

Profession *versus* Trade?

**A defining episode in the development of the gas lighting
industry in the late 19th century**

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Abbreviations and Acknowledgements

When quoting printed sources, I have given the full citation when the reference first occurs and short title notation subsequently. Some primary source titles and the names of record depositaries have been abbreviated as follows:

BAGM	The British Association of Gas Managers
Chartered Company	The Chartered Gas Light & Coke Company, London
IGEM	Institution of Gas Engineers & Managers
<i>JGL</i>	<i>Journal of Gas Lighting, Water Supply & Sanitary Improvement</i>
<i>GW</i>	<i>The Gas World</i>
South Metropolitan	The South Metropolitan Gas Company, London
<i>Trans TGI</i>	Transactions of The Gas Institute
<i>Trans TIGE</i>	Transactions of The Incorporated Institution of Gas Engineers
<i>Trans TIGE</i> (united)	Transactions of the (united) Incorporated Institution of Gas Engineers
WYAS	West Yorkshire Archive Service

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1. Introduction

Industrial growth and expanding urban developments made the supply of coal gas for lighting one of the most important industries of the late 19th century. Gas street lighting was extensively used throughout Britain, opening up new leisure opportunities; it was brighter and safer than oil for illuminating industrial and commercial premises, extending the working day; and it became increasingly popular for lighting domestic houses. Gasworks, both publicly and privately owned, proliferated across Britain and many small works were operated by technically competent gas managers rather than by experienced engineers.¹ As the gas industry grew, it was recognised that a specialist national forum was needed to enable otherwise isolated gas managers to meet and share expertise with professional engineers.

The British Association of Gas Managers, BAGM, was founded in 1863 as a ‘learned society’ enabling its members to participate in technical discussions with their peers about new developments in gas making, and providing a professional identity for the industry. In 1881, BAGM was in financial difficulties and decided to change its name to The Gas Institute to enhance its prestige, and to allow manufacturers and traders to become Associates in order to increase its subscription revenue.

This study analyses why this change in the Institute’s membership policy caused the underlying relationship between professional gas engineers and commercial traders to reach a crisis; it investigates why a dispute between a trader and the Institute about the organisation of the gas section of an international exhibition led to the near collapse of the gas industry’s national professional body, and the formation of a rival Institution of

¹ Even in 1900, 80% of all gas undertakings had less than 5000 customers, and almost half had less than 1000: Francis Goodall, *The British Gas Appliance Industry 1875-1939* (unpublished Ph.D. thesis, LSE 1993), p.141

Gas Engineers.² The study discusses the importance of the dispute in polarising attitudes between those gas engineers who saw themselves as providing an essential utility and being professionally superior to traders, and the more commercially minded engineers who saw the need to provide a service by working with the traders who manufactured gas burners, lamps, meters and appliances. The study addresses how this dichotomy in the profession was resolved such that the Institution became once again a united national voice on gas industry issues.

The key protagonists in the dispute were George Bray, a prominent manufacturer and trader of gas burners and lamps, and George Livesey, an exceptional gas engineer and manager. Bray was born to a Leeds working class family, and his business was focused on the wholesale market for low cost but efficient gas burners, street lamps for local authorities in the North of England and very large lamps for railways, docks and piers. Livesey, who became Chairman of the South Metropolitan Gas Company, was in the forefront of gasworks design, and also of commercial innovations such as installing penny-in-the-slot meters, renting out gas cookers, and replacing the burners in street lamps with incandescent mantles. (Brief career sketches of the professionals and traders involved in this episode of the gas lighting industry are presented in Appendix 1.)

The scenario which gave rise to such a schism in the gas industry was the 1882-3 International Electric and Gas Exhibition at Crystal Palace. Concerned about competition to their industry from electricity, the Institute was persuaded to organise the arrangements for gas traders to display a range of lights and appliances in half of the exhibition hall, the other half being given over to electrical lighting and appliances. The precedent for large exhibitions as a way for manufacturers to attract public interest in their products had been established by the Great Exhibition of 1851, but before 1882, gas companies had not

² See note on sources in Bibliography, p.77

made a combined effort to promote gas sales. Bray claimed that the Institute's subcommittee which organised the gas section of the exhibition, and whose members were George Livesey, Magnus Ohren and Charles Gandon, had shown unfair favouritism to another pre-eminent manufacturer and trader of gas lamps, William Sugg, in relation to the site of his stand and also in the way that awards were adjudicated. Sugg's Westminster-based business focused on gas lighting for prestigious London streets and the upper end of the London domestic market and he was a personal friend of Livesey, Ohren and Gandon, who all lived in London. Bray, coming from the north of England, was an outsider.

The issue of profession *versus* trade in the gas industry is only scantily addressed in historiography. Braunholtz reports on the issue and is surprised at the inept way in which the Institute refused to listen to Bray's concerns, but his purpose is to provide a synopsis of the proceedings of the Institute and the Institution rather than to look at the broader context. Other authors have touched on the Bray dispute but not addressed the issues in depth. Garrard, writing about traders paying 'commission' to gas company managers, makes brief reference to 'an unsavoury dispute about the relative visibility given to gas lighting appliances marketed by two of its [The Gas Institute] most prestigious members'.³ The Bray dispute was not about financial mismanagement but about fair play in the arrangements for an exhibition. Dillon says that 'the relationship between Sugg and Bray ... is central to understanding an aspect of mid and late Victorian business practices in the gas lighting manufacturing industry, where profit and protecting

³ The charge that it was customary for the engineering profession to receive 'commission' from contractors was refuted with outrage by the Institution of Civil Engineers in 1863, but the practice of traders paying bribes continued, especially by coal merchants wanting to secure gas company contracts: Buchanan, *The Engineers: A History of the Engineering Profession in Britain 1750-1914* (London, 1989), p.72 and John Garrard, 'The Salford Gas Scandal of 1887' in *Manchester Region History Review*, Vol. 2.2 (1988-9), p.12

and promoting one's "name" and product meant success, recognition and status.'⁴

However, Dillon presents a case study of Sugg and dismisses Bray's concerns, saying that his allegations were never challenged in court.⁵ Otter in his book about light, vision and power in 19th century Britain, refers to Sugg's publications and his lamp designs but does not mention the mass market achieved by Bray's products.⁶ Buchanan indicates that it was as a result of 'difficulties' in The Gas Institute that the rival Institution of Gas Engineers was formed, and simplistically attributes the 'difficulties' to the Institute accepting 'businessmen and administrators' to its membership.⁷ This study explores these 'difficulties' from a new perspective and evaluates how the ramifications of the conflict defined perspectives of professional status between gas engineers and traders.

The approach taken by this study is to sketch the professional expertise needed to build and manage gasworks, show how innovation by traders improved the design and illumination of gas burners and lamps, and how the gas industry developed a national professional body. The Crystal Palace Exhibition of 1882-3 is described to provide context for Bray's dispute with the Institute, after which the implications of different perspectives of status between engineers and traders are analysed, and this episode concludes with discussion of how these differences were resolved to achieve a collaborative industry.

⁴ Maureen Dillon, *Domestic Lighting in Britain 1879-1914: Competing Technologies, Design and Social Impact* (unpublished Ph.D Thesis, University of Brighton, 1997), p.183

⁵ *Ibid.*, p.208

⁶ Sugg's publications including his *Domestic Uses of Coal Gas* are referenced in: Chris Otter, *The Victorian Eye: A Political History of Light and Vision in Britain 1800-1910* (Chicago & London, 2008)

⁷ Buchanan, *The Engineers: A History of the Engineering Profession in Britain, 1750-1914* (London, 1989), p.96

2. Gas Engineers: development of professional skills and expertise

Collaboration with traders was far from the minds of the engineers who built the early gasworks. Samuel Clegg, who was appointed by the Chartered Gas Light and Coke Company to sort out the technical problems of building and operating their pioneering London gasworks, may be considered the first gas company engineer. Clegg did not consider it to be part of his responsibilities to handle commercial matters, not even arrangements for disposal of the by-products of the gas making process.⁸ Making gas from coal for lighting was a new technology in the early 19th century and this chapter discusses how gas engineers learned their skills, and how their expertise developed into a recognised profession as the gas lighting industry grew at an extraordinary rate across Britain.

Until late in the 19th century, opportunities for scientific training relevant to gas engineers were very limited, and there was a strongly traditionalist attitude to the education of engineers as a whole, based on pupilage and empirical engineering rather than formal theoretical training. Young men learned about gasworks by practical experience from being apprenticed to a family member or a senior professional engineer at one of the large gasworks. A number of engineers began their careers by working at the Chartered or other London companies' gasworks, and then went on to build gasworks at places such as Preston, Wolverhampton and Liverpool.^{9,10} George Livesey was one of many engineers following their family traditions when he was apprenticed aged 14 to his father, Thomas, at London's South Metropolitan Gas Company. Livesey's exceptional technical ability rapidly led him to develop his own innovative ideas, patenting a variety

⁸ Stirling Everard, *The History of the Gas Light and Coke Company, 1812-1949* (London 1949, reprinted for the London Gas Museum, 1992), p.71

⁹ Francis Sheppard, *London 1808-1870: The Infernal Wen* (London, 1971) p.186

¹⁰ There was also some contra-flow of engineers from the early formation of gas companies in Edinburgh and Glasgow. London's Imperial Company appointed John Kirkham, a Leith engineer as their Company Engineer in 1829: Everard, *The History of the Gas Light and Coke Company*, p.174

of technical improvements to gas production plant, most notably the gas purification process. In later years, Livesey was much in demand as a gasworks consultant; his design for the South Metropolitan's East Greenwich works included two gasholders, which were the biggest in the world when they were built in 1887.¹¹

Gasholders are the end point of the gas making process, before gas is distributed through mains to customers. The process starts with distillation of gas from coal in closed retorts, after which impurities are removed from the raw gas, before it is stored for distribution. Engineers starting out to build a gas works had to ensure that a suitable plot of land was available with good transport links, preferably with access to a navigable river, canal or railway, so that the many tons of coal needed to produce gas could be efficiently delivered to the site. It was important that engineers were knowledgeable about the quality of coal from different mines, as the brightness of gas lighting varied with the coal used. Plant and equipment for the gasworks had to be specified, purchased and installed, and mains laid. Figure 1 illustrates the key components of a gasworks.

Engineers also had to advise on the most commercially attractive way of disposing of the substantial quantities of residual products, including coke, tar and ammonia liquid, which resulted from the gas making process. Coke could be broken into pieces of small, uniform size and sold for domestic use with the benefit that it would produce heat without the polluting black smoke of coal fires.¹² Tar could be mixed with clinker, ashes and ground granite for surfacing footpaths, and processed to make creosote to preserve railway sleepers.¹³ Ammoniacal liquor from the gas scrubbers could be

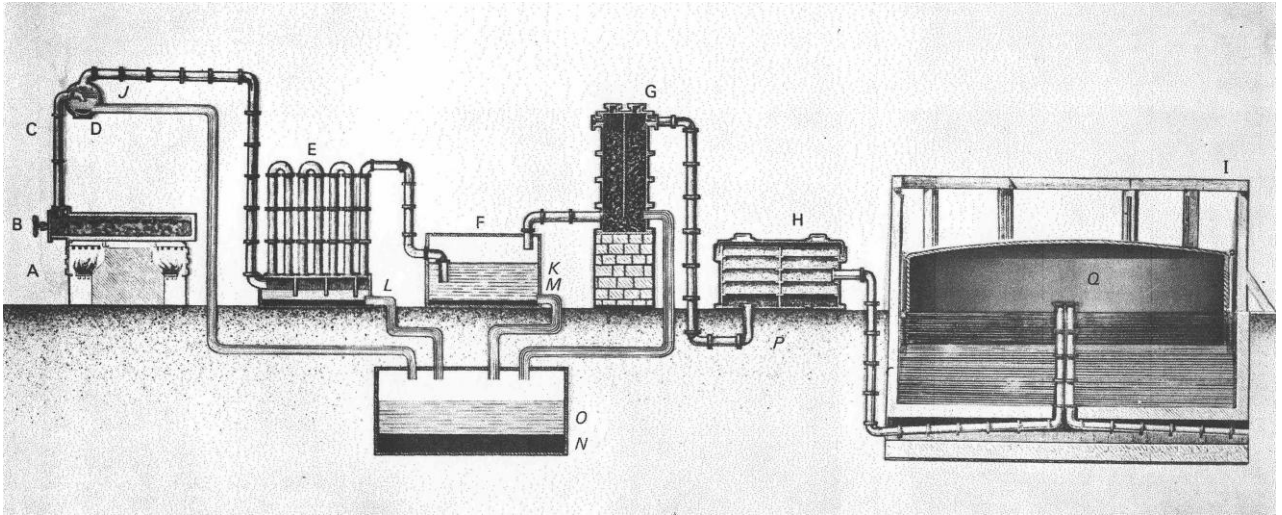
¹¹ George Livesey personally designed the East Greenwich gasholders, which were each large enough to accommodate the Albert Hall: David, J. Jeremy, ed., *Dictionary of Business Biography: a biographical dictionary of business leaders active in Britain in the period 1860-1980* (London, 1984), p.813

¹² Charles Sellers, manager of the York gasworks installed a machine for this purpose, which would break up 20 tons of coke a day: Thomas Newbigging, *Handbook for Gas Engineers and Managers, Fifth Edition, Enlarged* (London, 1889 – digital reprint by Amazon), p.367

¹³ From the 1850s, 12 million gallons of tar were processed each year at Silvertown, making enough creosote to preserve 1½ million railway sleepers: Sheppard, *London 1808-1870*, p.164

converted into sulphate of ammonia for use as a powerful agricultural fertiliser. Sale of the residual coke and other by-products from the gas making process could recoup about half of the cost of coal.¹⁴

Figure 1: Typical gasworks with horizontal retorts



Source: The Open University Press, 'Coal, the Basis of Nineteenth Century Technology' in *Science and the Rise of Technology since 1800, Block II Unit 4* (Bletchley, 1973)

Key to principal processes in diagram: A= furnace; B = horizontal retort filled with coal, made airtight and heated to a high temperature from the furnace below (later gasworks had vertical retorts). When the heat had distilled gas from the coal, the residual coke was removed from the retort, which was refilled with fresh coal ; C = raw gas rises through an ascension pipe to pass to treatment vessels; D = hydraulic main; E = condensers to cool gas and remove tarry vapours; F = washer where gas bubbles through water which absorbs ammonia, carbonic acid gas and some hydrogen sulphide; G = scrubber; H = purifier to remove sulphuretted hydrogen (initially using lime, but later iron-oxide); I = gasholder frame; Q = gasholder which expands and rises as it fills with gas to provide gas storage; O,N = well to store liquid and tar

Specifying the capacity of a gasworks was a key problem since production needed to be sufficiently flexible to cope with the variation in demand for lighting between long summer evenings and dark winter days. In industrial towns with factories and workshops, there was a substantial demand for gas during working hours and a drop in demand on

¹⁴ Newbigging, *Handbook*, p.411

Sundays when large factories were closed. Thriving city centres with shops, theatres, and multi-occupancy housing had different consumer demand patterns from suburban districts with low density housing. By the late 19th century, gas companies had to significantly increase production from their gasworks as shops and factories demanded brighter illumination levels, and domestic demand increased as householders wanted gas lamps in every room. In some urban areas, the nightly volume of gas consumption doubled in just a few years.¹⁵ Engineers had to try to anticipate this rapid growth in demand when designing gasworks so that they had space to allow their plant capacity to be easily and effectively expanded.

By 1888, it was estimated that there were some 1500 gasworks operating in Britain, directly employing about 60,000 people and gas engineers were much in demand.¹⁶ A substantial number of municipal authorities, particularly in the industrial North of England, operated gasworks which they had purchased from private companies in order to reduce the cost of street lighting, and to supplement their income from rate payers by selling gas to industrial and commercial customers.¹⁷ Municipal corporations and small gas companies would usually contract with an engineer to design, cost and supervise modifications to expand the capacity of gasworks or to build new works, and to provide advice on an 'as needed' basis. They would then employ a gas manager to be responsible for the day-to-day operation of their gasworks. Larger gas companies would employ their own engineers, not only to design and build but also to maintain their gasworks.

