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Why is it called Silver Steel?

Commerce and 'spin' in the Nineteenth Century

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Why is it called Silver Steel?

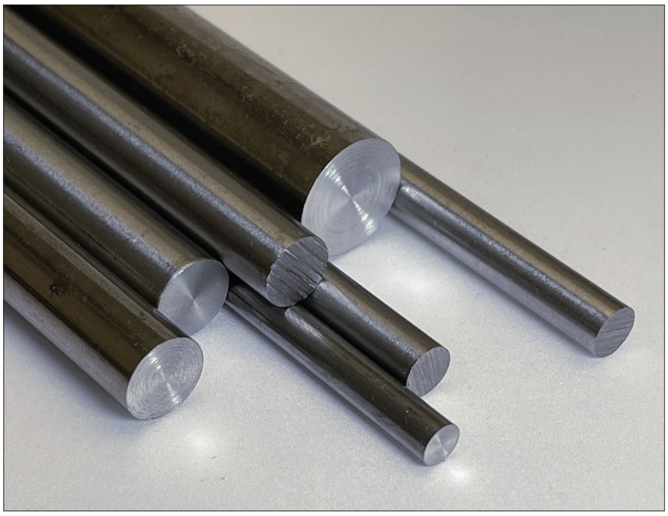
The majority of the readers of this *Journal* may be perfectly familiar with the term Silver Steel, regarding it as a readily available material, obtainable in a wide range of sizes, true to size, with a good surface finish, sold in the peculiar length of 13 inch, and capable of being hardened.

Nowadays, a variant with easier machining properties is fairly widely available. From the point of view of its use this knowledge is likely to be all that is really necessary. Living and working in Sheffield, the traditional home of fine quality steel, my interest goes somewhat deeper, and two particular aspects have long puzzled me — why the peculiar length, and why the name 'silver'?

As far as the length is concerned the majority of the texts I have read suggest that 13 inch enabled the manufacturer to mark his trade mark at one end and still leave a usable one foot piece. It is certainly true that one of the early and major manufacturers, Peter Stubs of Warrington, did mark his name on the larger diameters, but in the smaller sizes marking seemed to be conspicuous by its absence. Another suggestion has been that 13 inch closely approximates to the old French foot (*pied-de-roi*) and the adoption of this length would enable the maker to satisfy both home and export markets from a single stock. This hardly seems particularly tenable; manufacturers are not normally so altruistic as to give away an extra eight per cent on every length sold in the home market.

Peter Stubs was a major force in the pinion wire market; this was a fairly expensive material compared with the plain types of wire. It is recorded that Lancashire had for a considerable period a monopoly of its production, but that eventually manufacture took place in London as well, undercutting the Lancashire prices. With a costly product, there could be an incentive to devise a length which would give the maximum utilisation. I consider, after much thought and measurement, that 13 inch was decided on as yielding either two centre arbors or three normal arbors for a longcase clock, and that later this became the standard length for round wire as well. It should be noted that silver steel was only priced per length in the retail markets; sales from the manufacturer were always by the box of so many pounds.

The derivation of the term 'silver' as applied to steel had for many years been a mystery. The usual opinion, that the term was merely a reference to its bright surface, seemed hardly satisfactory and yet no other explanation, other than the obvious one that it contained real silver, was available. Some time ago I was discussing this problem with a friend who has an encyclopaedic knowledge of Sheffield industry and mentioned a reference I had encountered to the famous physicist Michael Faraday having had special steels melted in Sheffield in the 1820s by Sanderson Brothers (the forerunners of the present steel and tool manufacturing concern,



Sanderson-Kayser). He offered the loan of a book, written in 1931 by R. A. Hadfield, one of the finest metallurgists and steel-makers in the history of the industry and who may justly be regarded as the pioneer of modern alloy steels.[1] This book finally solved the mystery; Michael Faraday had in the period 1821 to 1824 co-operated with a London cutler and surgical instrument maker, James Stodart, in an extensive series of experiments on the effect of adding various likely and unlikely elements to steel in an attempt to improve its properties. It was only a few years before that the real nature of steel as being an alloy of carbon with iron established by the French scientist, Reaumur, had been widely accepted. Prior to this, steel had been regarded as a particularly pure form of iron and steel-making processes as ways of removing impurities rather than actually adding anything to the basic material.

