

William John Cock

A FORGOTTEN PIONEER IN THE METALLURGY OF PLATINUM AND PALLADIUM

By L. B. Hunt

The Johnson Matthey Group

For almost ten years after he established himself as an assayer and refiner Percival Norton Johnson worked entirely alone. His widening interests in the then booming lead, copper, silver and tin mines in Devon and Cornwall began to involve him in frequent spells of absence from London and he looked around for a partner to share his activities in Hatton Garden. His first choice was a fellow assayer, George Stokes, but the latter's death in 1832 put an end to the partnership.

How his choice of a successor was made, and how the man then selected, hitherto quite inexperienced in anything chemical or metallurgical, rapidly acquired a sound knowledge of his new profession, involves a complicated story of family connections.

The Family Background

The Cock family originally came from Kendal where in the seventeenth century several members held office as mayor. Towards the middle of the eighteenth century some of the younger members of the family moved to London, setting up as Hamburg merchants, exporting English woollens and importing German linen goods for finishing in this country. One of the brothers, Thomas Cock, retired to Tottenham where he and his family became well established in a country house and grounds. Thomas's first wife died and he then, in 1765, married Ann Green who had a brother Joseph who married Frances Cline, the sister of the famous surgeon Henry Cline of St. Thomas's Hospital and a pupil of John Hunter.

By his second marriage Thomas Cock had four children, Ann, John, Edward and Thomas, and as they grew up the parents entertained on a considerable scale and received

a number of distinguished visitors, among the regular guests being Henry Cline. In 1784 Cline had accepted into his own house a handsome young man from Norfolk who was to become his pupil, and he in turn became a regular visitor to the house in Tottenham. This was Astley Paston Cooper, later himself to become a most distinguished surgeon, and in due time he sought Thomas Cock's permission to marry his daughter Ann. This proposal was not received with enthusiasm, as a struggling young surgeon did not seem to be a sufficiently attractive prospect in view of Ann's wealth and position. Cock was, however, a sufferer from gout and Astley Cooper was so attentive to his prospective father-in-law that he became reconciled to the marriage and furnished a London house for the young couple.

Unfortunately just before the day fixed for the wedding in 1791 Thomas Cock became seriously ill and in fact died on that very day, but on his death bed he asked his future son-in-law "to be a father to my sons and to take care of Ann". The eldest son John became a prominent citizen in Tottenham and an underwriter at Lloyds; Edward, the second son, became a well known surgeon, spending a lifetime at Guy's Hospital and enjoying great respect there; Thomas, the youngest, who plays a leading part in this story, was only four years old when his father died and thus became a prime concern to his new brother-in-law and guardian, Astley Cooper. Thomas attended Charterhouse as a day boy for a short period, but Cooper was soon to place him in a most interesting environment. Quite early in his career Astley Cooper had been appointed lecturer in surgery in the medical school at Guy's Hospital, and in 1799 he was joined, as

lecturer in chemistry, by William Allen of the famous Plough Court Pharmacy in Lombard Street who, three years earlier, had founded the Askesian Society there. Allen and Astley Cooper became friends and thus it was that Thomas Cock, now aged thirteen, was taken into the pharmacy as a student or apprentice in 1800.

Allen and Cock Produce Malleable Platinum

William Allen, among his many chemical activities, took up the refining and fabrication of platinum in 1805 and in this he was assisted by Thomas Cock; the entries in Allen's cost book, headed "T. Cock", have survived and demonstrate the production of a number of crucibles, tubes and other articles in that year (1). No doubt Allen was fully occupied in running his extensive pharmaceutical business and the young Cock continued the work on his own, developing a powder metallurgy process that was described in 1807 in "A Dictionary of Chemistry and Mineralogy" compiled by the brothers Arthur and Charles Aikin as a process "that has been attended by Compleat Success" (2) although no attempt was made to remove base metals, nor was there any knowledge of the presence of iridium, osmium, palladium and rhodium in the starting material.