¹⁵ *JGL* June 16, 1885, p.1114

¹⁶ Parliamentary Returns in 1888 indicated that there were 384 works operated by statutory gas companies and 168 municipal gasworks. In addition Newbigging estimated that there were about 950 gasworks operated by non-statutory companies: Newbigging, *Handbook*, pp.411-2

¹⁷ By 1865, 28 municipal corporations had taken over their own gas supplies. Over the next 20 years, s further 82 private undertakings had been purchased by municipalities: Goodall, *Burning to Serve: Selling Gas in Competitive Markets* (Ashbourne, Derbyshire, 1999), p.53

After gaining experience and technical knowledge, engineers often set up as independent consultants. They advised gas companies and junior engineers, often acted as arbitrators and valuers, were called in to report on the condition of works, appeared in legal cases, and some gave evidence to parliamentary and other enquiries. Thomas Newbigging, a prominent consulting engineer (see Appendix 1), wrote a *Handbook for Gas Engineers and Managers*, first published in 1870. The *Handbook* provides advice on all aspects of building and managing a gasworks and also guidance on internal fittings and gas lights.¹⁸ Written in very practical language and published in a handy size to fit into (big!) coat pockets, the *Handbook* was a very important source of technical information and was so popular with both engineers and traders that it ran to at least eight Editions – there is a copy in George Bray’s archives.¹⁹

The *Handbook* covers everything from how to test coal for its gas producing qualities, to designing retorts, and from methods of removing impurities from gas, to the design of gasholders. The amount of detail which Newbigging provides is typified by his 42 pages on laying mains pipes, which include everything from specifying the diameter and thickness of the pipes, testing for leaks, depth at which the pipes should be laid to protect them from heavy traffic, the labour and tools needed to lay the pipe, and a series of tables to calculate the weight and cost per yard of cast-iron mains gas pipes.²⁰ For gasworks managers, Newbigging recommended that a number of Account books should be kept including a Collectors Book, Wages Book, Stock-taking Book, and a Public Lamp Register for street lighting as in The Strand, London (Figure 2).²¹

¹⁸ Newbigging was awarded the degree of Doctor of Science in 1912 by the University of Leeds: Walter T. K. Braunholtz, *The Institution of Gas Engineers: the First Hundred Years 1863-1963* (London, 1963), p.31

¹⁹ Additional information was added to successive editions of the *Handbook*. The 5th Edition, comprising 524 pages, measured approximately 5in by 7in but was more than 1in thick.

²⁰ Newbigging, *Handbook*, pp.218-259

²¹ *Ibid.*, pp.448-450

Figure 2: Gas street lights in The Strand, London, about 1865



Source: Dean Chandler & Douglas A. Lacey, *The Rise of the Gas Industry in Britain*, (London, 1949), p.75

Newbigging advised that gas managers should keep a Test Register for noting test results of the illuminating power and purity of the gas, and record the number of lamps lighted each night, the hours of lighting and extinguishing, and the hours of gas burning per lamp.

Writing the Preface to the Fifth Edition of his *Handbook*, Newbigging said that

‘The Book is the fruit of long experience and of much reading and thought. My ambition is that it may be referred to by the members of the profession, especially the younger members, and that it may afford them valuable assistance on occasions of difficulty and doubt.’²²

It was a reflection of the outstanding calibre of the leading gas engineers in the middle years of the 19th century that they were able to educate themselves, and pass on their knowledge to a younger generation. Newbigging stressed in his *Handbook* that although practical insight into gas making was very necessary, it was also essential that those responsible for managing gasworks should study and understand the theoretical aspect of

²² Newbigging, *Handbook*, Preface

gas manufacture. Examinations in Gas Manufacture were introduced in 1874 by the Society of Arts, and later became City and Guilds examinations.²³ The Institution of Gas Engineers collaborated with the Department of Technology of the City and Guilds of London Institute in 1907 to agree syllabuses for its examination in *Gas Engineering* and for a new examination in *Gas Supply* (see Appendix 2).²⁴

However, there was continuing concern that higher education for engineers lagged behind that of continental universities and that ‘there was too little research in the educational system of this country’.²⁵ This was not unique to the gas industry; it was also prevalent in the electrical engineering and chemical industries.²⁶ Gas making may be said to have fully matured into an engineering profession when the Livesey Professorship of Coal Gas and Fuel industries was established at Leeds University in 1910 (see page 54).

The syllabus for the City and Guilds examination in *Gas Supply* specifies the knowledge that traders would require for construction of different types of gas burners, gas meters and street gas lanterns. The next chapter discusses how the technology of gas burners and lamps developed and why gas traders were important to the promotion of the gas industry.

²³ Buchanan, *The Engineers*, p.96

²⁴ *JGL*, June 4, 1907, p.649

²⁵ Brauholtz, *The Institution of Gas Engineers*, pp.64,65

²⁶ Goodall, *The British Gas Appliance Industry*, p.207

3. Traders: innovation and competition in gas lighting

Technical education was important for the designers and manufacturers of gas burners as well as for engineers, since the best burners could give twice as much light as the worst for the same gas consumption. Gas burners and lamps had to be designed to suit not only a range of premises and illumination requirements, but also for varying qualities and pressures of coal gas.²⁷ Innovation and competition between traders led to significant improvements in efficiency and lighting levels of gas burners, culminating at the end of the 19th century in lamps with incandescent mantles, which could give ten times the illumination compared to simple flat flame burners.

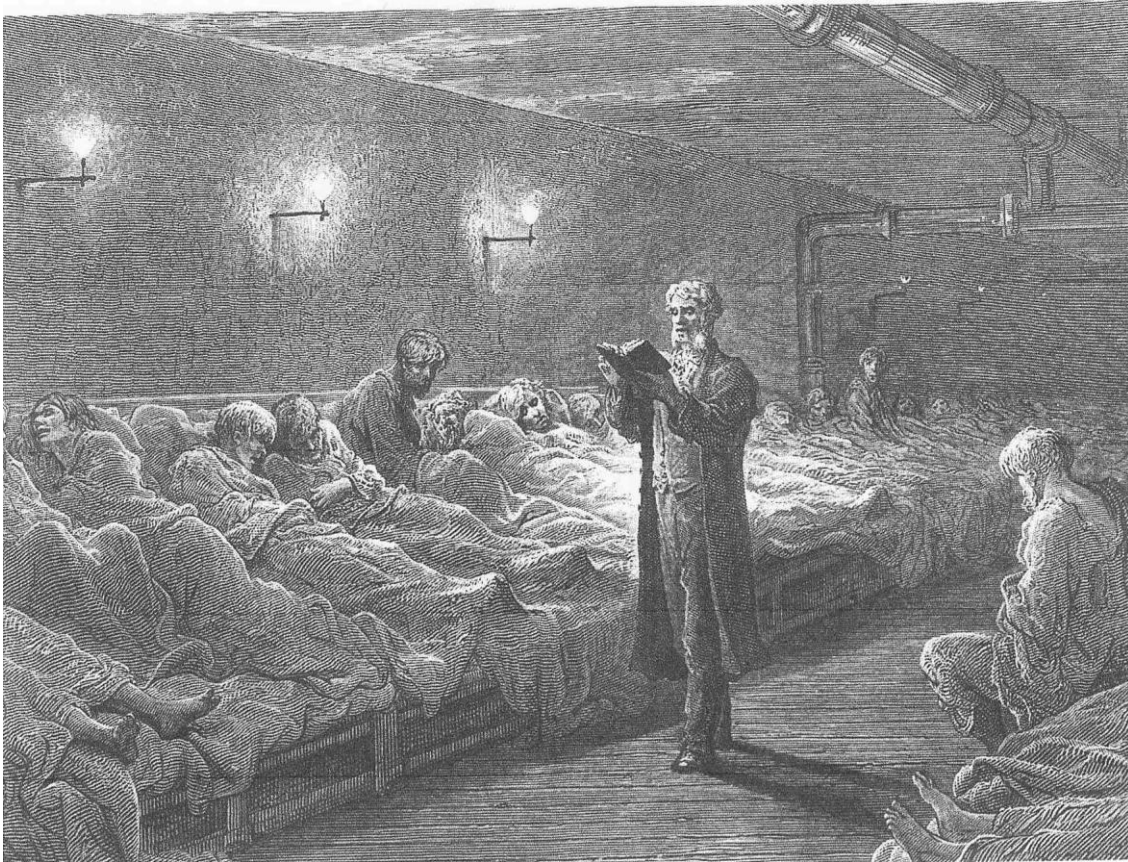
Many gas engineers and managers considered that the efficiency of gas lamps and fitting of internal gas piping was not their concern, and should be left to traders to specify and manage. However, this could rebound on the gas company as gas fitters were mainly local tradesmen and customers often complained that their gas gave only poor illumination, when in fact the problem was caused by the bad workmanship of the customer's gas fitters, or poor quality design and manufacture of the lamps they installed.²⁸ In the first half of the 19th century, gas lighting of railway stations and public buildings used cast iron burners which corroded and gave poor quality illumination for the volume of gas consumed. Two traders, who each patented a solution to this corrosion problem using different materials, were George Bray and William Sugg (see Appendix 1 for career sketches). Both traders were ambitious entrepreneurs of a similar age, who invented and patented many improvements in the design and manufacture of gas burners

²⁷ Before governors were introduced to regulate gas pressure, turning on a gas light in the top floor of a tall building could dim lights on lower floors. This was used as a key part of the plot in Patrick Hamilton's *Gas Light, a Victorian thriller in three Acts* (London, 1939)

²⁸ Goodall quotes the *Ironmonger* of March 1, 1875, as saying that the typical workman carrying out servicing or installation work was likely to be 'not a gasfitter but Jack-of-all-trades, a blacksmith, glazier, brazier, plumber and bellhanger all rolled into one' and that very few ever proceeded systematically to test pipes for leaks before leaving the job: Goodall, *The British Gas Appliance Industry*, pp.282-3

and lamps, but they took different approaches to how they developed their gas lighting businesses.

Figure 3: Gustave Dore's drawing of a scripture reader in a night refuge, 1872



Source: Brian Bowers, *Lengthening the Day: A History of Lighting Technology* (Oxford, New York, Tokyo, 1998), p.48

Flat Flame gas burners were designed so that the flame fanned out in various shapes, such as fishtail or batwing, to give more light. The gas lights in the wall brackets appear to be fishtail burners.

George Bray started experimenting with ways to improve the quality of gas burners after listening to a demonstration lecture about gas lighting.²⁹ He solved the problem of gas light flickering by inventing a brass, flat flame burner with a porcelain tip. The flat flame burners illustrated in Figure 3 may have been of this type.³⁰ Gas burners

²⁹ Water vapour in the gas supply caused the tips of cast iron burners to corrode so that the gas made a roaring sound and the gas light flickered.

³⁰ The *Leeds Mercury* (23 August 1905) commented that 'it is perhaps well to emphasise how seldom what appears a simple invention is obtained without careful investigation and study.'

had to be made with great precision, as an accurately machined burner orifice was essential to achieve a good illumination flame. Bray designed his own manufacturing machinery and, starting from scratch, set up in business making gas burners.³¹

Figure 4: Street lamp design patented by George Bray

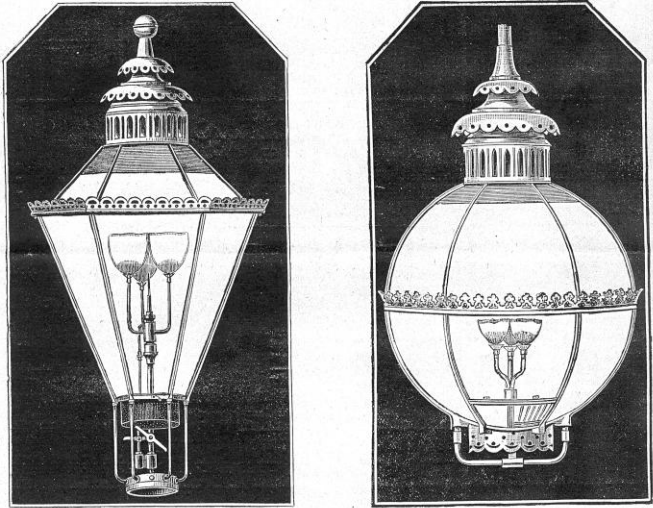
JAN. 1, 1887.] THE GAS WORLD. iii

BRAY'S

PATENT

Flat-Flame Lanterns

Have successfully stood the test of above seven years practical use in Street and other Lighting.



"STREET" PILLAR LANTERN. "GLOBULAR" SUSPENDING LANTERN.

We introduced our Flat-Flame System of Street Lighting with the following announcement, in 1879 (when the Argand System of Street Lighting was at the height of its fame):—

“The Flat Flame is the only practicable system of Street Lighting; and ‘in actual use’ will yield as much light with Common Gas, and more with Cannel Gas, than any Argand System.”

This introductory statement has been confirmed by experience throughout the world.

.....

GEO. BRAY & CO., GAS LIGHTING ENGINEERS, LEEDS.

The glass case of the street lamp was windproof, tapered downwards so as to avoid throwing a shadow on the ground in the immediate vicinity of the lamp post, and had reflectors in the top of the case to increase the illumination from the gas jet. Source: *The Gas World*, Jan 1 1887

³¹ George Bray was not the inventor of the non-corrosive tip (Sugg and others used steatite rather than porcelain) but Bray was the first to produce a tip at a price which was affordable for the mass market.

Bray's burners were independently tested and endorsed by Dibdin, who said that 'The "Special" burners are made...to suit any pressure or quality of gas...they give a large well-shaped flame, are indestructible, not liable to get out of order and show, after years of steady use, the same standard conditions under test'.³²

Bray continued to experiment and invent new designs for gas burners, lamps, and appliances, which he patented and manufactured for a growing market.³³ The *Yorkshire Post* said his street lamp (Figure 4), first introduced in 1879, became 'one of the commonest things in existence'.³⁴ Bray's chief customers were public bodies, railways, churches and pubs (see his advertisement, Figure 5). Charles Pawson, who started to work for George Bray as an office boy in 1888, said in his draft history of the company 'many docks, sea walls and promenades were lighted by our lamps. A huge trade was done in the sale of...Bray patented Shadowless Street Lamps and many of them were so large that I would squeeze through the lamp door and stand up inside, they being nearly 6' in height.'³⁵

Bray would have gained an insight into gas lighting in America, where he developed a substantial market for his products, when he employed an American called Mitchell as foreman of his tip-making room. Pawson says that Mitchell showed Bray an improved way to screw sockets, and that 4 tons a month of Bray's High Pressure Special Union Jets were exported to America.^{36, 37}

³² William Joseph Dibdin, *Public Lighting by Gas and Electricity* (London, 1902, digitally reproduced at Milton Keynes, 2010), p.201

³³ Tests carried out in Leeds in 1882 concluded that 'Bray's burners yielded the highest lighting power per foot of gas consumed for all the burners adapted for general purposes'. The tests included comparison with burners by Sugg, Bronner and Siemens: WYAS, WYL1207/52

³⁴ *Yorkshire Post*, August 23, 1905. Bray claimed to manufacture 3/4ths of all gas burners in Britain (see his advertisement, p.70).

³⁵ Charles Pawson, *A Short History of Geo. Bray & Co. from 1863 to 1943* (unpublished manuscript): WYAS, WYL1207/140, p.5

³⁶ As early as 1839, there were some 297 gas companies in America, serving 4,857,000 people: Susan Messham, *Gas: An Energy Industry* (HMSO, London, 1976), p.13

³⁷ Pawson notes that girls could screw sockets at the rate of 60/65 gross a day by hand in 1888: Pawson, *A Short History*, WYL1207/140, pp.2,9

Figure 5: Advertisement for George Bray's Shadowless Lanterns, 1881

p. 33

BRAY'S PATENT FLAT-FLAME SHADOWLESS LANTERNS

(From 30 to 1100 Candle Power)

Have been supplied to more than 200 of the Principal Towns in the United Kingdom; to India, Canada, Australia, Cape Colony, and several Foreign Countries; and are being extensively adopted throughout the United States.

