
Patents and Innovation in Welding Technology and Manufacturing

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INTRODUCTION

In today's economic scenario, competitiveness is influenced by many uncertainties, including such diverse factors as global economic trends, political developments and natural disasters, as never before felt in the past few decades. Therefore, the industry, in general strives to retain its market advantage through all possible means. This is done through increased value addition in every sphere of its activity. An important part of value addition is the continuing process of effecting improvements in manufacturing practices, product design and marketing. In a typical corporate entity manufacturing innovations are piloted by the R&D department, in close co-operation with production or manufacturing personnel. A major part of the organization's resources are spent, therefore in recruiting, motivating, nurturing and coordinating the teams that are part of the innovation chain.

Innovation in the industrial context is a broad concept that refers to any product or practice newly introduced. The driving force for innovation is the savings in time or resources or other value addition that it brings in. Invention is a special case of innovation that has a specific meaning in the context of intellectual property and refers to a product or a process that is both new

and useful. This article and others following it will attempt to demystify patents in relation to the welding field in India. This article will also discuss and analyse patent data in welding processes and welding consumables worldwide.

Any invention can be kept a secret if it is possible to withhold from public knowledge the key aspects that provide the value addition. This option would only provide limited protection against copying by competitors, while severely restricting the way the product or process is industrially applied, for obvious reasons. Therefore, in the general case, it would be imperative to obtain a patent so that widespread propagation and commercialization of the invention is enabled. A patent is a document that provides rights of protection for an invention to its author, the inventor. It carries an assignable right just as with a physical asset. The rights of protection to the invention are provided by the government within its geographical boundaries in return for a complete disclosure of the invention corresponding to the claims for which patent protection is sought. When an application for a patent is made, the document is published by the government before it is examined by the patent office and a patent granted for the invention. Thus, the patent is fully

disclosed to the public before it is examined, and remains in the public domain, with changes, if any, after the grant and thereafter.

The decision to pursue a patent for an invention is taken with several techno-commercial aspects in mind:

- The commercial worth of the invention: this is assessed in relation to the costs associated with patenting and development of the invention to bring it up to marketability, its potential in terms of geographical reach and licensing possibilities and the long term strategy of the company in the domain of the invention.
- The uniqueness of the invention which determines the ease with which copying can be detected and the ability and willingness of the patentee to apply his resources into defending his rights is another major factor in the decision to patent.

Many incremental inventions by themselves may not be worth patenting, if it is a minor improvement to an existing well known product or process and the value addition does not warrant the expense associated with patenting. In many cases pursuing a patent is a business decision fraught with a certain element of risk. A defensive strategy is sometimes adopted to publish the

invention before it is brought to market in order to prevent others from patenting it in the intervening period.

Contrary to common public perception, a patent does not provide the following:

- A patent does not carry any value by itself, unless it is used to earn revenue through licensing. Rather, pursuing and maintaining a live patent involves a lot of expense, which increases with every year that protection is desired.
- A patent is not a document of merit acquiring a patent need not represent any particular distinction for the inventor, academic or otherwise, except through its demonstrated benefit through public use.
- A patent is not an end in itself rather it is just a step in the pursuit of innovative thought and application of those ideas to provide value addition.

INNOVATIONS IN WELDING AND MATERIALS

Welding and materials related innovations can take any of several forms

1. new welding processes new developments or improvements ways to achieve metal transfer, new ways to join metal, new ways to harness physical phenomena for joining materials
2. new materials welding consumables, alloys, fluxes, etc.
3. welding equipment new design of welding power sources, new torches, etc.
4. welded manufacture new ways to construct modular structures, innovations that reduce material

use, novel structures formed by welding

OVERVIEW OF WELDING TECHNOLOGY SCENARIO

Any technological advancement that is commercially useful manifests itself first in the patent landscape. A review of patent databases therefore is revealing of the latest innovations, innovators and the commercial entities involved. However, the vastness of worldwide patent databases makes the problem of search and analysis of data non-trivial and the problem cannot be approached without a certain degree of sophistication. The worldwide welding technology scenario for the past 10 years was reviewed in the patent databases and the results are shown in Figures 1-5. The search strategy adopted was simple with selected keywords confined to title. Because of the limitations of the simple search criteria, the numbers presented here are not representative, but only

indicative of qualitative trends. The 2009 data are complete as of October and do not represent the whole year.

