The Mystery of the Galvanic Goblet*

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Among the great collection of Royal Plate at Windsor Castle is a small goblet made in 1814 for the Prince Regent to a design by John Flaxman (1). It bears the mark of Paul Storr, who was at that time a partner in the firm of Rundell, Bridge and Rundell in Dean Street, Soho. Its quite exceptional, indeed unique, characteristic, however, is that, deeply engraved on the underside of the base, there are the words 'Galvanic Goblet', indicating that it was gilt by electroplating.

This goblet features in the inventory compiled by Rundell, Bridge and Rundell for William IV in 1832 as

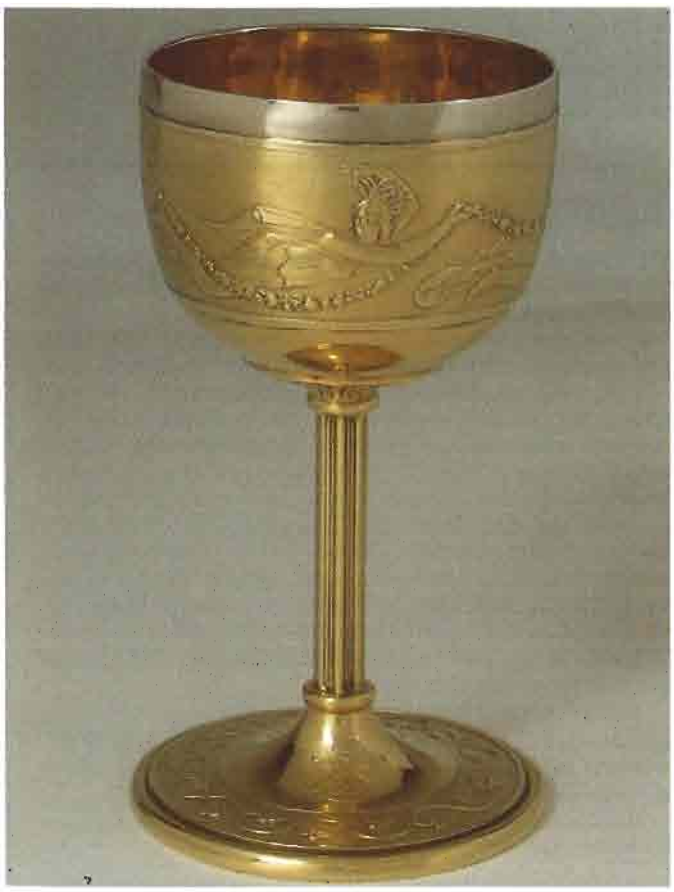
> 'A very small Galvanic Goblet, with basso relieve of the Hours around the body. From Flaxman.'

and again in the inventory prepared by Garrard and Co. in 1914 as

> 'A small Goblet with Basso-relievo of the Hours round the Body Paul Storr, 1814, 5oz. 4 dwt.'

The great problem it poses for historians of metal work is of course the extremely early date for the use of electrogilding. It has quite often been referred to as the first example of such a process, but it is well established that the successful electrodeposition of gold — and of other metals — was not achieved until around 1840.

The silver-gilt goblet, designed by John Flaxman and made by Paul Storr in 1814 for the Prince Regent, is still in the Royal Collection. Inscribed underneath the base 'Galvanic Goblet', this has always been taken to indicate that it was gilt by electroplating, in the terminology of the time, by the galvanic current derived from Volta's famous pile discovered by 1800. It was not, however, until around 1840 that the electroplating of gold or of other metals became a practical process. Photograph by gracious permission of Her Majesty the Queen.



The history of electroplating goes back to the invention by Alessandro Volta, (1745-1827), Professor of Natural Philosophy in the University of Pavia from 1778 until his retirement in 1819, who spent some nine years developing his *Couronne de tasses,* the electric pile or battery consisting of a column of silver and zinc plates in contact, each pair separated by a moist pad of cardboard. With this, for the first time, a continuous current of electricity could be produced, as distinct from the high voltage discharges, lasting only a few seconds, obtainable from the older static electrical machines. In 1800 Volta compiled a long letter to the then President of the Royal Society, Sir Joseph Banks, who quickly conveyed the news of this great discovery to some of the scientific community in London even before it was officially read to the Society in its meeting.

Several scientists immediately set about constructing Volta's pile for themselves, among them William Nicholson, Sir Anthony Carlisle, the chief surgeon to Westminster Hospital, and William Cruickshank, chemist to the Ordnance and lecturer in chemistry at the Royal Military Academy at Woolwich, while similar activity went on in France and Germany. In the course of these many experiments, it was found that a deposit of metal would be formed at the negative pole when copper wires were connected to the pile and immersed in dilute acids. All such deposits, however, were of a feathery or tree-like growth, and it was many years before the deposition of a smooth, coherent and adherent layer of metal became a practical possibility.

It was not in fact until 1836 that the invention of a constant battery by Professor J. F. Daniell (1790-1845) of King's College, London, provided a much more reliable source of current for researchers in electrodeposition and lead to the production of thin and uniform coatings. In the same year Warren de la Rue (1815-89) of the famous firm of printers, experimenting with Daniell's new source of current at the early age of twenty-one, obtained continuous and smooth deposits of copper, but the first successful electroplating of gold was the subject of a British Patent, No. 8447, filed in 1840 by George Richards Elkington (1800-65) and his cousin Henry (1810-52), Birmingham manufacturers of military badges, buttons and other small articles such as snuff boxes and spectacle frames. In this field of work they were naturally anxious to discover an improved means of gilding to replace the mercury amalgamation method which had such injurious effects on the workmen, and in the development of their new process they had the co-operation first of one of their own assistants, Alexander Parkes (1813-90), and then of a Birmingham surgeon John Wright (1808-44), who had independently devised a process employing gold cyanide as the

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electrolyte, and who now came to terms with the Elkingtons.