The following are a few of the Towns to which large numbers of

BRAY'S PATENT LANTERNS

Have been supplied during the Past Lighting Season:—

LONDON	STRAND.	LEEDS	CENTRAL RAILWAY STATION.
Do.	For Shoreditch Vestry.	Do.	VICTORIA SQUARE.
BELFAST	DONEGALL PLACE, the principal thoroughfare in the Town.	Do.	OXFORD PLACE.
Do.	For the Harbour Commissioners.	Do.	GREAT GEORGE STREET.
BIRKENHEAD	LANDING STAGES AND DOCKS.	MANCHESTER	CALVERLEY STREET.
BLACKPOOL	BANK HEY STREET.	Do.	MARKET STREET.
Do.	MARKET STREET.	Do.	PICCADILLY.
BOLTON	THE TOWN HALL SQUARE, and THE PRINCIPAL SQUARES and STREET CROSSINGS.	Do.	DEANSGATE, and many of the PRINCIPAL STREET CROSSINGS.
BRADFORD	For the Corporation.	NOTTINGHAM	THE MARKET PLACE.
CORK	For the Consumers' Gas Company.	Do.	PRINCIPAL STREETS and OPEN SPACES; CROSSINGS in the Suburbs.
CREWE	For the L. and N. W. Railway Co.	Do.	ROUND THE UNIVERSITY.
EDINBURGH	PRINCES STREET. The Corporation of Edinburgh have adopted BRAY'S Patent Lanterns in place of the Electric Light, which was tried, for several months, in this, the most famous street in Scotland, and, finally, discarded.	NORTH SHIELDS	AND TYNEMOUTH } FOR THE GAS COMPANY.
FOLKESTONE	THE PROMENADE AND PIER.	SHEFFIELD	For the United Gas Company.
GLASGOW	FERRIES, LANDING STAGES, and SHEDS, for Clyde Trust.	SOUTHPORT	For the Corporation.
HARTLEPOOL	For the Gas Company.	SOUTH SHIELDS	For the Gas Company.
LIVERPOOL	THE DOCKS, and some of the PRINCIPAL STREET CROSSINGS.	WESTON-SUPER-MARE	THE PRINCIPAL STREET & OPEN SPACES.
LEITH	THE DOCKS.	WIGAN	For the Coal and Iron Company.
		YORK	Adopted, with signal success, by the York Gas Company, to compete in the streets against the Electric Light, on the occasion of the visit of the British Association of Science in September last.

THE PHILOSOPHICAL SOCIETY OF GLASGOW held, in 1880, the most important Exhibition of Artificial Light Appliances ever brought together in Great Britain, and the Executive Committee voted a

"SPECIAL AWARD" TO GEO. BRAY & CO., LEEDS,

for their collection of Gas-Lighting Apparatus, which consisted of their Patent Flat-flame Shadowless Lanterns, and Patent Enamel "Standard," "Special," and "Regulator" Burners, for all kinds of street and interior lighting. No other manufacturer of apparatus for the like purposes obtained a "Special Award."

THE UNITED STATES INSPECTOR OF GAS, in his Official Government Report for the year 1881, says:—"The result of test with Bray's Standard Slit-Union was highly satisfactory; it will yield the maximum candle-power obtainable from a cubic foot of gas."

New Price List and all other information on application to

GEO. BRAY & CO., Gas Lighting Engineers,

BLACKMAN LANE, LEEDS.

Source: *JGL* July 4, 1881, p.33

This advertisement shows the spread of Bray's customers for docks, railways and street lights in Britain and internationally, including India, Canada, Australia, Cape Colony, and several Foreign Countries. He claims that his lanterns are being extensively adopted throughout the United States and were found to be highly satisfactory in the 1881 Official Report of the United States Inspector of Gas. The advertisement also states that Bray's lanterns have been adopted in place of a failed trial of electric light in Edinburgh, and successfully competed with electric light at a trial in York.

Bray took an innovative approach, not only to the design of burners, but also to marketing. Pawson recounts that until about 1890, Bray's products were only advertised in the *Gas World* and *Journal of Gas Lighting*, and travelling salesmen were sent to visit gas company managers. Then Bray wrote a leaflet, on the front of which was printed 'Your Gas Bill' and inside was a sales pitch explaining that the Bray Special Adjustable Burner consumed a third less gas than the Regulator Union Jet, and gave better illumination. Millions of leaflets were printed and a copy delivered to every house in the United Kingdom.³⁸ Pawson says that the campaign was a great success and subsequently Bray printed showcards, each copy carrying 2 doz Special Burners price 2d each; many thousands of the cards were sold and could be found in every plumber and ironmonger's shop.³⁹

In contrast to George Bray's background, William T. Sugg's family had been involved in gas lighting from its outset. When William's father died and he took on the family business, he was only 25. Prior to Bray patenting his porcelain tipped gas burners, Sugg had patented his own non-corrosive tip using steatite. He was interested in design and technology and spent a great deal of time experimenting with how gas burned and why.⁴⁰ One of Sugg's best known designs was his adaptation of Argand's oil lamp to burn gas. Sugg used the same principle as Argand, with combustion air passing up the centre of a circular ring of flame, as well as around the outside, to give a controllable bright luminosity. The design was so successful that Sugg's 'London' Argand burner was adopted as the standard gas burner for testing the quality of gas supplied by Metropolitan gas companies.⁴¹ Sugg's designs were quality at a price – his Argand lamps sold at 2s 6d each compared to Bray's simple batswing and fishtail burners, which sold for around 1d

³⁸ WYAS, WYL1207/140, pp.6,7

³⁹ WYAS, WYL1207/140, p.7

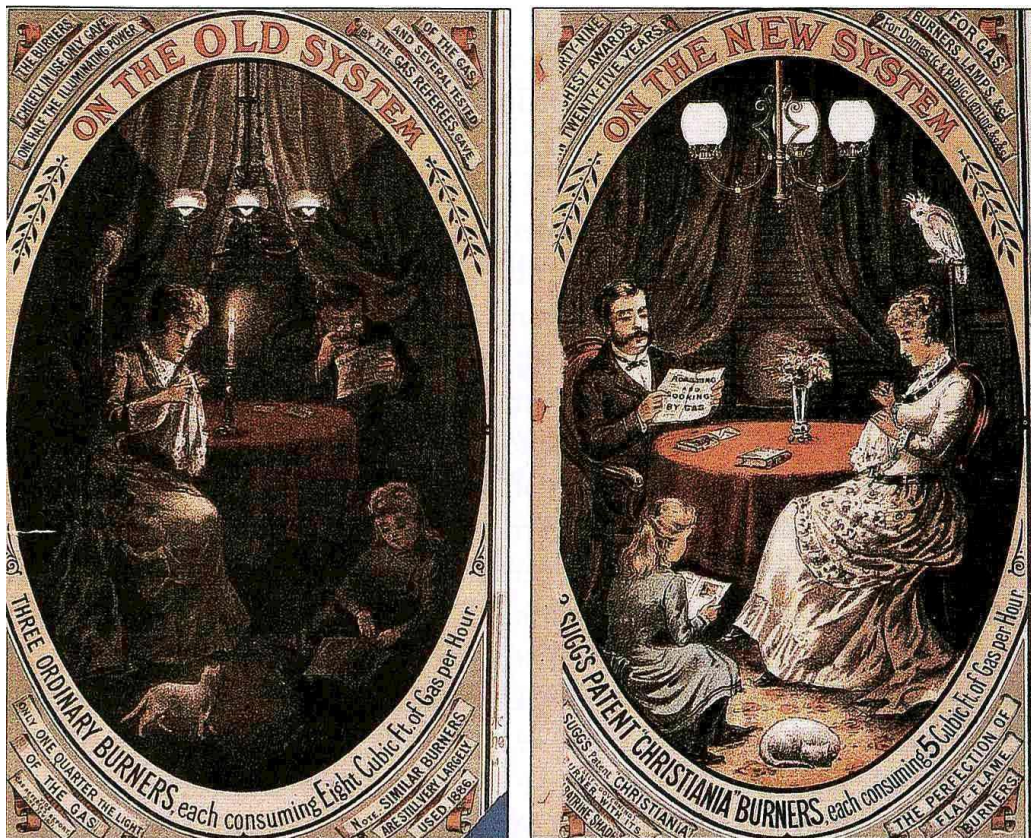
⁴⁰ *William Sugg & Co, History* [<http://www.williamsugghistory.co.uk/history.htm>, accessed 28 April 2010]

⁴¹ Many burners in common use produced significantly less light for the same gas consumption as Sugg's standard burner: *William Sugg & Co, History* [accessed 28 April 2010]

to 3d each.⁴² Sugg's Christiania flat flame burner (Figure 6) was a popular design and was praised by Charles Dickens [Jnr] in his *Dictionary of London, 1888*:

'GAS BURNERS- The Argand and fishtail burners made by Sugg, of Westminster, and supplied by all respectable gasfitters, are unquestionably the best....For reception and bed rooms the opal Christiania shade or globe....gives the best and most agreeable result with the least consumption of gas.'⁴³

Figure 6: Advertisement for William Sugg's Christiania burner



Sources: Maureen Dillon, *Artificial Sunshine: A Social History of Domestic Lighting* (The National Trust, London, 2002), p.138 and Otter, *The Victorian Eye*, p.198

The advertisement shows how the Christiania burner could improve evening activity in a middle class home. Sugg claimed the white glass shades reflected a diffused light downwards, making it 'agreeable and soft to the eye, and yet powerful near its work' and that other common burners gave only half or even a quarter of the illumination of his 'Christiania' burner, while consuming more gas. Sugg's burner maintained a steady light when the mains gas pressure fluctuated by including a governor, which was a self-regulating valve to maintain gas pressure at a steady level.

⁴² Goodall, *The British Gas Appliance Industry*, p.124

⁴³ Charles Dickens, *Dickens's Dictionary of London, 1888, An Unconventional Handbook* (Moretonhampstead, Devon, facsimile copy reprinted 2006), p.111

Sugg's street lamps were used in prestigious locations such as Parliament Square, Whitehall, and Ludgate Circus.⁴⁴ In contrast to Bray's approach to marketing, Sugg spent a lot on advertising and expanded his business with showrooms in the Grand Hotel Buildings, Charing Cross, London, and also in Paris.⁴⁵ His book *The Domestic Uses of Coal Gas* gives advice on the type of burners and fittings for different rooms in a house and discusses problems such as the waste caused by bad burners and how to ventilate rooms effectively.⁴⁶

Both Sugg and Bray were fiercely protective of any attempt to copy their designs and each sued anyone whom they thought was guilty of infringing their patents. Court cases over patents were discussed in the correspondence columns and Editorials of the technical press and were, in effect, another way of advertising the latest gas light innovations. Bray and Sugg were engaged in a dispute over patents in the early 1880s. (This was a different dispute from Bray's concerns about the Crystal Palace exhibition, but would have influenced his view of Sugg's business). Bray believed that Sugg had infringed his patent for a lamp design, Sugg said he had not and sued Bray for defamation. The court proceedings dragged on over several years, and the eventual judgement in 1885, which was reported verbatim in the *JGL*, ruled that Bray had had reasonable grounds for believing that Sugg had infringed his patent, but that Sugg had not done so. No costs were awarded, but the judge said that 'Each [party] appears to have thriven...and to have gained notoriety and custom for his wares'.⁴⁷ It seems likely that Sugg overvalued the worth of his patents and his aggressive pursuit of defending them in

⁴⁴ Three original Sugg lamps, which have been refurbished and converted to electricity, can still be seen in Trafalgar Square: *William Sugg & Co, History* [accessed 28 April 2010]

⁴⁵ *JGL*, March 5, 1907, p.595

⁴⁶ William T. Sugg, *The Domestic Uses of Coal Gas: As applied to lighting, cooking and heating, ventilation; with suggestions to consumers of gas as to the best mode of fitting up houses and using gas to best advantage* (London, 1884, digitally reproduced at Milton Keynes, 4 May 2010)

⁴⁷ *JGL*, May 19, 1885, p.915

the courts as well as getting into disputes with his own shareholders about the costs of his experiments and patents for new designs, resulted in financial difficulties for his Company in the last two decades on the 19th century.⁴⁸

Following the introduction of electric street lighting in Paris, Sugg wrote a paper on *Lighting by Gas and Electricity*, concluding with the remark ‘Gas Lighting is a progressive science: and if electricity has been galvanised into renewed life...so have we gas engineers received the contre-coup of the shock.’⁴⁹ Sugg presented a number of papers to the gas industry’s professional body, of which he was elected an Honorary Member in 1873. The next chapter discusses how and why the British Association of Gas Managers developed into The Gas Institute and set events in motion which produced a schism in its membership.

⁴⁸ Sugg had a total of 24 patents still current in 1881 when his firm became a limited company. These patents were valued at £25,000 and represented 31% of the total assets of the company: Dillon, *Domestic Lighting in Britain*, pp.185, 203-4.

⁴⁹ *JGL*, March 5, 1907, p.596

4. Profession: a learned society

In response to changes and development in technical skills resulting from advances in science during the 19th century, a number of professional associations were established.⁵⁰ The Institution of Civil Engineers was the first to be founded in 1818, reflecting the growth in civil engineering for railway construction; when railways began to need maintenance skills, the Institution of Mechanical Engineers followed in 1847.⁵¹ There were occasional lectures or discussions relevant to gas lighting at meetings of the Institution of Civil Engineers, and by the mid 19th century, technical gas journals began to be published.⁵² However, as gas lighting became increasingly popular, more and more gas undertakings were established across Britain, and gas manufacture and supply began to be regarded as a discrete industry. (The spread of gasworks is illustrated by the list of subscribers to the Crystal Palace Exhibition in Appendix 3.)

Production of coal gas required competent supervision of the operation of plant and equipment, but also required research, often involving trial and error, to improve the effectiveness of gasworks. Kaye defines a profession as being an occupation having certain characteristics and requiring its members to possess a skilled technique dependent on intellectual analysis.⁵³ Gas engineering developed into a profession as the technical complexity of gasworks increased.

A group of gasworks managers and engineers, who wanted recognition of their specialist professional knowledge and social standing, met in Manchester in 1863, and

⁵⁰ By 1890, there were 10 national engineering institutions, and the total membership was about 15,000: Buchanan, *The Engineers*, p.20

⁵¹ The Institute of British Architects was founded in 1834 and the British Medical Association was formed in 1856: Barrington Kaye, *The Development of the Architectural Profession in Britain*, (London, 1960) p.13

⁵² *The Gas Gazette and Monthly Adviser* was first published in 1847, and the *Journal of Gas Lighting* was published from February, 1849

⁵³ Kaye, *The Development of the Architectural Profession* pp.14,15

decided to establish The British Association of Gas Managers ‘for the encouragement and advancement of all matters connected with gas engineering, manufacture, and finance’.⁵⁴ Some gas managers were engineers who had gained experience from working for several gas companies, but others were works supervisors, who could be technically isolated when working for a small private company or a municipal gas undertaking overseen by a Gas Committee of local Councillors. BAGM’s objectives were that ‘the gas industry ...should make progress through the enlarged intelligence of its members, to be brought about by free exchange of opinion and experience’ and should not only communicate new knowledge, but also compare independent results.⁵⁵ The first Honorary Secretary of BAGM, James Blackburn, said that he needed ‘the utmost tact and discretion...in those days when almost every gas manager...was a stranger to almost every other. It seemed as though a link were necessary...to connect together the different members of the profession.’⁵⁶

BAGM elected Thomas Hawksley, an architect and consulting civil engineer, who was the Vice-President of the Institution of Civil Engineers, as their first President, and based its constitution and rules on those of the Civil Engineers.⁵⁷ Qualification for membership of BAGM had considerable flexibility as it was not concerned with establishing the technical competency of its members or with setting professional standards. Ordinary Members of the Association were engineers, managers, or secretaries of gasworks, but ‘gentlemen taking an interest in matters connected with gasworks’ could be admitted as Extra-ordinary Members, and ‘gentlemen who take a deep interest in

⁵⁴ *Trans, TGI* 1884, p.8

⁵⁵ Braunholtz, *The Institution of Gas Engineers*, pp.11,15

⁵⁶ When Blackburn was appointed Honorary Secretary in 1863 he was Manager of the gasworks at Droylsden. He was appointed Engineer to the Oriental Gas Company in Calcutta in 1868, and died in 1882: *Trans TGI*, 1882, pp.2,9

⁵⁷ Hawksley (1807-1893) built both water works and a large number of gas works at locations including Nottingham, Derby, Cambridge, Sunderland, Folkestone, Oxford and Bombay: Braunholtz, *The Institution of Gas Engineers*, pp.13,14

matters connected with gas engineering' could be admitted as Honorary Members.⁵⁸

These last two membership categories allowed the contribution of prominent traders to the gas industry to be recognised, and George Bray was elected an Extra-ordinary Member, and William Sugg an Honorary Member. From BAGM's first annual meeting membership grew rapidly, and 20 years later the re-named Gas Institute had almost 900 members.⁵⁹

The format of the Association's annual meetings became established as a Presidential address, presentation of papers, visits to gasworks, and sometimes lectures. A new President was elected each year from prominent gas industry figures and from 1867 annual meetings were held alternately in London and the provinces. Following the Institution of Civil Engineer's precedent, BAGM summarised the papers delivered at its meetings and recorded its business in bound volumes of annual *Transactions*.