The worldwide patent data relating to welding processes and welding alloy or flux-related developments are shown in Fig. 1 in the period 2000-2009, representing ~6000 patents in worldwide databases. The data show a decline in filings for both categories in the period 2000-2003, before increasing thereafter. A deeper study of the patents published is likely to provide the answers as to the reasons for this variation, but may be roughly correlated to the decline in manufacturing activity in the more developed economies prior to 2003, while the increasing trend after 2004 can be attributed to the rise of consumption in emerging markets, particularly China and India.

(welding and (torch or process or machine)) in the title

(welding and (alloy or composition or filler)) in the title

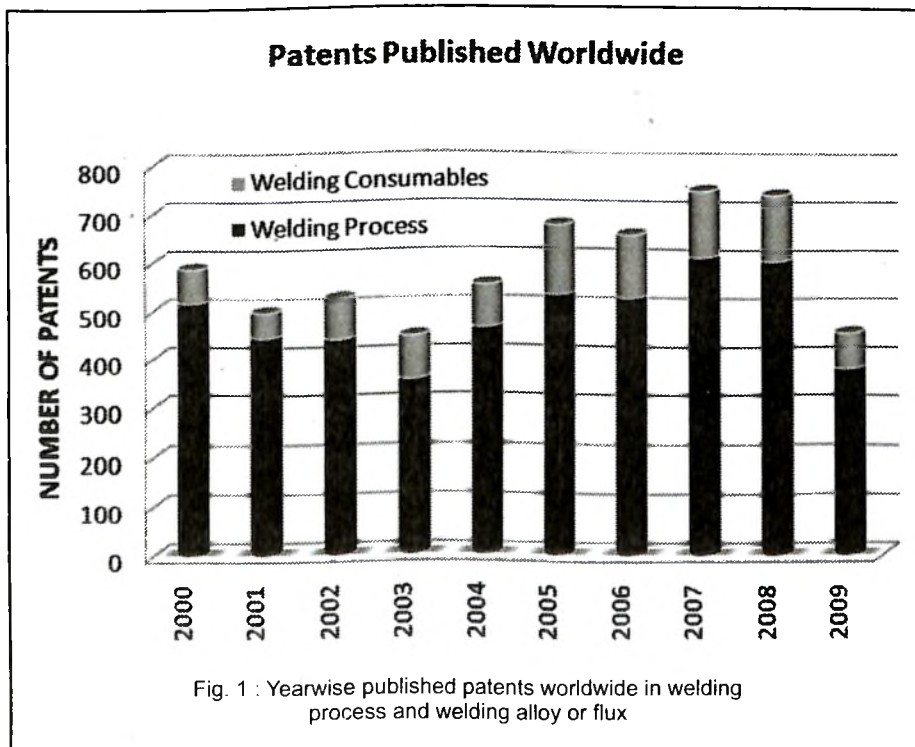


Fig. 1 : Yearwise published patents worldwide in welding process and welding alloy or flux

A breakup of the companies which filed the welding process related patents (corresponding to the dark lower portion of the data in Fig. 1) is shown in Fig. 2. The data shown in Fig. 2 represents a subset of only the top assignees (1221 out of 4868 patents), i.e. assignees having 16 patents or less are not represented. The field is led by the top welding power source equipment makers ITW, Lincoln, Fronius and Panasonic. These companies are followed by many that are involved in welding automation, supply of manufacturing lines, automotive manufacturing and so on. Although there is no direct link between each company's revenue and the number of patents filed by them, the expense involved in filing and maintaining patents does increase with the number filed and this number is therefore indicative of the financial strength of the company.