The great possibilities of the new gilding process were also realised by Charles Christofle (1805-63), the founder of a small jewellery manufacturing firm in Paris who, after some initial legal wrangles, took a licence under the Elkington patents. Other inventors and researchers now became active, particularly Alfred Smee (1818-77) first a surgeon at St. Bartholomew's Hospital, but then appointed surgeon to the Bank of England, who carried out all his experimental work there, devising an improved type of battery and compiling a remarkable text book, *Elements of Electrometallurgy* by the end of 1840.

The electroplating of gold was at last firmly established as an industrial process — a fact and a date that make it quite unlikely that a silver vessel could have been successfully gold plated as early as 1814.

It has always been assumed that the surface now to be seen on the Galvanic Goblet is an original electrodeposited finish. At the present writer's request, however, the goblet was scientifically examined. This examination was made possible by the gracious permission of Her Majesty The Queen and by the generous co-operation of Mr Geoffrey de Bellaigue, Surveyor of the Queen's Works of Art, to whom the author is grateful. The report of that examination, carried out in the British Museum Research Laboratory by Mr W. A. Oddy, with the assistance of Mrs Susan La Niece, reads as follows:

Galvanic Goblet from the Royal Collection

'We have now examined the gilded surface of this goblet by x-ray fluorescence analysis on both the outside of the bowl and on the foot. In both cases the gold contained a significant amount of mercury, strongly suggesting that the gilding was applied by the fire-gilding process and not by electro-plating.

In addition, examination under the microscope reveals the presence of minute bubbles in the surface of the gilding. These are hollow, and are thus characteristic of fire-gilding. Finally, the edge of the gilded area round the rim is not a straight line, but has the typical appearance of fire-gilding.

It must therefore be concluded that the gilded surface is the result of fire-gilding. Of course this does not exclude the possibility that a thin layer of gold was originally applied to the surface by electro-plating, and that it was subsequently covered by a thicker layer of gold using the amalgam process. Unfortunately, however, there is no way of testing this hypothesis scientifically.'

How then to explain the phrase inscribed on the base: Galvanic Goblet? One possible answer can be put forward. In the University of Pavia was an older collegue of Volta and his close friend, the Professor of Chemistry, Luigi Valentino Brugnatelli (1761-1818). Deeply interested in Volta's new source of electricity, and in its importance to the study of chemistry, Brugnatelli also began experimenting with electroplating, but as had the English scientists, he first obtained only 'beautiful crystals', but in 1803, writing in the journal he himself founded and edited, *Annali di Chimica di Brugnatelli,* he reported the deposition of copper, platinum and gold from an ammonium solution of those metals.

A year later, in a letter to his friend, Professor Jean Baptiste Van Mons of Brussels, who edited a similar journal, *Annales de Chimie de Van Mons,* he wrote that he had recently gilded two large silver medals 'by bringing them into communiction, by means of a steel wire with the negative pole of a Voltaic pile, and keeping them, one after the other, immersed in ammoniuret of gold newly made and well saturated'. This letter was reproduced in the *Philosophical Magazine* in 1805.

A rather more detailed account of his gold plating process was given by Brugnatelli in 1807 in another Italian journal, *Bibliotheque di Campagne:*

'The object in silver which is to be gilded must be immersed completely into the liquid containing the ammoniuret of gold, the galvanic circuit is closed by a wide band of moistened cardboard which passes from the ammonia to the positive pole of the pile, and in several hours the silver is found to be completely gilded by the galvanic action. The gilding can be coloured by the usual means and it takes the most brilliant lustre with the scratch brush of the gilders.'

The last sentence might well be taken as showing that Brugnatelli worked in cooperation with a practising silversmith or jeweller to achieve the results he described. But in the 1840s trials carried out by Charles Christofle, the Paris jeweller mentioned earlier, and published by him in his 1851 *Histoire de la Dorure et de L'Argenture Electrochimique,* led him to conclude that gilding by this method would be impracticable. Using the solution proposed by Brugnatelli, he found it to be quite unstable and to decompose, the gold passing out of solution, while he also considered that such deposit as he obtained was of very poor appearance.

Thus it seems likely that, while the Galvanic Goblet, already engraved with this name on its base, might initially have been the object of an attempt to apply electrodeposited gold, it seems likely that the result was found to be unsatisfactory — certainly for a royal customer — and that any such coating was then followed by a much thicker fire gilding.

One further intriguing possibility has been advanced by Mr A. M. Weisberg of Providence, Rhode Island, prominent in the gold electroplating industry and in its history, who believes that one of Paul Storr's workmen came from Pavia, that it was he who made the goblet and that he may well have learnt of Brugnatelli's embryonic gold plating process from the professor himself. But in no way can this goblet be regarded as the first, or even as an early, example of successful electroplating of gold.

Reference

(1) Exhibited at the V. & A. *Exhibition of Royal Plate,* 1954, No. 93: 'Goblet, gilt (height 5 in.) 1814: Paul Storr'. The fullest published description is in S. Bury, 'Victorian Electroplate', *Country Life*, 1971, pp. 6-7.