth, quiet arc, the visibility without slag, and the protection the gas provided for molten metals. I visualized that a better way of welding could be had by replacing the tungsten electrode with a continuous filler metal electrode". He and his colleagues put together a device with a pistol-shaped gun attached to a wire feeder. It worked the first time in all positional configurations giving birth to a new welding process which was to revolutionize the welding scene.

Initial development efforts were mainly confined to inert shielding gases such as argon and helium. The process gained in popularity in the mid-1950s when CO_2 was introduced as a shielding gas for mild steel welding. It was rechristened as Metal Active Gas (MAG) welding to recognize the "active" interaction of CO_2 with the molten weld metal as against the inert nature of shielding gases used in the Metal Inert Gas (MIG) welding. This, of course, was not the first ever occasion when CO_2 was used as a shielding gas. In 1920s CO_2 was employed for the first time to shield the arc in Carbon Arc Welding process but its use was not pursued further because of the presence of excessive porosity in the weld deposits. The next important step in the development of the process was when it was recognised that CO_2 can give much superior welding character-

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istics if used in combination with other gases. With the advent of active gas sheilding either singly or in conjunction with other gases, a whole new area of research opened up where different combinations of gases were tried in various proportions and their influence on the weldability of materials studied. Pure Ar, Ar-He, Ar-CO_2, tri-mixes of Ar, CO_2 and O_2 are commonly used with the GMAW process. The discovery of different modes of metal transfer obtained by manipulating welding parameters gave a further boost to the acceptance of the process by the welding community. Given a particualr kind and thickness of metal, each gas and mixture affects the smoothness of operation, weld appearance, weld quality, and welding speed in a different way.

In recent years the development of pulsed power sources based either on thyristor or inverter technology has added another dimension to the versatility of the GMAW process. Synergic GMAW, with a single-knob control on welding variables, is an added attraction. Now a welding engineer has a wide range of equipment and shielding gas combinations to choose from and judicious selection of shielding gas and power source characteristics can be employed to obtain welds at a lower cost with better welder appeal than was possible earlier. With environmental issues becoming a major concern in industrial activities, one has now to go in for those welding processes which have minimum polluting impact on our surroundings and also are not harmful to the health of welders. In one of the recent experiments, it has been demonstrated that the fume emmissions in the pulsed CO_2 welding can be cut down to as much as 50 to 90% of the level commonly encountered while using the conventional power sources.

Another equally important technological development took place in 1980s when major breakthroughs in manufacturing small diameter flux-cored and metal-cored wires were achieved. The potential production gains in the form of increased deposition rates, cost savings and excellent welder appeal of these wires are now recognised throughout the world.

In view of the various advantages and flexibility, the Shielded Metal Arc Welding (SMAW) process was replaced by GMAW at a very rapid pace in developed countries. In the last four decades, semi-automatic and fully-automatic GMAW has become the single largest welding process employed in industry; more than 65% of the weld metal is now deposited by using the process. However, in India the situation is just the reverse. SMAW is still the most popular welding process and about 90% of the total weld metal is deposited by the SMAW process. According to a survey concluded in 1989, the share of GMAW was less than 8%. I presume the situation has not changed substantially since. This clearly shows that the Indian welding industry is lagging behind and is not able to keep pace with the global trends. In the changed scenario of liberalization of trade and globalisation of industrial activities, we have to accelerate the rate of technology absorption and innovation. In this context organizing Seminars like the present one, where one can share information with fellow engineers, becomes all the more important. And that is where Institute like the Indian Institute of Welding can play a vital role.

In the coming years, the Indian Welding Industry will see rapid changes and it must prepare itself to face the challenges. The key words for survival are going to be - **Quality, Productivity, Cost Effectiveness, Technology Innovation, Environment-friendly and Information Technology.**

Looking at the technology gap today, it is clear that we must quickly try to bridge the gap by introducing new power sources and welding consumables. The latest welding power sources have been shown to save over 20% in electricity cost and about15% in material cost arising from power source size reduction, minimizing spatter and improving arc stability. The savings in decreasing the rejection rate have been estimated to be over 15%. The case for imminent replacement of SMAW by GMAW appears to be very strong.

On the welding consumable front, the scenario is slightly better as the production and availability of cored wires are picking up. Given the right tools, it is then left to the ingenuity of the Indian Welding engineer to exploit the opportunities available to him. It is very important to be aware of the changes taking place around us and adopt them wherever possible. Moreover, to attain a competitive edge over others it is essential to innovate and invent. In this context I would again quote Mr. Gibson's views on invention- "I look at inventing as an accumulation of knowledge and then putting various bits together to solve problems.....if [your idea] works, and is unique, it might be recognised as an invention. Whether it be a gadget, a fundamental design, or a process for doing something-you also need a little bit of luck."

Fortunately in India we have established, over the years, R & D Institutes of international repute. We also have one of the finest stock of human resources of engineers and technicians available. The entrepreneurial skill of the Indian businessman is well recognised all over the world. These assets and strengths are the reasons for the oft-repeated statement that India has a great potential. But what has been lacking is the synergistic interaction between the R & D scientists, industrial technologists and the entrepreneurs working togehter for the common goal of innovation and creativity in developing processes and products. The time and climate have come for inculcating, nourishing and cultivating such interactions and when this happens, our nation will realize its great industrial potential.

I do trust that the presentations and discussions today in this Meet will dwell upon some of the important issued raised by me.