Further the data on welding alloy or flux related developments corresponding to the top (lighter) portion of data in Fig. 1 has been analysed in terms of the filing country of origin and is presented in Fig. 3. While the data in Fig. 1 represents worldwide patent databases (1008 patents), the data in Fig. 3 is a subset containing only ~300 patents that were filed through the worldwide Patent Cooperation Treaty (PCT). The data can be interpreted in terms of companies that are interested in operating in emerging markets, since the data does not represent some direct filings in a native country that may not have been filed as PCT. Another confounding factor that is generally present in patent data is the presence of multiple filings for the same invention, which may require deeper analysis to separate. It is observed from Fig. 3 that China leads the field with 39% of the filings with

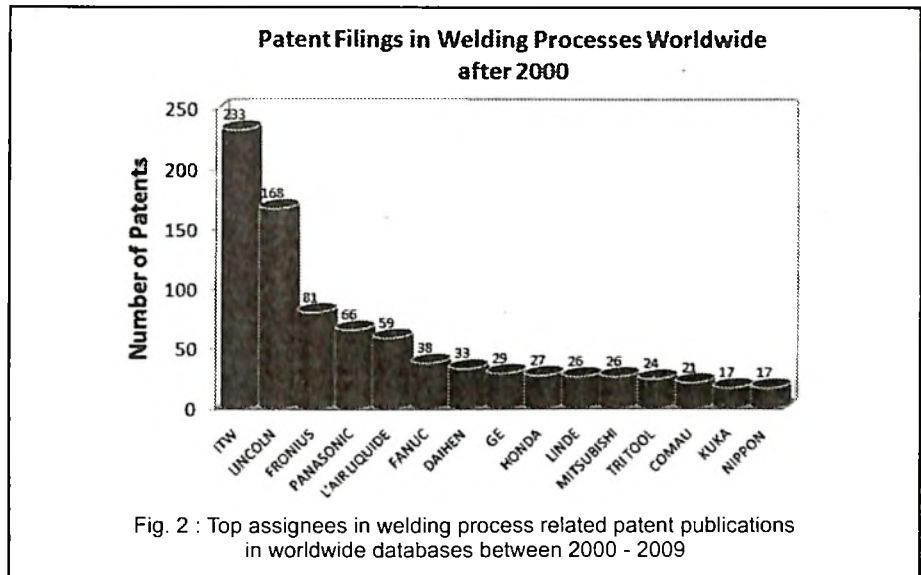


Fig. 2 : Top assignees in welding process related patent publications in worldwide databases between 2000 - 2009

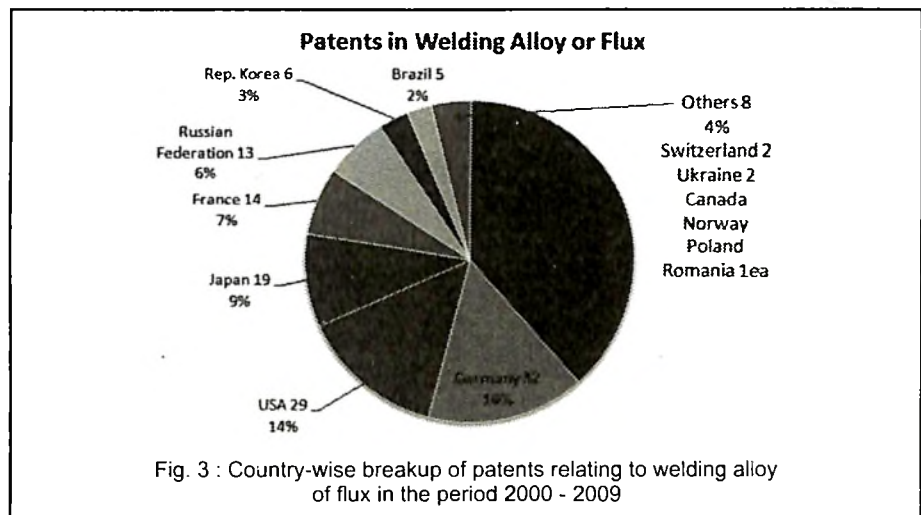


Fig. 3 : Country-wise breakup of patents relating to welding alloy or flux in the period 2000 - 2009