George Livesey, who was elected an Honorary Member at BAGM's first annual meeting, said when he was elected President 10 years later, that the Association had 'collected, by means of its papers and discussions, an amount of information and experience on gas engineering, manufacture and finance, of which few of us have any idea..'.⁶⁰ The annual visits arranged by the Association allowed its members 'to inspect many of the largest and best conducted gasworks in the kingdom..'⁶¹ Livesey went on to say that he hoped that BAGM would eventually expand its activities to include 'technical and research committees, education and training, scholarships, [and] co-operation with kindred bodies at home and overseas'⁶²

⁵⁸ Braunholtz, *The Institution of Gas Engineers*, p.268

⁵⁹ *Trans TGI*, 1883, p.236

⁶⁰ Braunholtz, *The Institution of Gas Engineers*, p.20

⁶¹ *Ibid.*, p.20

⁶² *Ibid.*, p.21

Despite its substantial membership, BAGM was in financial difficulties in 1881 and was concerned that, as gas lighting had become more commonplace, public respect for the gas industry had declined. In his Presidential address that year, Charles Hunt said:

‘..”Gasmaking,” it was observed to me not long since, “is a very simple process.”

“It appears so,” was my reply, “until one begins to know something about it” ’⁶³

To enhance its public prestige, BAGM decided to change its name to The Gas Institute and at the same time to change its Rules in order to increase its subscription revenue. (A list of successive name changes of the gas industry’s professional body is given in Appendix 4).

Under the new Rules, membership of the Institute was to comprise Honorary Members and Members as before, ‘such Extra-Ordinary Members as have been elected prior to June 16, 1881’, and a new class of Associates, defined as ‘persons holding a responsible position in gas-works, or Pupils of Gas Engineers,’ and also, most importantly for this study, ‘persons whose pursuits constitute branches of gas engineering, or who are otherwise qualified to assist in promoting the objects of the Institute..’.⁶⁴ Both George Bray, as an Extra-Ordinary Member, and William Sugg, as an Honorary Member, qualified for continuing membership.⁶⁵ It is unlikely that Members of the Institute would have sanctioned such a broad definition of ‘Associates’ if they could have foreseen just how much trouble it was going to cause them in the near future.

The following year, it was reported at the AGM that the financial condition of the Institute was only sufficient to cover expenditure of bare necessity and income needed to be increased, but the Council reported their satisfaction at the unusually large accession of 42 Ordinary Members and 49 Associates that year following the alteration of the

⁶³ *Trans TGI* 1881, p.17

⁶⁴ Honorary Members required the approval of two thirds of Members present to be elected: *Trans TGI* 1883, pp. 203-209

⁶⁵ Bray had been elected an Extra-Ordinary Member in 1879.

rules.⁶⁶ The new Gas Institute had a successful first meeting, and awarded their prestigious Birmingham medal to George Livesey in recognition of his contribution to technical research.⁶⁷ Livesey presented a paper on *The Principles of Gasholder Construction* and William Sugg presented a paper on *The Application of Gas to the Lighting of Open Spaces and Large Buildings*, in which he demonstrated that ‘gas is steadier and readier, and more useful for the purpose of lighting large interior and exterior spaces, than electricity.’⁶⁸ The President, George Stevenson, who had clearly been impressed by the electrical exhibition at Crystal Palace the previous year, warned members that they needed to keep their gas prices down in order to compete with electricity.⁶⁹ He suggested that this could be achieved by economy in the construction of gasworks, improved gas making processes, reduction in gas leaks, and diversification of business. He recognised that ‘**There is a disinclination on the part of some managers, who have had an engineering education, to regard their work from a trade point of view**’, but continued by saying that the way forward was to interest the public in the use of gas for cooking and heating through exhibitions, in order to increase gas consumption during daylight hours.⁷⁰ The next chapter discusses why the Institute became involved in the International Electric and Gas Exhibition at Crystal Palace and what issues about the exhibition triggered the schism among the Institute’s members as a result of the very ‘disinclination’ that Stevenson warned about.

⁶⁶ *Trans TGI*, 1882, p.2

⁶⁷ The Birmingham Medal was founded in 1881 to encourage the extension of use of coal gas, and it was directed to be bestowed for originality in connection with the manufacture and application of gas: *Trans TGI* 1882, p.25

⁶⁸ *JGL*, March 5, 1907, p.596

⁶⁹ Although the price of gas was steadily reducing, it was at this time still expensive for cooking and heating compared to coal: Goodall, *The British Gas Appliance Industry*, p.76

⁷⁰ *Trans TGI*, 1882, p.15

5. Crystal Palace Exhibition: gas industry showcase and trade competition

London hosted a succession of international exhibitions in the 19th century to display the products and technical progress of its Empire, starting with the Great Exhibition of 1851, where displays included a gas chandelier, cooking range and hot-air stove.⁷¹ Using the railways, people travelled considerable distances to see the Exhibition at Crystal Palace, which attracted some 6 million visitors.⁷² Subsequently, exhibitions became an increasingly important way for traders to make the public aware of their products, both because of the accompanying press coverage and discussion, and because the award of medals could be used for company advertising, as illustrated in Figure 7.⁷³

Exhibitions could benefit gas undertakings by persuading customers to use more gas for lighting and appliances, but not all gas managers viewed exhibitions with enthusiasm and some declined to co-operate when traders offered to provide display stands, exhibits, and salesmen. However, some of the more commercially-minded gas undertakings in the north of England began to sponsor local exhibitions. When the South Shields Gas Company invited traders to demonstrate gas cookers and heaters, and awarded silver medals for the best appliances on show, they attracted some 30,000 visitors in a week.⁷⁴ Other exhibitions followed, sponsored by both private gas companies and municipal gas undertakings, in towns including Birmingham, Bradford, Halifax, Wakefield, Rochdale and Newcastle.⁷⁵

⁷¹ Goodall, *Burning to Serve*, p.80

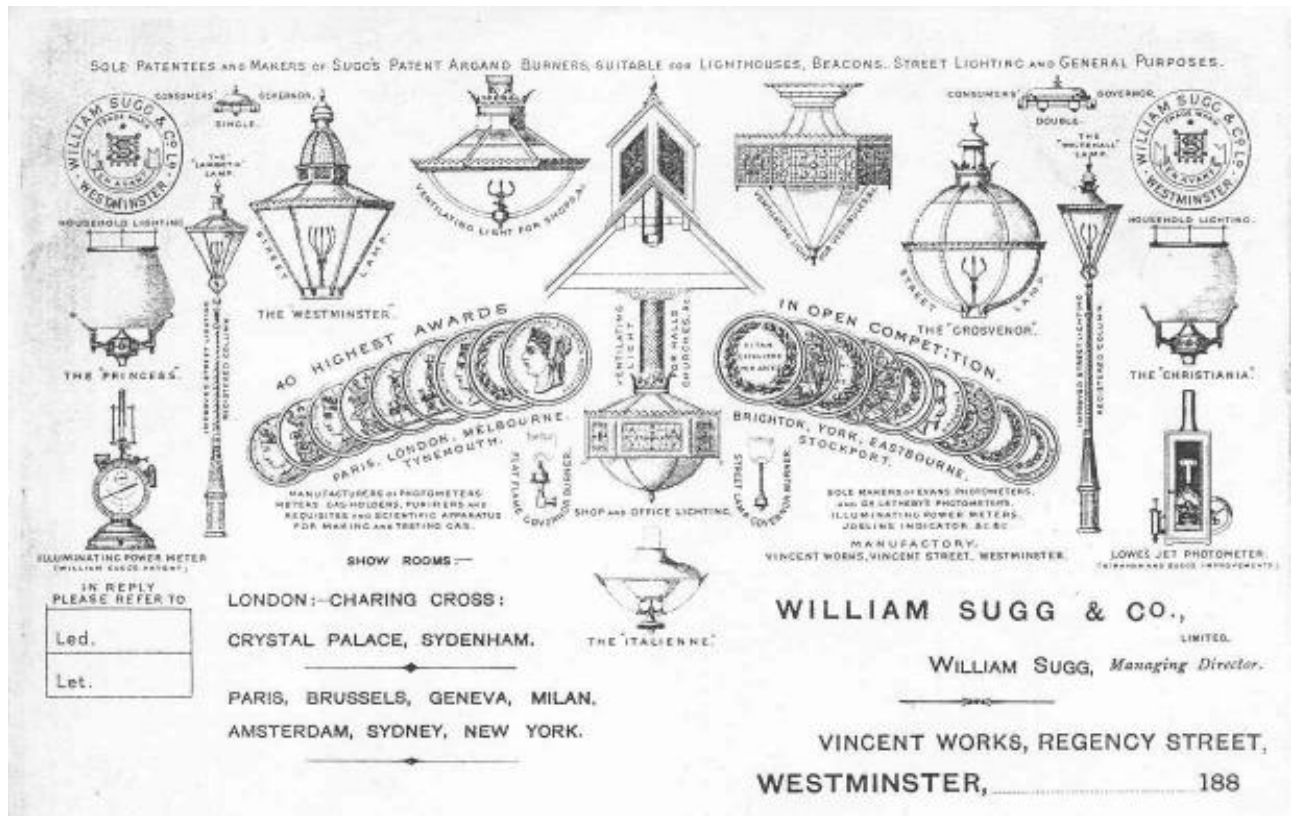
⁷² Douglas A. Reid, 'Playing and praying' in Martin Daunton, ed., *The Cambridge Urban History of Britain, Vol.3 1840-1950* (Cambridge, 2000), p.769

⁷³ The Paris Universal Exhibition of 1867 attracted exhibits from many countries, and included a display of gas lamps and cookers: Goodall, *Burning to Serve*, p.80

⁷⁴ Goodall, *The British Gas Appliance Industry*, pp.85-6

⁷⁵ *Ibid.*, p.86

Figure 7: William Sugg & Co headed notepaper used in the 1880s



Source: *William Sugg & Co., History* [accessed 28 April, 2010]

The figure illustrates some of William Sugg's range of gas lamps and highlights the awards he had received.

Whilst the gas industry was beginning to appreciate the value of exhibitions, so also was the nascent electrical industry, which held an International Exhibition of Electrical Appliances at Crystal Palace in early 1882. The previous year at the Paris Electricity Exposition, Edison had shown his carbon filament lamp, claiming that 'the light given out by the lamp resembles gaslight in colour and intensity, but differs from it in that it is absolutely even and steady.'⁷⁶ A French report compared electric light very favourably with gaslight: 'Electric light leaves no combustion residues in the house...to pollute the air ...[or] to damage paintings and fabrics...and does not give off

⁷⁶ Wolfgang Schivelbusch, *Disenchanted Night: The Industrialization of Light in the Nineteenth Century* (University of California Press, paperback edition, 1995), pp.59-60

uncomfortable and fatiguing warmth.⁷⁷ During the electrical exhibition at Crystal Palace, The Gas Institute held an informal dinner and meeting to discuss how electricity might affect their industry, but gas sales were continuing to grow and many gas engineers were at first complacently dismissive of electric lighting, and only slowly realised that their industry needed to innovate in order to compete.⁷⁸

Figure 8: Electric incandescent lamps possibly displayed at the Crystal Palace Exhibition

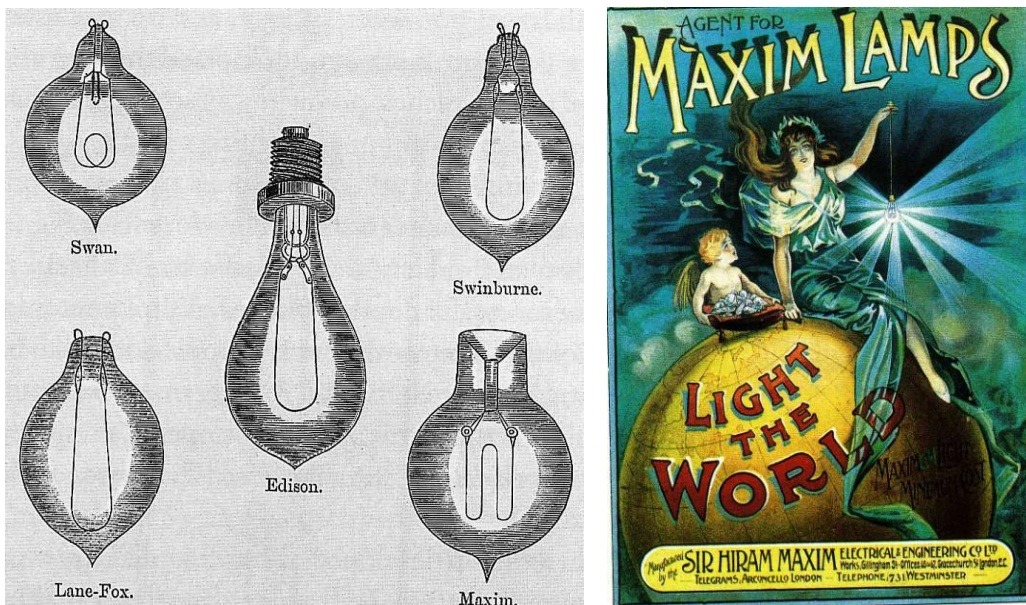


Illustration from R. Hammond's 'The Electric Light in our Homes' published c.1882, and an advertisement for Maxim lamps, c.1900 Source: Dillon, *Artificial Sunshine*, pp.164-5

By 1882 electric street lighting was being trialled by some local authorities, and it was proposed to hold an international exhibition at Crystal Palace where the gas industry, not only in Britain, but also from Europe and America, could show how they could compete with electricity, not only for lighting, but also for cooking and heating.⁷⁹

⁷⁷ Schivelbusch, *Disenchanted Night*, p.60

⁷⁸ *Trans TGI*, 1882, p.3

⁷⁹ Electricity was first used to light the Avenue de l'Opera in Paris in 1878: *JGL*, March 5, 1907, p.596

The Institute was at first reluctant to become involved in working with traders to organise a display. The *JGL* in an unusually outspoken report said that:

‘the larger Metropolitan Gas Companies have not yet decided to help in the vindication of gas lighting at this exhibition. We prefer to state the case in this way rather than to say that the Companies positively decline to have anything to do with it. They may have mistaken the situation [the threat from electricity] until the present... we fully endorse our correspondent’s [William Sugg] vigorous expressions respecting the great damage to the gas interest that will result from a *fiasco* in this part of the enterprise. If electricians appeal to the public eye, so must gas engineers..’⁸⁰

Ultimately, pride in being ‘universally acknowledged as the executive authority of the industry we represent’ won the day.⁸¹ The Institute’s President, Robert Paterson said that when the Directors of Crystal Palace decided to hold the exhibition ‘it was natural that they should seek for the assistance and co-operation of those who were able to guide them; and ..appealed to your Council to aid them in the work of the gas section.’⁸² The Institute set up a subcommittee comprising George Livesey (Chairman), Charles Gandon (Deputy Chairman) and Magnus Ohren to organise the gas section of the exhibition (see Appendix 1 for biographies). However, it was problems resulting from this subcommittee’s management of the gas exhibition arrangements that led to the dispute between the Institute and trader George Bray.

The Exhibition was originally planned to open in October 1882 and run until March 1883, and the Institute’s subcommittee set about fund raising for the gas section. Gas undertakings from across Britain donated a total of £5,594 14s 0d (a list of subscribers has been compiled as Appendix 3). The big London gas companies, the Chartered and South Metropolitan, each donated £500 and several local authority Gas

⁸⁰ *JGL* July 11, 1882, p.77

⁸¹ *Trans TGI* 1883, p.14

⁸² *Ibid.*, p.14

Committees donated amounts ranging from £10 to £150. Small undertakings such as the Fleetwood Gas Company, who wished to be shown as subscribing, donated 1 guinea.