In the 1740s a Quaker clockmaker, Benjamin Huntsman, had developed in Sheffield the steelmaking method known as the crucible process and this is generally regarded as the first time that steel had been made in a liquid form with the consequent advantages of uniformity and an almost total absence of slag inclusions. However, later in that century, considerable interest was engendered by the importation of small quantities of a steel from India. Known as 'Wootz', It would appear that this was made by a form of crucible casting and was only available in the form of small cakes, weighing about 1kg each.

Stodart had a high opinion of this material and is recorded as having used it in at least some of his surgical instruments and razors, as well as having personally forged the knife edges for Captain Kater's famous pendulum from it. At this period one of the most highly regarded features of crucible steel was its ability to take a very high polish and it appears that at least part of the Faraday/Stodart project was to try and reduce its propensity to rust, in an endeavour to render it fit for use as mirrors for reflecting telescopes. It was believed that Wootz had certain peculiarities of composition which enhanced its hardenability, corrosion resistance, and also enabled an effect similar to the damascening, which had always been one of the features of the famous swords known as Damascus to be simulated. For a period of some years limited amounts of this Indian steel were imported into England; high hopes being held that on the larger scale it could be cheaper than the English product, since labour costs in India were low and it was believed that the sub-tropical climate would ensure almost unlimited supplies of cord-wood for making the necessary charcoal. This seemed to be one of those unrealised dreams of Empire and gradually interest was lost.

Faraday and Stodart's approach appears to be one of using only the so-called 'noble' metals. Such exotica as platinum, palladium, iridium, and osmium — metals which had only relatively recently been isolated by Dr. Wollaston, were added in fairly high proportions despite their great cost, the necessary materials being supplied by Wollaston without charge.

Silver additions at varying levels seem to have had only limited success, the very low solubility of silver in iron caused segregation on solidification and microscopical examination revealed Silver in a thread-like form in the iron matrix. Despite this, very low levels of Silver did seem to improve the qualities of the steel, and trial melts were produced by the then largest steel producers in Sheffield, Sanderson Brothers at their works on West Street. Strict secrecy was ensured by a trusted employee of Faraday watching the additions being made during the melting process, having brought these up from London by stage-coach. Sanderson's appear to have bad no direct knowledge of the nature of the additives and seem merely to have acted as sub-contractors for the actual melting.

Sir Robert Hadfield was lucky enough to have access to the samples of Faraday's materials and to razors which Faraday had presented to his friends and, in some cases, used himself His book details the analyses which, with the full resources of a major steel-works laboratory, he had carried out. It is noticeable that in none of the examples actually made into implements could the presence of silver be detected. This raises the question: had Faraday been misled in his belief as to the efficacy of silver in steel or had a commercial deceit been practised on him? Some light is shed on this situation by quoting from Faraday's own paper; in discussing the properties of steel alloyed with 0.2% silver, he claims 'This alloy is perhaps only inferior to that of steel with rhodium, and it may be procured at a small expense; the value of silver, where the proportion is so small, is not worth naming; it will probably be applied to many important purposes in the arts.' It seems that Faraday was sure that silver would be commercially successful as an alloying material.