Germany and USA following with 16 and 14% of the filings, showing the strong emergence of Chinese in welding and materials-related innovation.

The data corresponding to Fig. 3 is represented in terms of the assignee companies in Fig. 4, where it emerges that there are no major dominant assignees unlike in equipment. The top of the field is represented by Nippon Steel, EPRI, ExxonMobil, Framatome, Wuhan Iron and Steel, and Kobe among others. Nearly half of the filings designated Group 1 in Fig. 4 are by 120 assignees with one or two patent filings only, many located in China, Korea and

Japan, which partially correlates with the large number of filings from China in Figure 3. Group 2 represents companies with 4 patents each, while Group 3 represents companies that have 3 patents each.

The innovation scenario in welding can be analysed by reviewing the Indian patent databases. Indian patent databases are not completely searchable unlike the PCT database or other national databases such as US and EP that are much more accessible. A limited search of the Indian patent database was conducted through a non-government database available with Big

Patents (<http://india.bigpatents.org>) that retrieved 300 patents with the keyword "welding" and the results are shown in Fig. 5 (a) and (b). A breakup of companies (Fig. 5 (a), left side) shows that the major entities who have actively filed in India so far are Lincoln followed by some of the European majors. Fig. 5 (a) represents ~104 patents assigned to major companies and entities only out of the 300 patents analysed. The rest of the patents have been filed by a large number of entities or individuals with 1 or 2 patents in their name. While there may be several reasons as to why the worldwide filing trend is not replicated in

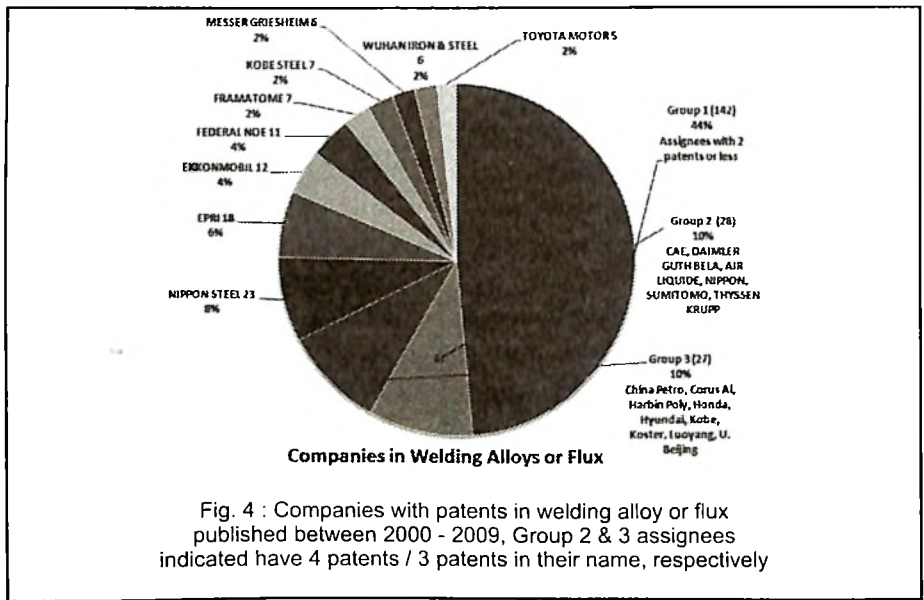


Fig. 4 : Companies with patents in welding alloy or flux published between 2000 - 2009, Group 2 & 3 assignees indicated have 4 patents / 3 patents in their name, respectively