William John Cock 1813-1892

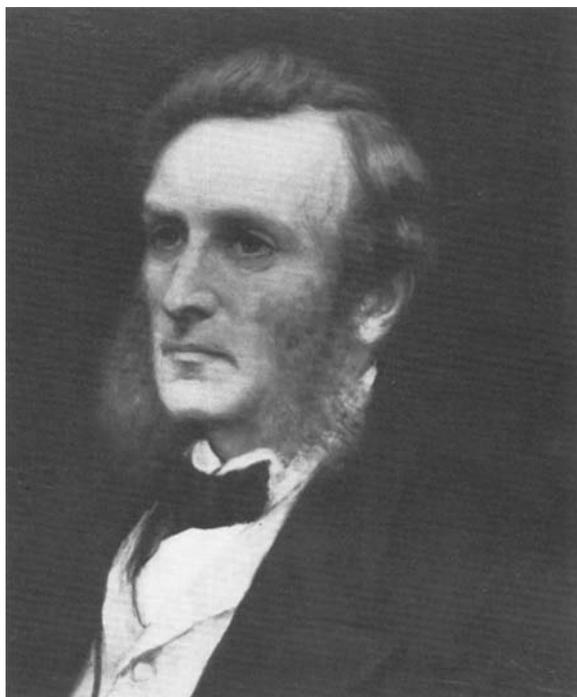
Apprenticed to Percival Norton Johnson in 1833, Cock rapidly acquired a sound knowledge of the platinum metals and in 1837 was taken into partnership. Unfortunately his health was never robust and he retired in 1845, returning however for two further periods to assist Johnson and the young George Matthey. His contributions to the refining and fabrication of palladium and platinum were outstanding in the early years of the industry

His process became, however, the one adopted by Johnson, by the French and by the Russians until William Hyde Wollaston disclosed his improved method in 1828.

Now Cock had married, in 1809, Anna Maria Smith, daughter of Thomas Smith who was Vestry Clerk to the Parish of Tottenham and also Receiver-General to the Dean and Chapter of St Pauls, and they set up house in Hackney where the husband built a laboratory and continued to work on platinum, severing his connection with Plough Court, and associating himself with Percival Norton Johnson, who almost certainly supplied the native platinum. So it was that when Johnson embarked on the refining of platinum it was Cock's process that he used, and it was Cock himself who supervised operations, spending much of his time in the Hatton Garden laboratories until his death in 1842.

The New Partner

In 1817 Johnson married Elizabeth Lydia Smith, the younger sister of Mrs Cock, doubtless having come into contact with her



family through his friendship with Thomas Cock. It was natural, therefore, that when George Stokes died Johnson should turn for advice about a successor to his old friend, collaborator and brother-in-law.

The person suggested was his second son, William John, now approaching twenty-one, who had been articled to a solicitor in 1828 but like his father had a flair for chemistry. On receiving an offer from Johnson the young man abandoned the legal profession and entered the business with the promise of a partnership. This came to pass in 1837, the firm then changing its name to Johnson and Cock. The new recruit quickly acquired a knowledge of chemistry and metallurgy and began to improve the procedures for platinum fabrication, increasing the size of the equipment and so of the ingots from a mere six ounces to about sixty, introducing a sectional mould for the powder and replacing an old screw press with an hydraulic one, but still using his father's process.

Palladium and Its Alloys

For a number of years Johnson had been successfully engaged in the extraction of palladium from Brazilian gold, and the young Cock also interested himself in this metal. One result of his activities was the reading of a paper to the Chemical Society in 1843, "On Palladium—Its Extraction, Alloys, etc." (3) (Both he and Johnson had been founder members of the Society two years earlier). After detailing the method of extraction and refining he gave a perceptive account of the major properties of palladium, its resistance both to corrosion and to oxidation, except at high temperature, and the subsequent reduction of the oxide when the temperature is raised still further, and concluded:

"It may be alloyed so as to be malleable with gold, silver and copper, several of its alloys with the two latter metals being of great use in the arts from their hardness and elasticity, and non-liability to rust or tarnish. When added to gold or copper, it whitens both these metals in a very great degree, about 20 per cent being sufficient in either case to destroy the colour of those metals.

The uses to which the alloys of palladium have been applied are for the points of pencil cases, for

lancets for vaccination, for the graduated scales of instruments, as a substitute for gold in dental surgery, or for any purpose where strength and elasticity, or the property of not tarnishing, is required."

The great Professor John Percy, in his book on the metallurgy of silver, later wrote:

"Mr. W. J. Cock was the first to investigate the alloys of silver and palladium and to introduce into the arts the alloy consisting of 60 per cent silver and 40 per cent palladium." (4)

More than a hundred years have passed since this was written, but it is something of a tribute to William John Cock that this particular alloy is still very much in demand.

