

A Brief History of the GTAW Process

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Abstract

2022 marks the 80th anniversary of the patent for the "rudimentary version" of the process currently known as Gas Tungsten Arc Welding. To celebrate the anniversary of this important welding process, we bring a brief history of the context in which it was conceived.

A look at the history of welding reveals the need to meet the demand of industrial progress as the driving force in the development of welding processes. In fact, this maxim prevails to the present day. However, unlike what happens today, at the beginning of the last century the welding rehearsed its first steps. The development of the various arc welding processes, including GTAW, permeated a field still of discoveries regarding the understanding and mastery of the electric arc and its properties to meet the interests of welding. In the early nineteenth century, the phenomenon of the electric arc was reported by many scientists who performed their experiments in air or low pressure, with metal or carbon electrodes. In this context, historical records indicate the British scientist Humphry Davy as being the first to clearly describe the phenomenon of electrical discharge and employ the word "arc" to establish an arc between two carbon electrodes in 1801.

With the discovery and mainly the mastery of electric arc, the welding began to develop slowly. In this context, the GTAW Welding previous significant advances date only from mid-1890s when the Frenchman Auguste de Méritens used the heat generated by an electric arc, established between a carbon electrode and a workpiece, for joining lead plates. The process was patented by his Russian assistant Nikolay N.

Benardos, with the name of Carbon-Arc Welding. Some years later, Charles L. Coffin recorded the first U.S. patent of a welding process entitled "process of welding metals electrically", in which a metal was used as an electrode. Fundamentally, the only feature that distinguishes Coffin's work from Benardos' is the fact that in Coffin's the electrode was melted and added to the weld joint.

In the 1920s, as a response to the demand for armaments production potentialized by the First World War, the welding was developed based on the work of Coffin, i.e., with the development of various kinds of consumable electrodes with self-protective coating. However, with the use of coated electrodes could not be a satisfactory protection of weld against contamination of the air. Based on this, at this same time researches have been conducted seeking to protect the weld by applying gases externally. However, only in 1930, Hobart and Devers, both from General Electric Company, proposed the use of inert gas in the welding. Essentially, the patents of Hobart and Devers describe the process Carbon-Arc Welding, proposed by Benardos, running in an almost closed environment filled by argon gas (in patent Devers) and helium (in patent Hobart) as shown in **Figure 1**. Nonetheless, due to the high cost of these gases the process was not used commercially at the time.