The subcommittee determined the layout of the exhibition stands in the south nave of Crystal Palace, choosing to place only a few selected gas stands in the nave and locating most stands in somewhat cramped conditions in the west aisle (Figure 9). This contrasted with the electrical section, where all the stands were grouped into the centre of the northern nave. Gas and electric sponsors were each asked to provide overhead lighting for sections of the Exhibition Hall, and William Sugg proposed a complete plan of gas lighting arrangements to the Institute's subcommittee. (Sugg said that he was the only exhibitor to respond on time to the subcommittee's invitation to submit lighting arrangements, but it is likely that he had prior notice since he and Magnus Ohren were both Founder Members of the same Masonic Lodge.)⁸³ Sugg said that the Institute 'had been pleased to approve of this scheme, and had granted to the company the best position in the Palace for lighting, and also the best site for their stall.'⁸⁴ (Figure 10 shows that Sugg's lights were Section 21, and Bray's were Section 22.)

The subcommittee's inexperience in organising exhibitions was apparent when George Bray pointed out that the prescribed stand height of 8 feet was inadequate to demonstrate lighting and that similar stands elsewhere were all 12 feet tall.⁸⁵ He had specially constructed his display for a central position at stand number 111 or 112, but was allocated an end position at 110. (Sugg's stand was in prime position at 102, the orchestra end of the south nave).

⁸³ This was the Evening Star Lodge, No.1719. Its members were exclusively 'directors, auditors, secretaries, engineers, managers of gasworks...or contractors for the supply of gas material'. Another mason described the Lodge as 'a trade association of the most odious character': *JGL*, March 5, 1907, p.596 and March 26, 1907, p.799 & Goodall, *The British Gas Appliance Industry*, p.144

⁸⁴ This was reported at William Sugg & Co.'s Half-Yearly General Meeting: *JGL*, October 3, 1882, p.606

⁸⁵ WYAS, WYL1207/12

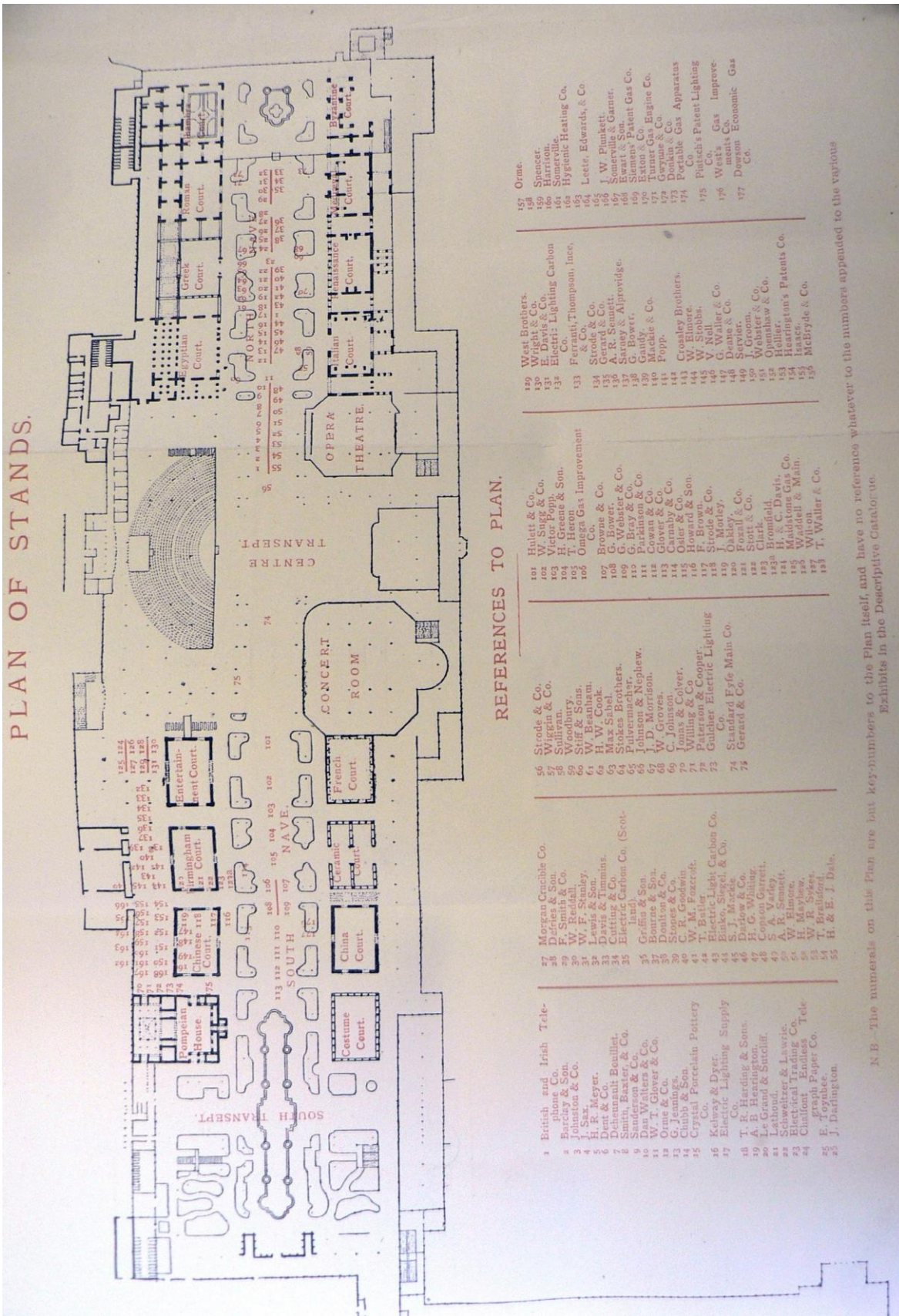


Figure 9: Plan of stands at the Crystal Palace International Electric and Gas Exhibition, 1882-83

The red marker shows George Bray's stand, the blue marker shows William Sugg's stand

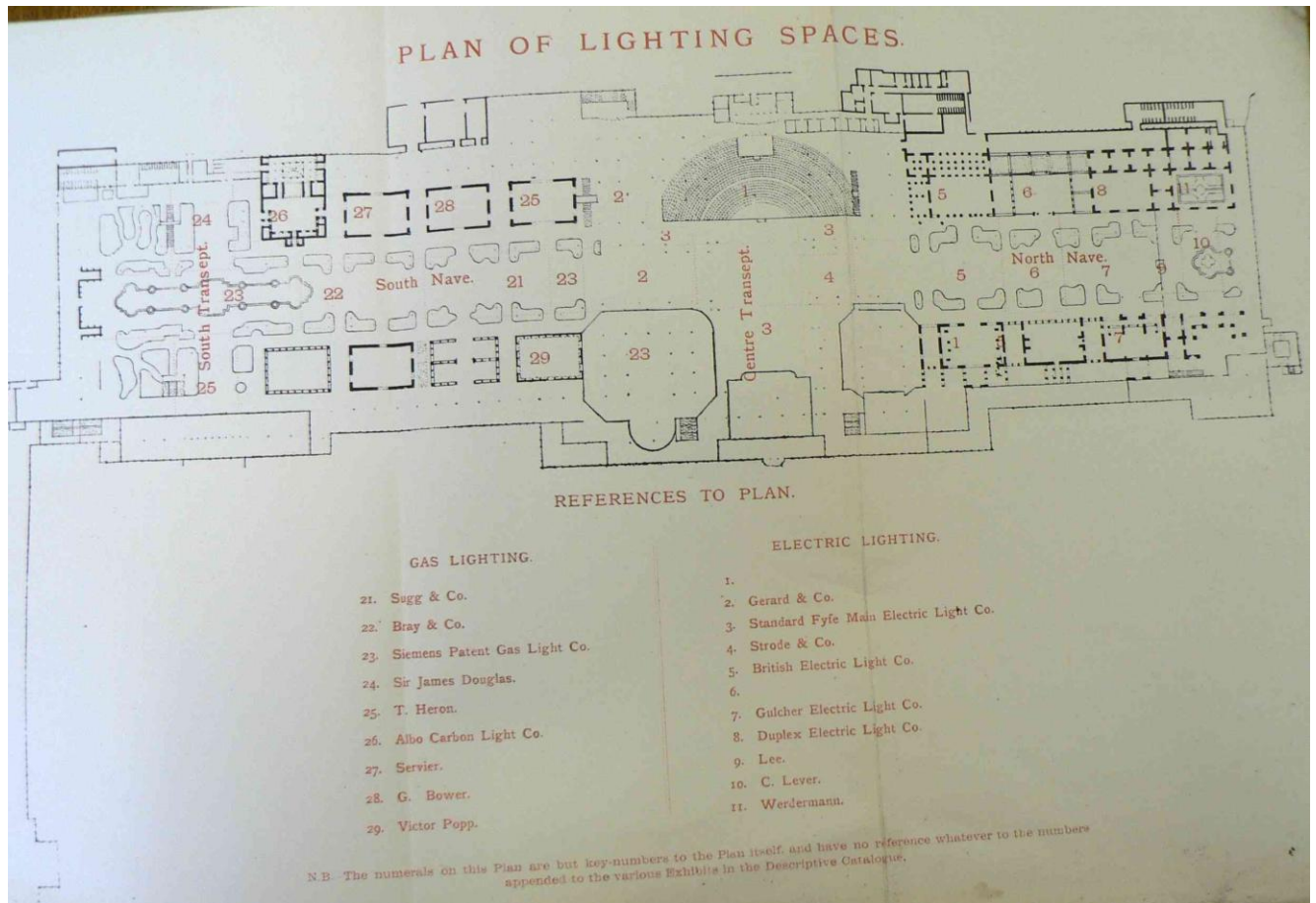
Source: WYAS, WYL1207/12

REFERENCES TO PLAN.

- 1 British and Irish Telephone Co.
- 2 Barclay & Son.
- 3 Johnston & Co.
- 4 J. Sax. Merer.
- 5 Dent & Co.
- 6 Delisle & Co.
- 7 Smith, Baxter, & Co.
- 8 Sanderson & Co.
- 9 Sanderson & Co.
- 10 W. T. Glover & Co.
- 11 Orme & Co.
- 12 Chubb & Son.
- 13 G. Jennings.
- 14 Crystal Porcelain Pottery Co.
- 15 Kelway & Dyer.
- 16 Electric Lighting Supply Co.
- 17 T. E. Harding & Sons.
- 18 Le Grand & Sutcliff.
- 19 Lathou.
- 20 Schweitzer & Lawrie.
- 21 Electrical Trading Co.
- 22 Chubb & Son.
- 23 Telegraph Paper Co.
- 24 E. Tevabee.
- 25 J. Darlington.
- 26 Morgan Crucible Co.
- 27 D. Fries & Son.
- 28 F. Smith & Co.
- 29 W. Reynolds.
- 30 J. Lewis & Son.
- 31 Davis & Timmins.
- 32 Cutting & Co.
- 33 Electric Carbon Co. (Scott.)
- 34 Griffin & Son.
- 35 Bourne & Son.
- 36 Dealton & Co.
- 37 Storer & Co.
- 38 W. M. Power & Co.
- 39 T. Butler.
- 40 Electric Light Carbon Co.
- 41 B. J. Blake.
- 42 J. J. Blake.
- 43 B. G. Whiting.
- 44 Copson Garrett.
- 45 S. A. Varty.
- 46 W. Elmore.
- 47 H. Mayhew.
- 48 W. R. Sykes.
- 49 T. Bradford.
- 50 H. & E. J. Dale.
- 51 Strode & Co.
- 52 Wignall & Co.
- 53 W. Whithy.
- 54 Stiff & Sons.
- 55 W. Besant.
- 56 H. W. Cook.
- 57 Max Steel.
- 58 Pulvermacher.
- 59 Johnson & Nephew.
- 60 J. D. Morrison.
- 61 W. Groves.
- 62 C. John Colver.
- 63 Willing & Co.
- 64 Paterson & Cooper.
- 65 Galaher Electric Lighting Co.
- 66 Standard Electric Main Co.
- 67 Gerand & Co.
- 68 Hulet & Co.
- 69 W. Sugg & Co.
- 70 Victor Popp.
- 71 H. Greene & Son.
- 72 J. Hervey.
- 73 Gas Improvement Co.
- 74 Browne & Co.
- 75 G. Bower.
- 76 G. Bell & Co.
- 77 B. & Co.
- 78 Parkman & Co.
- 79 Cowan & Co.
- 80 Glover & Co.
- 81 Carmany & Co.
- 82 Howard & Son.
- 83 F. Brown.
- 84 Strode & Co.
- 85 G. L. Money.
- 86 J. Foxall & Co.
- 87 Frost & Co.
- 88 Clark.
- 89 Bromfield Davis.
- 90 Maddison Gas Co.
- 91 Waddell & Main.
- 92 Wilton.
- 93 T. Waller & Co.
- 94 West Brothers.
- 95 W. Light & Co.
- 96 Electric Lighting Carbon Co.
- 97 Ferranti, Thompson, Ince, & Co.
- 98 Strode & Co.
- 99 Gerand & Co.
- 100 A. R. Semett.
- 101 Sarney & Alprovidence.
- 102 Gaudy.
- 103 Mackie & Co.
- 104 Popp.
- 105 Crossley Brothers.
- 106 W. Elmore.
- 107 W. Stobbs.
- 108 Y. Nall.
- 109 G. L. Money.
- 110 Sarvey.
- 111 J. Groon.
- 112 Webster & Co.
- 113 O. Shaw & Co.
- 114 Heaton's Patents Co.
- 115 Isaac.
- 116 Mcbride & Co.
- 117 Orms.
- 118 Spencer.
- 119 Hurmille.
- 120 Hygienic Heating Co.
- 121 Leets, Edwards, & Co.
- 122 J. W. Plunkett.
- 123 Sonerville & Garner.
- 124 Ewart & Patent Gas Co.
- 125 Ewart & Co.
- 126 Turner Gas Engine Co.
- 127 Gwynne & Co.
- 128 Double Gas Apparatus Co.
- 129 Putsch's Patent Lighting Co.
- 130 W. Gas Improvement Co.
- 131 W. Gas Improvement Co.
- 132 Doyson Economic Gas Co.
- 133 West Brothers.
- 134 W. Light & Co.
- 135 Electric Lighting Carbon Co.
- 136 Ferranti, Thompson, Ince, & Co.
- 137 Strode & Co.
- 138 Gerand & Co.
- 139 A. R. Semett.
- 140 Sarney & Alprovidence.
- 141 Gaudy.
- 142 Mackie & Co.
- 143 Popp.
- 144 Crossley Brothers.
- 145 W. Elmore.
- 146 W. Stobbs.
- 147 Y. Nall.
- 148 G. L. Money.
- 149 Sarvey.
- 150 J. Groon.
- 151 Webster & Co.
- 152 O. Shaw & Co.
- 153 Heaton's Patents Co.
- 154 Isaac.
- 155 Mcbride & Co.
- 156 Hulet & Co.
- 157 W. Sugg & Co.
- 158 Victor Popp.
- 159 H. Greene & Son.
- 160 J. Hervey.
- 161 Gas Improvement Co.
- 162 Browne & Co.
- 163 G. Bower.
- 164 G. Bell & Co.
- 165 B. & Co.
- 166 Parkman & Co.
- 167 Cowan & Co.
- 168 Glover & Co.
- 169 Carmany & Co.
- 170 Howard & Son.
- 171 F. Brown.
- 172 Strode & Co.
- 173 G. L. Money.
- 174 J. Foxall & Co.
- 175 Frost & Co.
- 176 Clark.
- 177 Bromfield Davis.
- 178 Maddison Gas Co.
- 179 Waddell & Main.
- 180 Wilton.
- 181 T. Waller & Co.
- 182 West Brothers.
- 183 W. Light & Co.
- 184 Electric Lighting Carbon Co.
- 185 Ferranti, Thompson, Ince, & Co.
- 186 Strode & Co.
- 187 Gerand & Co.
- 188 A. R. Semett.
- 189 Sarney & Alprovidence.
- 190 Gaudy.
- 191 Mackie & Co.
- 192 Popp.
- 193 Crossley Brothers.
- 194 W. Elmore.
- 195 W. Stobbs.
- 196 Y. Nall.
- 197 G. L. Money.
- 198 Sarvey.
- 199 J. Groon.
- 200 Webster & Co.
- 201 O. Shaw & Co.
- 202 Heaton's Patents Co.
- 203 Isaac.
- 204 Mcbride & Co.

