

Thirty years of EB innovation for French firm

An ever expanding range of equipment and applications has kept French specialist company TECHMETA at the forefront of electron beam technology since 1964. On its 30th anniversary, Chief Executive, D Sommeria, outlines his company's philosophy and highlights advances including an 800m³ vacuum chamber and electron guns up to 600kW.

The history of TECHMETA began in the 1950s in the laboratory of Frédéric Joliot Curie who encouraged Jean Sommeria, his pupil at that time, to study a new phenomenon: The possibility of extracting, accelerating and focusing an electron beam at very high energy concentration.

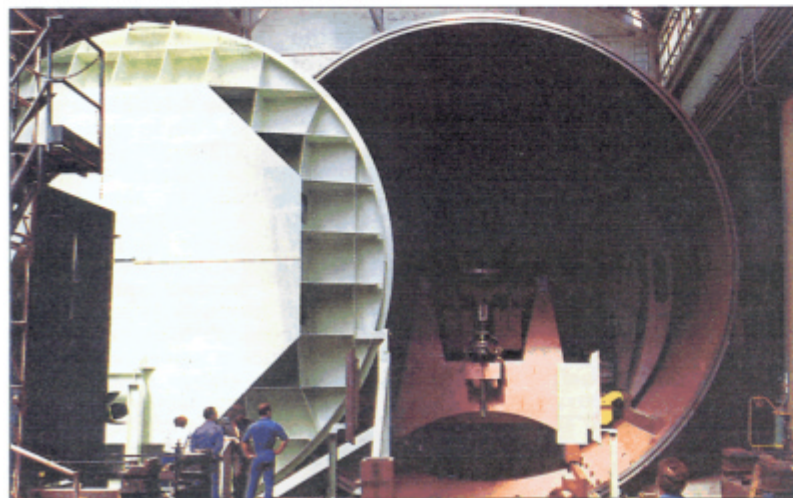
Jean Sommeria devoted all his energies from that time until his death in 1989 to transforming this discovery into an industrial tool, giving reliable and economical service in large scale industrial applications.

In 1964 he floated the TECHMETA Company in Haute-Savoie in a small workshop near Annecy.

In an industrial context where electron beam generally represents the 'High Tech' prestige department of a company manufacturing conventional welding equipment, TECHMETA is uniquely specific: The electron beam is its only reason for existence.

TECHMETA has developed and refined over its 30 years the concept of an electron beam gun, presenting a great number of original features and encouraging it to become a real industrial tool.

An EB 'hyper machine' with 800m³ vacuum chamber.



Equipment development

Some critical choices have formed the basis of the company's progress. The first was a reduction of the working voltage to about 60kV, generally termed medium voltage, to get the same quality of narrow weld as with higher voltages.

This has led to a miniaturisation of the electron gun, allowing construction of very compact machines. Handling the gun in space with the considerable acceleration required for welding at high speed in three dimensions has thus become possible.

The reduction in voltage has also decreased the risks of the process and the required biological X-ray shielding.

Weld beads at 60kV, similar to those obtained at higher voltages, have been achieved by means of high quality electronic optics, assisted by technologies of beam treatment such as vibrating or pulsating the beam, which give precise control. The reduction of voltage has led to a reduced risk of flashback, considerably enhancing the reliability of the process.

A second significant development has been progressed in parallel. It concerns the indirect heating of the cathode by means of a filament located at the rear, maintaining the cathode at the optimum temperature for electron emission. This has made it possible to control the cathode emission and to extend life time up to periods of several hundreds of working hours, diminishing the need for maintenance and the cost of using the process.

The present concept of a medium voltage, indirectly heated cathode for the EB gun has thus taken shape, with all its advantages, to make it a tool perfectly

F Trente ans d'innovation dans le domaine des rayons électroniques pour une firme française

Une gamme de matériels et d'applications toujours grandissante maintient le spécialiste français TECHMETA au premier plan de la technologie des rayons électroniques depuis 1964. Pour son 30ème anniversaire, le Directeur, D. Sommeria, expose à grands traits la philosophie de sa société et met en lumière les perfectionnements, dont une chambre à vide de 800m³ et des canons à électrons de jusqu'à 600 kW.

D Französische Firma blickt auf dreißig Jahre innovativer Elektronenstrahlschweißung zurück

Ein ständig wachsendes Programm an Schweißausrüstungen und Anwendungen sichert dem französischen Spezialisten TECHMETA seit 1964 seine Spitzenstellung in der Technik der Elektronenstrahlschweißung. Anlässlich des 30jährigen Jubiläums der Firma äußert sich ihr Vorsitzender, D. Sommeria, zur Firmenphilosophie und beschreibt unter anderem Fortschritte, die mit einer 800-m³-Vakuumkammer und Strahlkanonen mit einer Leistung bis 600 kW erzielt wurden.

I Trenta anni di innovazione nei fasci elettronici per una società francese

Una gamma sempre in espansione di attrezzature e di applicazioni ha mantenuto la società specialistica francese TECHMETA all'avanguardia della tecnologia dei fasci elettronici dal 1964. In occasione del suo trentesimo anniversario, il Direttore Responsabile, D Sommeria, spiega la filosofia della società e delinea alcune delle novità in preparazione, come una camera a depressione da 800m³ e fasci elettronici da fino a 600kW.