A Break in the Partnership

Sadly the partnership with Johnson was not to last long. In 1845, his health troubling him, Cock retired, aged only thirty-two, but four years later, unable to remain idle, he returned to Hatton Garden, no longer as a partner but in his own words "to help out". In 1852 his health again failed; he embarked on a voyage to Australia but remained there for only three weeks, returning to England and again to Hatton Garden, this time taking entire charge of the platinum refinery.

The Melting of Platinum

By this time Johnson had acquired a new partner in George Matthey, and it was he who, on a visit with Cock to the Paris Exhibition of 1855, made contact with Henri Sainte-Claire Deville and Jules Henri Debray who were developing their method of melting platinum in a lime-block furnace fired by a mixture of oxygen and coal gas. In 1857 Matthey acquired the British rights under their patent, and there followed a long and tedious series of experiments, fraught with difficulties, to put the new process into successful operation. Oxygen was not available as it is today and had to be prepared on the spot from manganese dioxide, while the pressure of the London coal gas supply was extremely low. Cock now came to the help of his younger colleague and proved an invaluable collaborator. Some of his diaries have survived in the possession of Johnson

13 Ash WEDNESDAY [44-331]

a little Rain.
Tried fusion of Plat. with G.M. - could not
succeed - as the flame tho' it was well
a strip of Plat. ^{4 in} about its middle part
would not keep the button fused on the
bottom of the furnace - D. Faraday was
present. Cut out 25 1/2 circle of
No. 9 Plat. sheet for bottom of Refy. vessel.

This entry in Cock's diary records the visit of Michael Faraday to Hatton Garden to witness the melting of platinum, just before his famous lecture on platinum to the Royal Institution

Matthey and a few entries from February 1861, by which time the process was still not fully operative, show something of the problems.

"6 WEDNESDAY, Read Deville's last letter to Matthey. . . Prepared and set iron retort in furnace room and charged it with 98 lbs ox. manganese.

8 FRIDAY, A little rain. Set retort again and lit fire. When some oxygen had come over the retort melted. Had old wrought iron retort re-fitted.

11 MONDAY, A little snow. Charged wrought iron retort and set it ready in furnace for lighting tomorrow morning.

12 TUESDAY, Fine. Oxygen fire kept going all day, but ox. came over very slowly.

13 WEDNESDAY, A little rain. Tried fusion of platinum with G.M.—could not succeed—as the flame tho' it could melt a strip of platinum if held in about its middle part would not keep the button fused on the bottom of the furnace—D. Faraday was present. Cut out 25 1/2 circle of No. 9 platinum sheet for bottom of Refy. vessel."

One week later Faraday delivered his famous "Lecture on Platinum"—one of his last appearances at the Royal Institution—in which he described the new melting process and referred to 'Messrs Johnson and Matthey, to whose great kindness I am indebted for these ingots and for the valuable assistance I have received in the illustrations'.

Success was finally achieved in May 1862, the size of the platinum melt being greatly increased and very large ingots produced, but unfortunately in the preceding December Cock had again retired, owing to ill health, for the last time. He remained a bachelor, took up residence first in Somerset and later in Devon,

and he died at Ashburton in December 1892.

George Matthey's younger brother Edward, a partner in the firm from 1860 until 1904, prepared an appreciation of Cock for private circulation and this later came into the hands of Professor William Chandler Roberts-Austen who in turn passed it to Sir William Crookes, the editor of "Chemical News". This resulted in a lengthy memorial to Cock being published in that journal in 1899 under the heading of "A Forgotten Metallurgist" (5). Two paragraphs from this article are as follows:

"It was in dealing with the minerals of the platinum group that Mr. Cock most distinguished himself and at one time he had no equal in the knowledge of the treatment of the metals platinum, iridium, rhodium and palladium. His ability and resources are said to have been almost endless, and he has been known to work for days together, hardly ever speaking, from 7 a.m. to midnight, with perhaps half-an-hour for a meal.

Owing to his somewhat retiring habits, his wonderful ability has not become as widely known as it should have been. If he had put himself more forward he would undoubtedly have obtained honour and distinction in the scientific world, but all his ambition seemed to be to properly complete the work he had in hand."

References

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- 2 A. and C. R. Aikin, "A Dictionary of Chemistry and Mineralogy", London, 1807, 2, 233
- 3 W. J. Cock, *Proc. Chem. Soc.*, 1843, 1, 161-164
- 4 J. Percy, "Metallurgy: Silver and Gold—Part I", London, 1880, 182
- 5 W. Crookes, *Chemical News*, 1899, 80, 287