N.B. - The numerals on this Plan are but key-numbers to the Plan itself, and have no references whatever to the numbers appended to the various Exhibits in the Descriptive Catalogue.

Figure 10: Plan of lighting spaces at the Crystal Palace International Electric and Gas Exhibition, 1882-83



The great height of the Palace necessitated high power burners and the lighting plan was for burners of at least 600-candle power, placed 24 feet apart, and about 30 feet above the floor.

The lighting space by George Bray is marked in red, lighting space by William Sugg is marked in blue.

Sources: WYAS, WYL1207/12, and *JGL* Nov 21, 1882, p.918

The exhibition was originally planned to open in October 1882 but was twice postponed and was finally opened by the Mayor of London on 13 December 1882.⁸⁶

The Official Catalogue of the Exhibition lists the very substantial product ranges displayed by both Bray and Sugg (their catalogue entries and advertisements are shown in Appendix 5). Bray's stand included his 'Patent Flat Flame Burners, adapted for every

⁸⁶ It was not until almost two months after the exhibition opened that the *JGL* reported 'The gas section is practically complete with one or two omissions': *JGL*, February 6, 1883, p.223

kind of street and interior lighting..' and also 'A display of improved Globes for various kinds of fittings...and Bray's Patent Flat flame Shadowless Lanterns....'.

Figure 11: Example of William Sugg & Co. display stand at a gas exhibition (unknown location)



Source: Family Archives held by Chris Sugg

The display stand shows not only large ceiling-hung lamps and small table top lamps, but also Sugg's range of ovens, and a large lamp at top right clearly meant to hang outside a public house or restaurant.

Sugg's stand included his Christiania burners, and his accompanying advertisements proclaim the awards he had won for his exclusive products. Figure 11 shows a Sugg stand at an unknown exhibition.

Since the Crystal Palace exhibition had initially been planned to run until the end of March 1883, Bray had committed to remove his display to another exhibition in

Sheffield in early April. When the Institute's subcommittee advised that the exhibition would be extended and judging for awards would not take place until April, Bray's protests were ignored. He was not the only exhibitor to be obliged to clear his stand, as W. & B. Cowan were also committed to take their display to Sheffield.

The Gas Institute considered the Exhibition to have been a great success, and the *JGL* congratulated George Livesey on his directing of the gas section 'he is a worker, and never allows his sanction and authority to go forth as a cover for work done by others.'⁸⁷ Robert Paterson, President of the Institute, saw the occasion as critical to the gas industry:

'had we not been appealed to, and had not the gas authorities throughout the country generously responded to the application we made to them for the necessary funds, the gas section of the exhibition would have been a dismal failure. What this would have meant...when the advocates...of electric lighting were exuberant in the recollection of their success in the same building last year, is not difficult to conceive.... if this exhibition had preceded by a couple of years or so the electric exhibition of last year, ruinous launching of gas stock upon the market by timid owners [fearful that the gas sales market would collapse in favour of electricity] would not have taken place.'⁸⁸

Surprisingly, it was a year before the awards were announced.⁸⁹ When William Sugg was distinguished by the award of no less than five silver medals, George Bray felt that, having incurred substantial costs to put on an extensive display, he had been unfairly treated both in being excluded from the awards process, and in the allocation of stand space, because 'the practical control of the Gas Section was in the hands of the shareholders and partisans of a limited company [ie. William Sugg & Co]'⁹⁰

Bray was also excluded from the subcommittee's post-exhibition Report, which comprised a series of articles about gas lighting and appliances. One article addressed the

⁸⁷ *JGL*, June 2, 1885, pp.999, 1007

⁸⁸ *Trans TGI* 1883, pp.14,15

⁸⁹ The judges were Robert Harris (President of the Institute of Gas Engineers), W. J. Russell (Institute Member) and Captain Douglas Galton, C.B (possibly an independent juror). *JGL*, April 8, 1884, p.614

⁹⁰ *GW*, March 19, 1887, p.360

illumination and quality of flat flame burners, but was based on very limited independent tests, using only burners manufactured by Sugg and by Winsor & Bronner.⁹¹

The next chapter discusses why the exhibition was a catalyst for polarising issues of status and perception between professional and traders, and why this led to a schism in the gas industry and the formation of The Institution of Gas Engineers as a rival professional body to The Gas Institute.

⁹¹ The Report was published in a series of articles in *JGL*, the gas burners article appearing in April 7, 1885, pp.620,621

6. Profession *versus* Trade: issues of status and perception

Despite the success of the Crystal Palace exhibition, many gas engineers and managers continued to professionally distance themselves from traders. The Institute's refusal to listen to Bray's concerns was symptomatic of the view of many gas engineers and managers that traders were at best to be tolerated as Associates, and at worst were a nuisance. Bray's persistent efforts to have his complaint heard by the Institute polarised the profession's perception of traders between those who recognised the benefits of working together to promote the gas industry as a whole, and those who maintained that a learned society had no place for commercial members.

Only three years after the Institute had revised its rules to include Associates, the *JGL* drew attention to the imperative need for change in respect of 'the practice of cumbering the hall of [the annual] meeting and lobbies with articles intended to advertise the makers. Nobody wants to stumble, whenever he enters the meeting, over stoves such as can be seen at any dealer's'⁹² Whilst making an exception for 'novelties' which the *JGL* thought might be well worth seeing, it recognised that 'Nobody can prevent manufacturers from getting up shows and entertainments in the nearest available spot to the hall of meeting; but it is enough to admit themselves to the latter, without permitting the encroachment of their goods.'⁹³ George Livesey remarked that when he attended a meeting of the Gas Institute 'the principals in certain trading firms were there [in the lobby] buzzing about like a lot of bees'.⁹⁴

A *JGL* editorial, said that admission to the Institute had been 'thrown open too widely just at the time and place where there was most risk of invasion...the new class of Associates suddenly assumed bloated proportions...the privilege of admission ...was

⁹² *JGL*, June 17 1884, p.1037

⁹³ *Ibid.*, p.1037

⁹⁴ *Trans TGI*, 1901, pp.63-4

abused by men who had no moral right to avail themselves of it.’⁹⁵ This problem was not unique to The Gas Institute. A similar issue had arisen several years previously, when the Bristol Society of Architects allowed ‘persons engaged in pursuits appertaining to Building’ to become Associate members, but then reorganised in 1862 to exclude the builders.⁹⁶ However, the issue for the gas industry was not clear cut. In a letter to *The Gas World*, George Bray drew attention to the inequity of professional gas engineers or managers, who were ‘patentees of, and traders in, apparatus sold to gasworks, and ... directors and shareholders in limited companies engaged in similar businesses’, not only retaining their Member status but eligible to serve on the Council of the Institute, whereas other traders could only be admitted as Associates.⁹⁷

Bray tried hard to get the Institute to investigate his complaint about the unfair arrangements for the Crystal Palace Exhibition. His approach to the subcommittee which had been responsible for the gas section of the Exhibition was to no avail.⁹⁸ Consequently, he informed Thomas Newbigging who was President of the Institute, that he would appeal to members at the next AGM, but said ‘If you can show me how I can obtain justice in any other reasonable way than by bringing the matter before the annual meeting, I will adopt the course you suggest.’⁹⁹ Forewarned of Bray’s intentions, the Council resolved that when Bray got up to speak, the President would rule him out of order.¹⁰⁰ In his Presidential address at the start of the meeting, Newbigging referred to ‘Mr. Sugg and Mr. Bray, twin genii of the lamp – a trade doubtless, but mutual friends of the gas manufacturer, who esteems the work of both’. However, when Bray attempted to

⁹⁵ *JGL*, May 13 1884, p.817

⁹⁶ Kaye, *The Development of the Architectural Profession*, p.90

⁹⁷ *GW*, March 19, 1887, p.360

⁹⁸ *GW*, April 2, 1887, p.423

⁹⁹ *Trans TGI* 1888, p.26

¹⁰⁰ Opinion of Institute Council members was apparently divided at this time since Bray thought that the resolution against him was only passed by 6 votes to 5. Charles Sellers said that the President himself was personally opposed to the ruling which he had orders to enforce: *GW*, April 2, 1887, pp.422, 423, and *JGL* June 9, 1885, p.1075

voice his complaint, ‘a band of members...drowned my voice by stamping, shouting and other forms of rowdyism’ such that ‘I failed to obtain even a hearing’.¹⁰¹

It appears that some of the more moderate members of the Institute’s Council wanted to quietly close the matter since a letter from Bray published in *Gas World* says that he had

‘had visits from a gentleman, acting as ambassador for some of the parties chiefly concerned in the malpractices of the Gas Institute Committee at the Crystal Palace Exhibition, with the view of inducing me to agree to private and personal arrangements, whereby the matters in dispute might be settled.’¹⁰²

As Bray’s friend Charles Sellers¹⁰³ said in another letter published by *GW*, ‘the gentlemen charged by Mr Bray with unfairness have always told the world that Mr Bray’s charges were baseless, and ridiculous, and beneath notice, and yet a strong attempt has lately been made to settle those charges privately. Why?’¹⁰⁴ Sellers goes on to argue that if Bray’s charges were baseless, there was nothing to settle, and pointed out that the Institute had declined to submit the matter to a committee chosen half by one side and half by the other. Bray declined the settlement proposals, contending that his reputation had been injured and that he would not receive justice if his complaint was swept under the carpet.

More correspondence published in *GW* illustrates how the split among professional members of the Institute was opening up. W. Carr, an Institute Council member wrote that, regarding the merits of the dispute between Bray and the Institute, ‘I know very little, and care less’.¹⁰⁵ Sellers berates this view, writing that:

¹⁰¹ *GW*, March 19, 1887, p.360

¹⁰² *Ibid.*, p.360

¹⁰³ Charles Sellers supported and defended Bray throughout the dispute. (See Appendix 1 for biography)

¹⁰⁴ *GW*, April 2, 1887, p.422

¹⁰⁵ *Ibid.*, p.422 (Carr was Manager of the gasworks at Halifax, Yorkshire)

‘Personally I was always under the impression that the main object of the members of the Gas Institute was for mutual protection and benefit, but ifwhen a member makes a complaint other members have the right to bully him, and treat his complaint with the most heartless indifference, then the sooner each member looks out for himself the better.’¹⁰⁶

Sellers continued by alleging that although originally admitting that Bray had not been rightly treated by the Institute, Carr was now ‘sick of the business’ and had done a volte-face saying he (Carr) now has the ‘utmost confidence in the men whose integrity Mr. Bray has impugned.’¹⁰⁷

The next step by the Institute’s Council was to change their rules to redefine qualifications for Associates, provide for members to be expelled, and increase subscription costs. George Livesey was the key Council member responsible for drafting the amendments. It was agreed that the former class of Associates would be divided into *Associate Members* and *Associates*. This was an attempt to distinguish between junior employees or pupils of Gas Undertakings (*Associate Members*) and a broad definition of *Associates* as ‘persons who, by reason of their professional knowledge or experience, are qualified to assist in promoting the objects of the Institute.’¹⁰⁸ The name change was in essence a way of emphasising the lower status of traders (*Associates*) compared to all other classes of *Member*.

As can be seen from Table 1, the influx of Associates had increased membership until 1883, when it stagnated. The Institute at this stage clearly wanted to keep the membership subscription revenue from traders because, as the *JGL* pointed out, the average annual cost of each member had been calculated at 15s 7d, which was unsustainable when fees were levied at 10s 6d.¹⁰⁹ To rectify this, fees were doubled to a

¹⁰⁶ *GW*, April 2, 1887, p.422

¹⁰⁷ *Ibid.*, p.422

¹⁰⁸ *Trans TGI* 1885, p.222, 227

¹⁰⁹ *JGL* May 20 1884, p.861

uniform subscription of a guinea for all classes of members except Associate Members who were to pay the reduced amount of 15s.

Table 1: Membership of the Gas Institute between 1881 and 1901

Year	1881	1882	1883	1884	1885	1889	1890	1899	1900	1901
Honorary Member		20	20	20	20	18	20	19	19	18
Ordinary Members		650	664	656	651	520	444	518	524	523
Extra-ordinary Member		77	75	73	69	53	48	32	30	30
Associate Member						33	27	57	56	66
Associate		49	126	124	135	78	65	56	54	51
Total	724	796	885	873	875	702	604	682	683	688

Source: Compiled from *Transactions* of The Gas Institute

A further change in the Rules said:

‘The Council may refuse to receive the subscription of any person who shall, in their opinion, have been guilty of such conduct as shall have rendered him unfit to continue to belong to the Institute....giving due notice to the person concerned, who shall have the right to be heard; and if two-thirds of the members present [at an AGM] so determine, his name shall be erased from the roll of the Institute...’¹¹⁰

George Bray took advantage of the right to be heard to get his letters of complaint read out to Institute members at the next AGM. The Council still maintained that they were ‘totally incompetent to inquire into the charges you have made against the gentlemen

¹¹⁰ *Trans TGI* 1885, p.225 (Almost 20years earlier, the Institution of Civil Engineers had sought legal opinion on whether it could expel a member for misconduct and had been advised that it could do so, but not ‘at the arbitrary will of the Council or a majority of the members’: Buchanan, *The Engineers*, p.73)

referred to in your former letter.’¹¹¹ After further disruption, the President invoked the new rule to recommend that Bray be expelled from the Institute and members present voted in favour.

Bray still valued his membership of the Institute and challenged his expulsion in the High Court, which found in his favour on a technicality. This was the crunch point. The Institute were obliged to reinstate Bray and pay his costs for challenging his expulsion, and shortly afterwards most of the leading members of the Institute, including George Livesey, resigned in protest.¹¹² For once, the *Journal* and *Gas World* were united in criticising the Council’s ineptitude in handling Bray’s complaint.

The gas engineers and managers who resigned from the Institute set about establishing The Incorporated Institution of Gas Engineers as a rival national professional body from which traders were explicitly excluded. Its founding principle was that ‘only men actively engaged in the management of gasworks or professionally in their construction were proper men to form an association representing the gas industry.’¹¹³ Having induced more members to defect from the Institute, the Institution had 70 members at its first annual meeting in 1891.¹¹⁴ George Trewby, the Institution’s President, boasted that their members were of a superior character to those of the Institute representing ‘a capital expenditure of gas undertakings of upwards of £23million’ – essentially an organisation of the largest gas undertakings.¹¹⁵ In defining a professional divide from the Institute, Trewby was echoing the Institution of Civil Engineers many years earlier when Thomas Telford said in his Presidential address that ‘talents and respectability are preferable to numbers, and that from too easy and promiscuous admission, unavoidable, and not infrequently incurable, inconveniences perplex most

¹¹¹ *Trans TGI* 1888, p.27

¹¹² Brauholtz, *The Institution of Gas Engineers*, pp.37,38

¹¹³ *Trans TIGE* 1901, p.60-61

¹¹⁴ *Trans TIGE* 1890, p.10

¹¹⁵ *Trans TIGE* 1891, p.17

societies.’¹¹⁶ It was perhaps due to a wish to avoid comparison with the Institute that no annual membership lists were published in the *Transactions* of the Institution, and in some years, not even the total number of members was reported.

The Institute suffered an immediate fall in numbers in 1890 as can be seen in Table 1, but succeeded in keeping the majority of its members including industry leaders such as Thomas Newbigging. In his Presidential address that year, George Garnett said that there had been an attempt to show that the split had caused ‘the men of “brains”’ to defect to the Institution.¹¹⁷ However, the Institute’s membership rebounded to stabilise by the late 1890s at around 680, of which about 12% comprised Associate and Extra-Ordinary Members, and professional engineers and managers co-existed peacefully with traders.

Both Institute and Institution were national bodies and both continued to publish and discuss technical papers at their annual meetings. Both remained concerned with the social status of their members rather than with setting standards for professional competency. A significant number of professionals were members of both the Institute and the Institution.

¹¹⁶ Buchanan, *The Engineers*, p.63

¹¹⁷ *Trans TGI* 1890, pp.8,9

7. Collaboration: profession and trade working together

The Institute and Institution continued their rivalry to represent the national gas industry for 10 years. It was not until 1900 that the rift was healed and negotiations began to unite the two organisations. This chapter discusses how the vexed question of trader membership was resolved to allow a new Incorporated Institution of Gas Engineers to be formed as the single voice of the gas industry; how the drive to increase gas sales led to professionals and traders working together to install pre-payment meters and rented gas cookers; and how gas lighting was able to compete more effectively with electricity following the invention of the incandescent gas mantle.