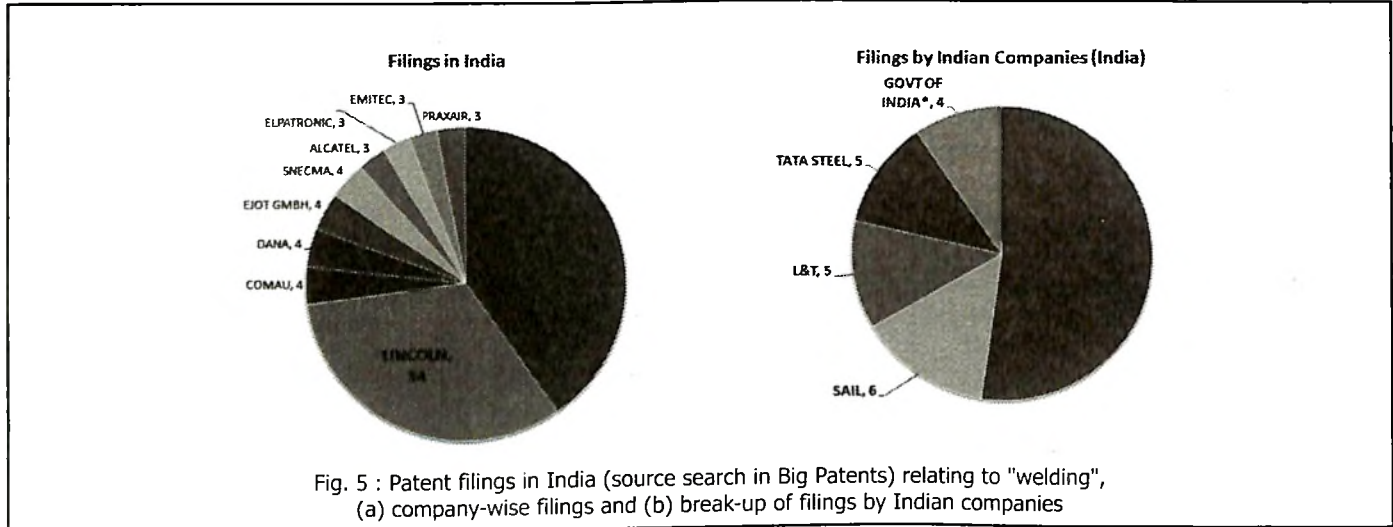


Fig. 5 : Patent filings in India (source search in Big Patents) relating to "welding", (a) company-wise filings and (b) break-up of filings by Indian companies

the Indian filings despite the presence in India of most of these companies, the emergence of India as a major technological and innovation market has skyrocketed filings in India in recent years according to patent office sources (http://ipindia.gov.in/cgpdtm/AnnualReport_English_2007-2008.pdf). The increased filings will manifest in the next few years as issued Indian patents in greater numbers. World Intellectual Property Organization (which supervises the PCT patent filing system) released figures recently for the year 2009 show that 761 PCT applications were filed from India (in all fields including

welding), while 7946 applications originated in China in the same period (http://www.wipo.int/pressroom/en/articles/2010/article_0003.html).

Analysing the filings by Indian companies, a look at major entities reveals that Indian filings are dominated by the public sector giants BHEL and SAIL, along with Govt. R&D units. In the private sector, L&T and Tata Steel seem to be the only companies that have filings in India as of date, apart from individual inventors.

In summary, analysis of the patent databases with reference to welding

process and welding filler or alloy or flux revealed companies that are leading global entities in welding technology.

In the area of welding consumables (alloy or flux), the market is much more fragmented and there are a large number of small companies, particularly from China.

Filings in Indian patent databases are dominated by overseas companies. Among the Indian companies, government-owned companies are dominant filers (75%), while privately-owned companies filed only 25% of the patents filed by Indian companies.