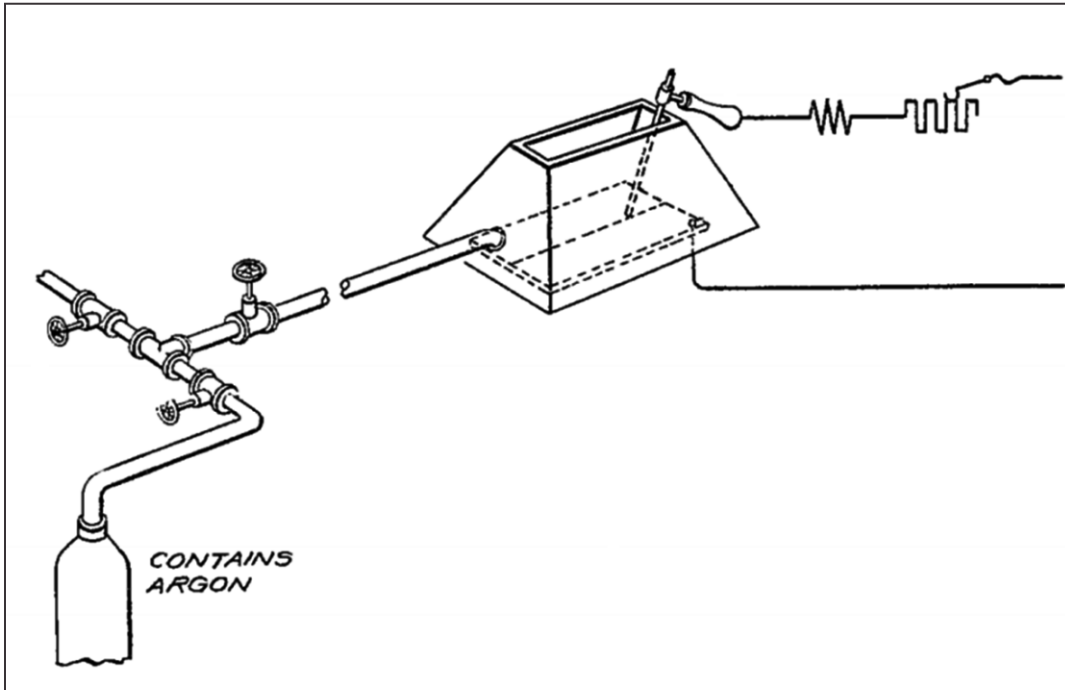


Figure 1 : Original scheme of the apparatus proposed by Devers, Philip K. "Arc welding." U.S. Patent No. 1,746,191. 4 Feb. 1930.

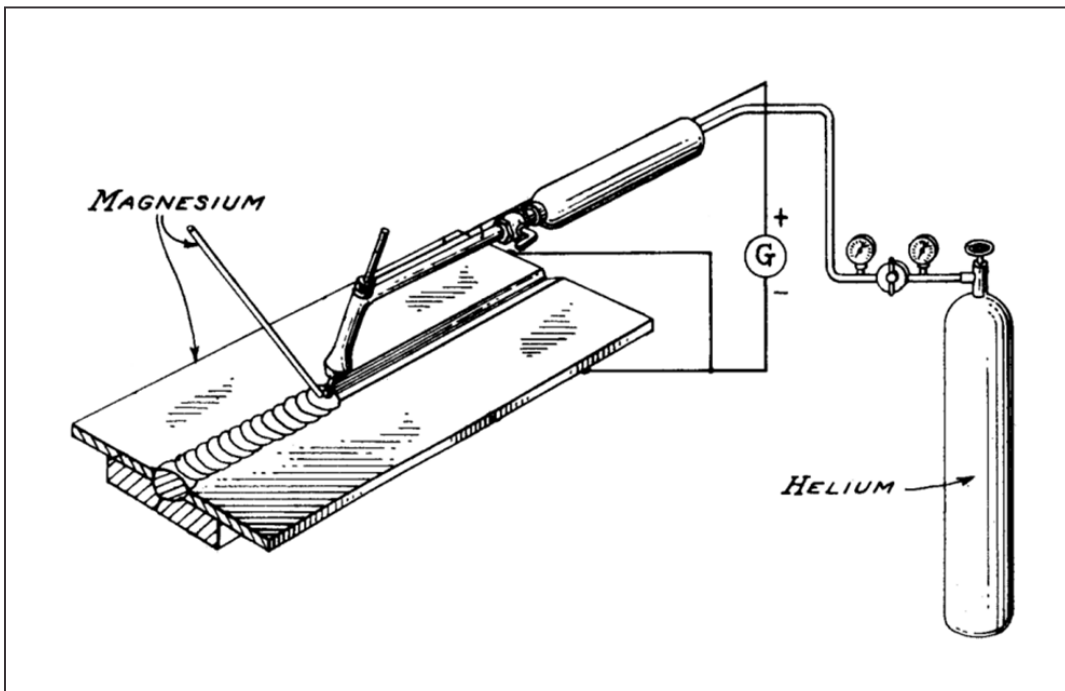


Figure 2 : Original scheme of the welding torch proposed by Russell, Meredith. "Welding torch." U.S. Patent No. 2,274,631. 24 Feb. 1942.

With the Second World War, there was a growing need for welding aluminum and magnesium alloys to meet the aviation industry. However, the welding processes available at the time did not provide the required quality of union to the aforesaid application. In this context, having as a background the developments of 1930, Russell Meredith, from Northrup Aircraft Inc., in 1942 patented a welding process which employed a non-consumable electrode made of tungsten. This process was called Heliarc by the use of helium as shield gas. Moreover, in this same patent, it was proposed the first practical welding torch able to allow proper fixation of the

electrode and at the same time lead the inert gas to protect the electrode, the weld pool and the base metal adjacent to this (**Figure 2**). At this time, it was, therefore, conceived the "rudimentary version" of the process now known as Gas Tungsten Arc Welding (GTAW).

Since then, this process has evolved significantly seeking to meet the productivity levels required by modern manufacturing processes without, however, fail to provide the excellent quality of the welded joint that consecrated him as one of the main arc welding processes.