George Livesey had a ‘can do’ attitude and Mills says that his personality was such that he could walk into a meeting and say ‘Look this is how it is’ and with a clarity of message could change the agenda, and change how people think.¹¹⁸ This is certainly what happened when Livesey, accompanied by George Bray and Charles Sellers, unexpectedly walked into the annual meeting of the Institute in 1900. They were greeted with loud applause, invited to occupy seats on the platform and were each requested to address the meeting.¹¹⁹ Livesey said

‘how pleased he was to find himself once more, in company with Mr Bray and Mr Sellers, among his old friends.....It was a great satisfaction to both Mr Bray and himself to be present. The past was gone and they had to look to the future...No doubt there were difficulties in the way of union; but if men were sincerely desirous of it, he had no fear but that it would be brought about.’¹²⁰

Bray said that

‘as far as there ever was any fundamental difference of opinion between him and the Institute [about the organisation of the Crystal Palace Exhibition] it was now, at all events settled. For

¹¹⁸ Mary Mills, *The Ghost in the Dome* [<http://gihs.gold.ac.uk/ghost.html>, accessed 5 May 2010]

¹¹⁹ Brauholtz, *The Institution of Gas Engineers*, p.50

¹²⁰ *Ibid.*, p.51

many years, though Mr. Livesey might not have known it, he had regarded him with growing admiration...¹²¹

Charles Sellers, who had been the friend of both Livesey and Bray said that

'he had had a little to do with bringing Mr. Livesey and Mr. Bray together and in effecting an amicable settlement of the differences which existed between them. He felt he should succeed, because he always associated generosity with bravery; and the two men who had just spoken were both brave and conscientious.'¹²²

These remarks were received with hearty approbation, and a Joint Committee of both the Institute and Institution was subsequently appointed to negotiate the terms of amalgamation. As can be seen from Table 2, almost a third of the ordinary members of the Institution were also members of the Institute. When the two bodies united in 1903, membership of the Institute was almost three times that of the Institution.

Table 2: Membership of the Institute and Institution before and after amalgamation

Class of Membership	Belonged to both old Societies	Old Institute	Old Institution	New Institution
Honorary Members	-	18	1	19
Members	62	520	188	577
Extraordinary Members	-	28	-	-
Associate Members	5	60	-	78
Associates	-	46	38	-
Students	-	-	12	10
TOTAL	67	672	239	684

Source: *Trans TIGE* (united) 1903, p.12

¹²¹ Brauholtz, *The Institution of Gas Engineers*, p.51

¹²² *Ibid.*, p.51

The sticking point for agreement was a proposed rule which said that ‘No person shall be qualified to be or remain a member of the Institution who shall be actively engaged in...the management or business...of any trading company, firm or concern doing business with gas undertakings...’¹²³ George Livesey spoke in support of excluding traders from the new body, arguing that the Institution’s members, being actively engaged in the management or construction of gasworks, were responsible for buying and selling of all articles used by their gas undertakings, and therefore must be above suspicion in their relations with traders.¹²⁴ However he suggested that traders, such as Past Presidents who had since started up their own businesses in gas making equipment or ‘who had rendered service to the industry’ such as William Sugg, should receive an honorary distinction.¹²⁵

Some years earlier, the *JGL* had tried to take a balanced approach, saying that

‘We are not of those who would condemn the recognition of what is called the “trading element”. The gas industry is not a purely scientific or scholastic pursuit. A man does not cease to be an engineer when he makes articles for sale, instead of selling his time and skill...At the same time, the Institute is not a trade society and must not be patronised as such.’¹²⁶

It was agreed that the Institution should compliment those who had ‘rendered distinguished service to the progression of gas engineering, or have specially promoted the interests of the gas industry’ by electing them as Honorary Members.¹²⁷ With the exclusion of most traders, the new united Institution had just 12 more members than the former Institute (see Table 2), but by the time of its first annual meeting, an additional 48

¹²³ *Trans TIGE* 1900, p.17

¹²⁴ In the late 1880s, there were scandals about ‘commission’ payments by traders to secure contracts from gas undertakings, notably in Salford in 1887 in relation to coal supplies. A Public Bodies Corrupt Practices Act was passed in 1889, which made bribery a criminal offence, but only for municipal undertakings: Goodall, *Burning to Serve*, p.115

¹²⁵ For example, John West, the Institute’s President for 1893-4, had been Chief Engineer of Manchester Corporation Gas Department but left to establish West’s Gas Improvement Company Ltd: Brauholtz, *The Institution of Gas Engineers*, p.285

¹²⁶ *JGL*, May 13 1884, p.817

¹²⁷ *Trans TIGE* 1902, p.28

applications for membership had been accepted (bringing the total membership to 732).¹²⁸

When the first meeting of the united Institution of Gas Engineers was held in 1903, there were just five nominations for election to Honorary Member, including George Livesey and George Bray. Livesey gave credit to Bray and said

‘But for Mr. Bray, this union could not possibly have taken place; and they were very much indebted to him for the great magnanimity he displayed when he said to the old Institute that he was willing to retire if he were an obstacle to union. Mr Bray was a hard hitter, and he said hard things; but he was an honest man and he never made use of the Institute to further his personal objects.’¹²⁹

Livesey was quick to pursue the new opportunities for professionals and traders to work together which were opened up at this time by the invention of the penny-in-the-slot meter. As a result of cheaper coal prices and increased revenue from sales of residual products, gas undertakings had been able to steadily reduce the prices they charged customers. However, gas lighting was still beyond the means of working class homes. The ability to pre-pay little and often with pennies opened up a new mass market for gas sales once gas pipework had been installed.

Livesey developed a scheme at the South Metropolitan Gas Company, whereby the company paid the capital outlay to install a pre-payment meter and gas lighting in a customer’s home. Recognising that a significant increase in gas sales could be achieved, and gas useage spread throughout the day, if customers were encouraged to use gas for cooking, the South Metropolitan offered gas cookers on a rental basis. The customer paid a surcharge on the gas price charged through the pre-payment meter to reimburse the gas

¹²⁸ Following their exclusion from the new Institution, traders formed their own organization in 1905 - the Society of British Gas Interests.

¹²⁹ *Trans TIGE (united)* 1903, p.25

company for their initial costs.¹³⁰ Livesey contracted to buy meters and fittings from William Sugg, who had a showroom in the South Metropolitan Company office.¹³¹ A series of cooking demonstrations was arranged and just twenty demonstrations in 1888 resulted in orders for 859 stoves.¹³² The huge success of the scheme is illustrated by Livesey's comment in 1897 that 'a single collection from these machines [pre-payment meters] has yielded 10 tons in weight of copper' and that 'there has been at times an actual dearth of copper money in South London'.¹³³

Similar meter pre-payment schemes became enormously successful throughout Britain. Figure 12 shows just how dramatically the popularity of gas cooking increased gas sales in Manchester, shifting the peak gas supply period from the evening to midday by 1936. The scheme necessarily meant that gas supply companies became very big customers of the traders who manufactured the pre-payment meters and who also designed and sold the light fittings and gas cookers.¹³⁴ Since gas companies generally rented out cheap cookers at less than cost, no retail market in appliances developed, and traders were constrained to produce the cheap, robust models which gas companies chose to bulk order for their hire market.

¹³⁰ Gas cookers had been provided on hire from 1882 by Leicester Corporation Gas Department, who rented out 2000 stoves to customers within 2 years. Liverpool was first to use penny-in-the slot meters, but it was not until pre-payment meter and hire schemes were introduced across London by the South Metropolitan and shortly afterwards by the Chartered Company, that such schemes became commonplace across the country. By mid 1894, the South Metropolitan had supplied some 15,000 pre-payment meters: Goodall, *Burning to Serve*, pp.93,103

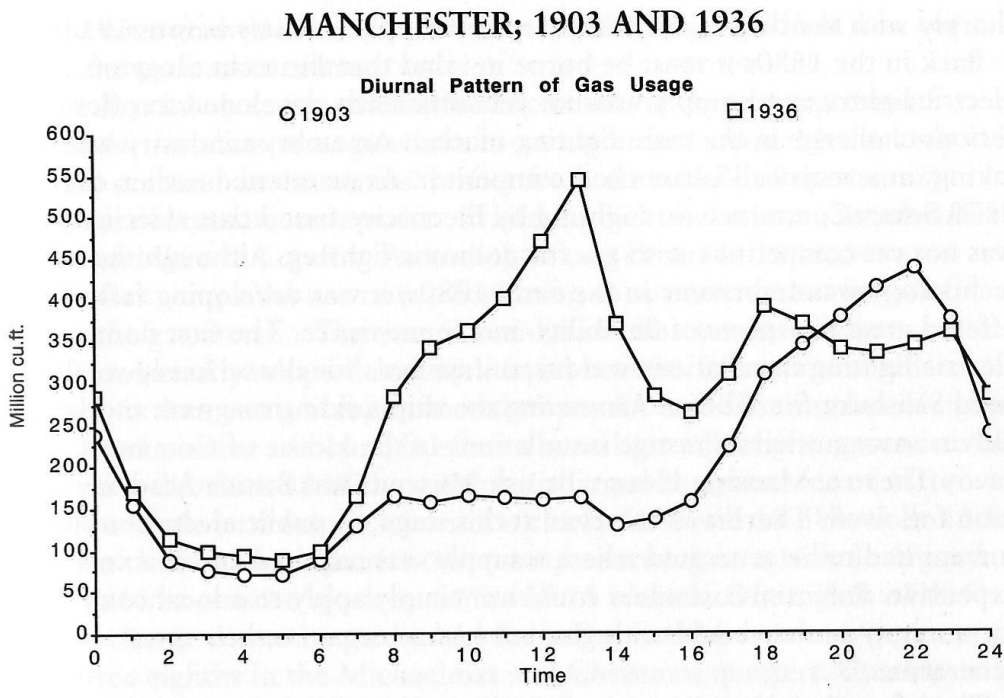
¹³¹ Sugg did not compete successfully in the gas cooker market as he used a different, less effective, burner principle from other manufacturers.

¹³² Goodall, *The British Gas Appliance Industry*, p.88

¹³³ Otter, *The Victorian Eye*, p.148

¹³⁴ Appliances such as domestic ovens, gas fires, gas rings and water heaters were made by Bray and Sugg and also made by firms such as Cannon, Parkinson and Cowan: Goodall, *The British Gas Appliance Industry*, p.11

Figure 12: Comparison of diurnal pattern of gas useage: Manchester, 1903 and 1936



Source: Goodall, *Burning to Serve*, p.67

Lighting gave high levels of demand for gas sales during only a third of each day, whereas the combined lighting and cooking demand meant high gas sales for over 2/3rds of each day.

It was the traders who enabled the gas industry to successfully compete with electricity by introducing incandescent gas mantles, which greatly improved both street and domestic gas lighting by giving several times more light than a flat flame burner with less gas consumption.¹³⁵ The profession was initially very sceptical about the effectiveness of incandescent mantles, but by the mid-1890s traders were able to demonstrate that the mantles, which could be screwed on to existing gas fittings, were giving 18 candlepower illumination per cu.ft of gas, compared to just 2 candlepower from a simple flat flame burner. In addition to making domestic lighting brighter and being more efficient of gas useage, the mantles solved the problem of gas lighting making rooms hot and stuffy. Incandescent mantles also meant that gas street lighting could

¹³⁵ After his first mantle was shown to be very fragile, Welsbach continued to experiment and patented an improved mantle and impregnating fluid in 1892: Goodall, *Burning to Serve*, pp.127-8

provide cheaper and better illumination than that available from electric lamps and for large areas such as railway stations, incandescent burners could give as good illumination as electric arc lamps (see figure 14).¹³⁶

George Livesey was again in the lead in working with traders to exploit the mantles. He offered to convert all the street lamps in the South Metropolitan Company's area from flat flame to incandescent burners at the Company's expense. Because the mantles were more efficient and provided a brighter light with less gas consumption, the Company would continue to charge their customers at the same rate as previously until their costs were recouped, and then reduce the customer's bill to reflect actual gas used with the new mantles. Within a year, almost 2/3rd of the 21,000 street lamps in the South Metropolitan's supply area had been converted.¹³⁷

George Bray's company, managed by his sons after his death, became one of the largest manufacturers of incandescent burners, which were displayed at showrooms opened in central London in 1905.¹³⁸ The *JGL* reported that

'A visit is interesting as it shows how considerably the firm have entered into the incandescent business...the firm, we learn, are turning out more flat-flame burners than ever ... The firm's ordinary incandescent burner, with its gas and air adjusters, and beautifully constructed head, has won much favour...Of fittings, globes and shades, there are samples of choice design [see Figure 13]; and in fact, a careful examination of them will bear out the firm's claim that cheapness, good material and high efficiency are companionable merits.'¹³⁹

By the turn of the century, it was the traders who were promoting the gas industry through marketing of incandescent gas lights and cooking and heating appliances. The idea of linking the prepayment meter to installation of gas pipe work for lighting and the

¹³⁶ By the end of 1896, the Welsbach Incandescent Gas Light Company, which was based in Westminster and had a licence to manufacture mantles under the Welsbach patent, was producing 30,000 mantles a day. The price of the mantles fell from 1s3d in 1895 to 7½d in 1900: Reg. Brown, 'Seeing the light – the great leap forward', in *The Historic Gas Times*, Issue 56 (2008)

¹³⁷ Goodall, *Burning to Serve*, pp.134-5

¹³⁸ Bray & Co.Ltd sold 2 million incandescent burners a year: WYAS, WYL1207/140, p.11

¹³⁹ *JGL*, December 5, 1905, p.701

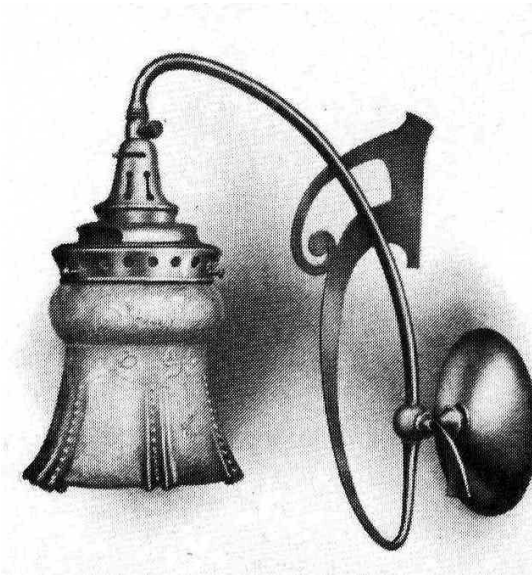


Figure 13: Bray Inverted incandescent gas mantle

This shows how George Bray & Co Ltd developed their domestic lamp designs. Illustration from their 1912 catalogue.

Source: Gledhill, *Gas Lighting* (Shire Publications, Aylesbury), p.23



Figure 14: Sugg 'Rochester' outside light

The lamp has three mantles and is typical of railway stations in the early 20th century

Source: Gledhill, *Gas Lighting*, p.32

rental of gas cookers, was a turning point in the perception of gas engineers and managers that they needed to involve themselves in the appliance trade and could not continue to stand on their professional dignity. The Incorporated Institution of Gas Engineers renewed its focus as a professional 'learned society', but made provision to recognise outstanding traders as Honorary Members, with George Bray being one of the first to be elected.

8. Conclusion

The 1880s, when electricity was beginning to emerge as a competitive energy source to gas, were a period of tension between the more commercially-minded engineers and managers who recognised the benefits of working with traders to develop the market for gas sales, and other engineers who saw themselves as professionals, above and apart from involvement in trade. For the traders, there was increased competition to manufacture and market new designs of gas lamps and also to diversify into gas appliances. It was a combination of the attitude of superiority among professional engineers, and aggressive competition between traders, that caused a major schism in the gas industry's professional body.

When the British Association of Gas Managers was first founded, its membership grew very rapidly; the presentation of technical papers and visits to gasworks at its annual meetings enabled members to share expertise and keep pace with new developments in gas engineering and manufacture. Recognition was given to outstanding traders by electing them as Honorary Members or Extra-Ordinary Members.¹⁴⁰ However, by the early 1880s membership numbers had stalled. BAGM was in financial difficulties and attempted to raise its profile by changing its name to The Gas Institute and to increase its revenue from membership subscriptions by amending its Rules to admit traders as Associates. This strategy had unanticipated results when not only did membership applications from traders begin to outnumber those from engineers, but some traders used the Institute's annual meetings as an opportunity to importune gas engineers and managers for business.