The GENOVA has a 50m³ chamber.

adapted for industrial applications.

Another aspect of the TECHMETA philosophy is always to give priority to the application, and to adapt the concept and the construction of the EB machine to it.

Applications

In some applications EB brings a real improvement on conventional technology, either regarding the quality of the weld, or regarding speed and productivity. In others, EB greatly enhances working conditions, principally for large size or deep penetration welds, and in yet others, EB is the only technical solution.

TECHMETA has accordingly assembled its own workshop of over 16 EB welding machines, the most powerful being 100kW. This facility is at the disposal of industries wishing to access electron beam technology. It allows a company to test a full size application by tuning a prototype, and to advance to a manufacturing series as job shop work. At the same time, and on the basis of such trials in real size, TECHMETA engineers have been able to build and adapt machines corresponding exactly to the needs of customers.

This dialogue between the manufacturer and users of EB welding machines, during 30 years accumulated experience, has put the emphasis on the real industrial function, an exact adaptation to customer requirements, and reliability versus 'performance for performance sake'.

A modular solution

A large range of modular machines is available from TECHMETA for all general industrial applications. They consist in particular of multi-purposes machines (brand name *Medard*), provided with small vacuum chambers. They can be fitted with a large range of tooling or motion systems.

In a recent development, the multi-purpose machine is designed to weld parts needing several operations automatically, or a variety of different parts. A universal indexed fixture allows the machine to recognise the part and to perform a specially adapted welding programme.

The *LARA* multi-purpose machines

are fitted with larger vacuum chambers. They are designed to make it possible to clear the working table completely when the door is opened, and are particularly suited for aeronautical applications. These machines use a combination of a linear external motion of the gun, and linear and circular motions inside the vacuum chamber. This system gives a gain in productivity by reducing the evacuated volume and through easy maintenance of the mechanical systems.

The company also produces a range of high productivity machines designed for special purposes. They are generally built according to the particular specifications of the end user.

Purpose built machines

The business of multi-metal strips welded by electron beam, which includes mainly bi-metal saw blades, invar/stainless steel temperature compensators and copper base sockets for power transistors is one of the oldest centres of activity at TECHMETA.

Here also, the millions of kilometres continuously welded in the company's workshops over 30 years have played a great part in the evolution and increased reliability of the latest generations of machines. These machines profitably use the industrial advantages of medium voltage on very high productivity plants. Their basic set-up consists of two electron guns able to perform two very thin continuous welds, at the same time, at a speed of about 12m/min. Such equipment is in use in Europe, the USA and Asia.

Welding of precision tubes or large size pipe is also a specialised electron beam application area at TECHMETA, in addition to longitudinal welds in pipe making and circular butt welds to form long lengths of pipe.

In this case, electron beam demonstrates its three main advantages:

- Speed of operation, on completely automatic machines,
- precision and quality of the weld, and
- completely reproducible parameters.

These can be decisive for critical applications such as in the nuclear, petrochemical or special piping industries.

Today, computer technology is

invaluable to the electron beam user. It can be used for simulation of the melting process, or for supervision of the electron beam welding machine, for example real time viewing systems. Anti-flashover systems of passive or active type, and vibration or pulse modules are among auxiliary systems developed by TECHMETA. Linked to a measuring centre continuously recording the parameters or selected deviations, these can ensure quality control in industrial production. Connection by modem can allow visualisation at a distance by the supervisor, and efficient help in supervising repair by telephone.

High technology

The latest developments, and the industrial maturity of medium-voltage EB technology, have made it an essential feature of some of the most notable high technology projects currently underway.

Thus the French Navy and the Ariane space consortium have chosen medium-voltage EB for assembling some vital parts, for which TECHMETA has designed and manufactured large, special machines. In these, the EB gun is located inside the vacuum chamber and operated by a multi-axis robot, which allows the gun to move in the whole available space and to access the parts to be welded at the optimum working distance. 'Hypermachines' are the result of this type of plant development, provided with vacuum chambers exceeding 800m³ and a gun power of 80kW.

Further advances

The company's ambitions do not stop at the present stage of development. Its staff of over seventy highly specialised engineers and technicians continue to seek new applications for EB, especially for very large parts and for high power applications.

When the part to be welded is definitely too big for it to be placed inside a vacuum chamber, the solution is a special machine with 'local vacuum'. Spectacular equipment has already been built, for example for applications on nuclear submarine fabrication.

New, still secret, developments are in progress concerning pressure vessels, or other very large structures, that the company claims will soon bring a revolution in EB technology in industrial sectors which have adhered to conventional technology up to now.

With a view to enlarging the applications of EB, TECHMETA has developed very high power units (100 - 600kW). Already important equipment has been delivered to customers for fusion or evaporation in vacuum.

The next 30 years look likely to see a gathering pace of innovation in EB equipment and applications, as a broader range of industries wishes to exploit the advantages of the process.