Contemporary use of Faraday's alloys is indicated; correspondence from the Sheffield company of Green and Pickslay survives. On April 14th 1824, they write to Faraday expressing interest in his published report, mentioning that they saw possibilities in using his alloy steels for cutlery and also for the front of stoves and fenders where the ability to take a high polish was requisite. They also ask where the necessary alloying ingredients could be obtained 'on the best terms and price'. A subsequent un-dated memorandum confirms that they have obtained the alloying materials from Mr. Johnson of 79 Hatton Garden (the founder of the precious metal company Johnson Matthey), have conducted a series of experiments and have sent Faraday a pair of razors made with an alloy containing silver, iridium. and rhodium. A later letter perhaps indicates that 'passing off' is not a totally new phenomenon in commerce; dated November 16th 1826, parts of it read: 'I send you a razor marked 'Silver Steel', it is made of the commonest steel that can be produced, the Person who forged it informs me, he makes a great quantity, of the same quality all marked 'Silver Steel'. We therefore deem it prudent to keep the alloys we use secret, for should we publish them, the same Persons who mark 'Silver Steel' on such spurious articles as the blade sent, would not hesitate to assert that they used the same alloys as we did and thus bring it into disrepute.'

No further developments seem to have taken place and any return correspondence from Faraday has not been discovered. A fashion then seemed to develop in the specialised business of producing high quality steels by the crucible process. Steel was sold bearing such brands as 'Peruvian Steel'; perhaps an indirect reference to silver, since at this period much silver was being mined in places such as Peru. Companies were not above inventing non-existent elements, such as Volanium, and letting the customer believe that some magic nostrum was included in their material. It should be remembered that, at this time, steel was made on a craft basis from very pure Swedish Iron, carburised by packing in charcoal at a very high temperature; the resulting 'blister steel' then being broken into pieces and melted in special fire clay crucibles holding perhaps 40 pounds. The main controls exercised over quality were the selection of raw materials especially low in sulphur and phosphorous, sorting into closely defined limits of carbon content by highly skilled visual examination of the fractured surface of the resulting ingot and careful forging and rolling of the bars before sale. Even as late as 1902, references to such practices can be found: Tool-Steel, by Otto Thallner of Bismarckhütte in Germany states, 'varieties of steel, especially of English origin, are brought into commerce under the names of molybdenum steel, titanium steel, vanadium steel, but of course they do not contain any of these constituents.'

I conclude that the evidence suggests that:

1. Initially, efforts were made to alloy small percentages of metallic silver in steel in an honest attempt to improve its properties.
2. Very quickly, less honest manufacturers claimed the presence of silver in their own products without going to the trouble and expense of actually including any.
3. Eventually, the term 'Silver Steel' became purely a trade description for a good quality high carbon steel and was applied to both black and bright finishes. The term has persisted in the case of the drawn and centreless ground material familiar today.
4. Any actual improvement found by Faraday and Stodart may well have been due to the greater care taken in the selection of particularly good base materials for their trials, and equally careful melting and subsequent manipulation of the alloyed material.

Whether the addition of a small percentage of silver actually does improve the properties of a high carbon steel I have not been able to reliably ascertain, since no modem textbooks available consider silver as an alloying material in ferrous metals.

Acknowledgments:
My thanks are due to K. W. Hawley for the loan of the book by Sir Robert Hadfield.

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1. Hadfield, Bt, Sir Robert A, *Faraday and His Metallurgical Researches with Special Reference etc.* (London: Chapman and Hall, 1931).
2. Thallner, Otto, *Tool-Steel, A Concise Handbook on Tool-Steel in General, etc.* (Philadelphia: Henry Carey Baird, 1902).

This article was first published in the *Journal of the South Yorkshire Industrial History Society* (Edition number 2 of the year 2001). Its really interesting insights warrants this re-publication for the benefit of a wider audience.

Jim's profession was a Quality Control Engineer working many years with Stanley (tools) and later with Rabone Chesterman (precision measuring devices).

Since his retirement he has been a regular contributor to the *Horological Journal* on subjects ranging from horological tools, watchmaking, and metallurgy in addition to being a technical consultant and peer reviewer.

Ken Hawley, passed away in 2014. His huge collection of tools is preserved as the Ken Hawley Collection Trust and is housed at Kelham Island Museum in Sheffield. In addition to the really interesting collection of tools, Kelham Island is well worth visiting, especially when they fire up their huge triple-expansion marine steam engine (with a flywheel taller than a man), get it running at high speed, and then terrifyingly, throw it into near-instantaneous reverse. —JJK.