The attitude of professionals towards traders began to harden after the Institute had been persuaded to organise the gas section of an international exhibition at Crystal

¹⁴⁰ William Sugg was elected an Honorary Member in 1873, and George Bray was elected as an Extra-Ordinary Member in 1879: *Trans TGI* 1883, pp.213, 231

Palace. Trader George Bray tried to complain about the way that the subcommittee which was responsible for the Institute's management of gas industry representation at the exhibition, had allocated stands and arranged the judging for awards. From the available evidence, Bray was justified in his complaint, but the subcommittee members, George Livesey, Charles Gandon and Magnus Ohren, who were all friends of Bray's rival trader William Sugg, refused to acknowledge that there could be any question to answer about their organisation of the exhibition.

Bray was a man of strong principles and doggedly determined to achieve recognition that he had been unfairly treated, remaining steadfast for many years in withstanding bullying and harassment by members of the Gas Institute, and vilification in the *Gas Journal*. It was the Institute's inept attempt to expel Bray for being a nuisance that far from resolving the issue, led to the Institute losing its status as the single national focus for the gas industry. When a High Court hearing obliged the Institute to reinstate Bray, the perceptions of professionals towards traders became polarised. Many senior members resigned from the Institute to form the Institution of Gas Engineers, taking the view that their national professional body should be restricted to engineers and managers, and that all traders should be expressly excluded. The Institute by contrast retained its Associate membership class for traders. A letter by Charles Hunt said:

'It cannot be too clearly understood that the rock upon which The Gas Institute split is the question of the exclusion or otherwise of the trading element.'¹⁴¹

Apart from this issue of traders, there was no significant difference between the constitutions of The Gas Institute and the Institution of Gas Engineers, and for the next 13 years both held annual meetings, both published technical papers and both sought to represent the national gas industry. The two professional bodies eventually agreed a set of rules which allowed them to unite, but some perceptions die hard. At the first meeting of

¹⁴¹ Brauholtz, *The Institution of Gas Engineers*, p.43

the new united Incorporated Institution of Gas Engineers, a member tried unsuccessfully to block George Bray from being elected an Honorary Member. George Livesey confirmed that Bray's issue was settled, saying 'he was very glad indeed that Mr. Bray's name was associated with his own in the Honorary Membership – in fact, it would have taken off the greater part of the pleasure if it had not been.' Bray and Livesey were both independent, strong-minded individuals with a 'can do' attitude, who managed successful businesses with a clear code of ethics at a time when payment of 'commission' for gas contracts was common. Both had a keen sense of their own capabilities and status – Bray as an inventor and manufacturer of burners and appliances, Livesey as a professional engineer and manager.

Recognition of professional status through the establishment of industry bodies was one of the significant social changes of the 19th century. James Helps, President of the Institution of Gas Engineers in 1900, highlighted the progress that the gas industry had made towards professionalism, saying:

'in the earlier days of gas manufacture, managers of works were men who held their position by the possession of strong natural intelligence and undoubted energy, but who, through no fault of their own, were hardly possessed of that early training which fitted them for acting in any other capacity than that of manager.'¹⁴²

Helps went on to say that, although there were many gas managers who had contributed to progress in the industry, they had relied on consulting engineers for technical assistance. Britain led the way in gas engineering expertise and more experienced gas engineers found they were in demand to give advice about gasworks all over the world, including Thomas Hawksley in Bombay, Thomas Newbigging in Brazil, Charles Gandon in Smyrna for the Ottoman Gas Company, and Henry Woodall in Melbourne, Australia. In 1899, the Institute elected Frederick Marshall as its President, a British engineer who

¹⁴² *Trans TIGE* 1900, p.32

was working for the Danish Gas Company, where he rebuilt several of their gasworks. The professionalism of the united Institution was respected internationally, and at its 1907 annual meeting, held in Dublin, it welcomed visitors from France, Germany, Denmark and Japan, as well as two visitors from the United States who presented technical papers.¹⁴³

George Livesey was the outstanding gas engineer and manager of his generation. His education had been essentially practical, through apprenticeship to his father, but by the time of his death, the value of scientific theory had been accepted as integral to engineering competency.¹⁴⁴ Professional bodies, such as the Institution of Civil Engineers, were reflecting the desirability of university education in their qualifications for membership. The Institution of Gas Engineers endowed the Livesey Professorship of Coal Gas and Fuel Industries, to direct teaching and research for the gas industry at Leeds University, as a memorial to Livesey's contribution to the gas industry (see Appendix 6 for discussion of why Leeds was chosen rather than a London college).¹⁴⁵ George Bray had been a Life Governor and regular donor to the Yorkshire College of Science, and had supported its development to become established as Leeds University. Trade and profession came together when Bray's son, John William Bray, was nominated to be a University representative on the Advisory Committee which was set up to administer the Livesey Professorship.¹⁴⁶

Over the following years the Institution was increasingly recognised as the authoritative voice of the gas industry, promoting advances in research, technology, and

¹⁴³ *JGL*, June 25, 1907, p.893

¹⁴⁴ King's College, London, set up a separate Faculty of Engineering in 1896, followed by University College and Imperial College: Buchanan, *The Engineers*, p.172

¹⁴⁵ There were other precedents for endowing a specialised subject appointment at a University. In 1884, a Chair in Naval Architecture at Glasgow University was endowed by The Institution of Naval Architects, soon followed by similar developments at Newcastle and Liverpool: Buchanan, *The Engineers*, p.95

¹⁴⁶ Letter of July 18, 1910 from The University, Leeds, to the Institution of Gas Engineers (Private archive of Mary Mills)

the training and qualification of gas engineers. The grant of a Royal Charter in 1929 enabled the Institution's members to style themselves with the title *Chartered Gas Engineer*. Changes in the Institution's by-laws associated with the Royal Charter meant that a technically qualified person involved in trade could be admitted to the same classes of membership as engineers and managers of gas undertakings.¹⁴⁷

By the 1920s, the tungsten filament electric light bulb had been developed and electricity, now sold at an affordable price, was seen as a modern and labour-saving competitor compared to gas which was smelly and hazardous. When the national grid became operational, electricity superseded gas lighting and the future for both gas companies and traders was in the use of gas for cooking and heating.¹⁴⁸

The Livesey Professorship continued during the 20th century as also did Leeds University's links to George Bray & Co. In the 1960s, the research carried out under the aegis of the Livesey Professorship included a study of the effect on gas burners of the change from coal gas to natural gas; this study was initiated by George Bray & Co., who provided a fellowship for the research, and it was considered to be of national importance since coal gas was about to be superseded by natural gas produced from the North Sea.¹⁴⁹

Today, the professional body is known as the Institution of Gas Engineers and Managers and continues to publish technical papers. It sets industry standards for professional competence, and although membership is not a requirement for employment, the Institution's 11 grades of membership, ranging from Student Member to Fellow, provide recognition of a spectrum of technical expertise relevant to both engineers and traders.

Katrina Hide 13 September 2010

¹⁴⁷ Institution of Gas Engineers and Managers, www.igem.org.uk/company/history.asp accessed 31/05/2010

¹⁴⁸ In 1880, lighting represented well over 90% of gas sales, but had fallen to only around 10% by 1939: Goodall, *Burning to Serve*, p.64

¹⁴⁹ *The Houldsworth School of Applied Science: The Fuel Department after 60years* (The Institution of Gas Engineers, 1966)

Appendix 1

Brief career sketches of professionals and traders involved in this episode of the gas lighting industry:

Sir George Thomas Livesey, 1834-1908



George Livesey was following a family tradition in becoming a gas engineer. His great uncle Thomas was one of the initial shareholders of the first gas company, the Chartered Gas Light and Coke Company. Thomas became so concerned about poor operating practices at the Company's gasworks that he took on a leading role in re-organising the way the Company managed its business. Thomas junior, George's father, joined the Chartered Company as an apprentice to great uncle Thomas, and having developed his technical capabilities, moved to an appointment as manager at the South Metropolitan Gas Company's gasworks.¹⁵⁰ George started working with his father at the South Metropolitan at age 14, and remained with the company for 60 years, becoming Assistant Manager at the age of 23, and progressing to the position of Engineer & Secretary, before retiring to become a Director and later Chairman of the company. George Livesey was responsible for the South Metropolitan expanding to become the second largest gas undertaking in the country in volume of output.¹⁵¹ He was President of The British Association of Gas Managers in 1874, and in 1882 was the first recipient of The Gas Institute's prestigious Birmingham medal for research, awarded 'for originality in connection with the manufacture and

¹⁵⁰ Thomas was a notably successful manager, improving the efficiency of the gasworks and introducing workmen's benefits such as a contributory sick fund: Goodall, 'Livesey, Sir George Thomas (1834-1908)' *Oxford Dictionary of National Biography* [accessed 6 May 2010]

¹⁵¹ Between 1862 when George was appointed Engineer, and his death in 1908, the gas output of the South Metropolitan Company rose from 350 million to 12,520 million cubic feet per year: *Ibid.*

application of gas, such qualification to be interpreted in its widest possible sense’.

Livesey was a generous philanthropist and was knighted in 1902.

Sources: Mary Mills, *A Biography of George Livesey* (Southwark Local History library, Pamphlets 920/Liv, 2001); Mary Mills, *The Ghost in the Dome* [<http://gihs.gold.ac.uk/ghost.html>, accessed 5 May 2010]; Braunholtz, *The Institution of Gas Engineers*, p.321

Magnus Ohren, 1821-1907

Magnus Ohren started his career by becoming articled aged 16 to the Engineer-in-Chief of the British Gas Company’s Ratcliffe gasworks. After spending a period in Hamburg to assist in establishing gas lighting for the city, Ohren became Superintendent of the Commercial Gas Company. In 1855, he was appointed Manager and then later was Secretary of the Crystal Palace Gas Company, a position he held until 1893. Ohren was a founder member of the British Association of Gas Managers. He resigned from The Gas Institute in 1890 and became one of the auditors of the rival Institution of Gas Engineers. When he retired in 1893, George Livesey was one of the supporters of a proposal that company shareholders should pay Ohren a pension.

Source: *JGL*, March 26, 1907, p.799

Charles Gandon, 1837-1902



Charles Gandon began his career by assisting in construction of gas works in Germany. He moved to Smyrna, where he was Engineer & Manager, of the Ottoman Gas Company. After a period as Engineer & Manager of gasworks in Bombay, Gandon returned to England as Engineer & Manager of the Crystal Palace Gas Company, a position he held for over 20 years. He

was President of The Gas Institute in 1888.

Source: Braunholtz, *The Institution of Gas Engineers*, pp.282-3

Charles Sellers, d.1902

Charles Sellers was Secretary and Manager of the York United Gasworks Company. He was elected a member of the British Association of Gas Managers in 1874 and was a Council member of The Gas Institute in 1883-84. No other biographical information about him has been found.

Sources: Braunholtz, *The Institution of Gas Engineers*, p.52, and *Trans TGI* 1883, p.226

Thomas Newbigging, 1833-1914



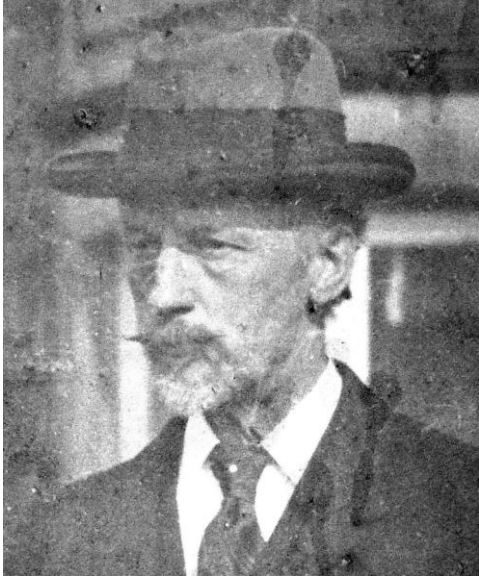
Thomas Newbigging started his career as an engineering apprentice in Blackburn, and after progressing to become Secretary & Manager of the Rossendale Union Gas Company, he went to Brazil as Engineer & Manager for the Pernambuco Gasworks.¹⁵² Returning to England in 1875, he set up a consulting business in Manchester and his professional activities

took him all over the world. Newbigging was one of the leading authorities on gas engineering and he first published *The Gas Manager's Handbook* in 1870, in which he laid down guidelines on how a gas supply undertaking should be managed. His *Handbook* was so popular it ran to at least 8 editions. Newbigging was one of the founding members of the British Association of Gas Managers and was President of The Gas Institute in 1885. He was awarded a Doctor of Science degree by the University of Leeds in 1912.

Source: Braunholtz, *The Institution of Gas Engineers*, pp.31, 280

¹⁵² Braunholtz, *The Institution of Gas Engineers*, pp.31,281

George Bray, 1841-1905



George Bray started work, aged 12, with a printer and bookseller, who encouraged him to educate himself by attending night classes at his local Mechanics Institute.¹⁵³ Having learned the basics of chemistry, physics and metallurgy, Bray went to work for a Leeds company which manufactured textile machinery and machine tools, where he became proficient in working with brass and drilling the ultra-fine holes needed for carding machines. He developed an interest in ceramics and after much methodical study and experiment with different clays and glazes, invented a brass, flat flame gas burner with a porcelain tip, which would not corrode, thus curing the flickering light problem. Bray took out his first patent for a gas burner at the age of 24. He used his experience at the textile machine tool company to make his own machinery for manufacturing burners in order to keep his production process unique to his business, which he developed into an enterprise employing 700 workers by the time of his death. Bray handed over the management of his business to his sons, John and Arthur, in about 1900 and converted it into a Limited Liability Company in 1903. Bray took a philanthropic interest in facilities for working men in Leeds, founding the Leeds Athletic Club, and setting up soup kitchens during the long severe winter of 1895.

¹⁵³ Mechanics Institutes were originally founded to provide a scientific education for the working class - see Appendix 6

Sources: A N Curren-Briggs, *The Life of George Bray*, WYL1207/143, p.2, Photograph of George Bray, 1900, WYL1207/84; Pawson, *A Short History of Geo. Bray & Co*, WYL1207/140; WYL1207/117

William Thomas Sugg, 1832-1907



William Thomas Sugg's family were involved in the gas lighting business from its outset. Thomas Sugg, an ironmonger who worked with tin and sheet metal, is thought to have manufactured and installed pipes for Frederick Winsor's first demonstration of gas street lighting in Pall Mall, London. Thomas's son, William, went to work for a meter maker and then set up his own business in Westminster as:

'William Sugg & Co., Brass and Iron Founders, Gas Engineers and Fitters, Makers of Improved Gas Meters, Manufacturers of every description of plain and ornamental bronze, brass and iron work for OIL or GAS....',¹⁵⁴

William's son, William Thomas, worked for Thomas Livesey at the South Metropolitan Gas Company, where he learned about gas supply and appliances, and he took over his family's business at age 25 years when his father died. William T. Sugg was elected an Honorary Member of the British Association of Gas Managers in 1873 (despite being a trader rather than a gas supply manager), giving papers at annual meetings and authoring a book on *The Domestic Uses of Coal Gas*.¹⁵⁵ He spent a lot on advertising and expanded his business with showrooms in the Grand Hotel Buildings, Charing Cross, London, and also in Paris. To raise more capital for development, he converted his business into a Limited Company in June 1881 but at a time when investors

¹⁵⁴ Advertisement in *The Builder*, December 31 1842: William Sugg & Co, History [accessed 28 April 2010]

¹⁵⁵ William T. Sugg, *The Domestic Uses of Coal Gas: As applied to lighting, cooking and heating, ventilation; with suggestions to consumers of gas as to the best mode of fitting up houses and using gas to best advantage* (London, 1884)

were concerned about the challenge of electricity to gas lighting, the flotation was substantially under-subscribed.¹⁵⁶ William Sugg's company suffered from a loss of commercial direction during the late 1880s. Its gas cooker design did not compete successfully with those of other manufacturers, and a number of its patents were never put into manufacture.¹⁵⁷ Sugg's company got into financial difficulties, and no dividends were paid between 1888 and 1896.¹⁵⁸ It was not until the firm was re-organised after Sugg's death and refocused on its core business of gas lighting, that it recovered its reputation and profits.

Sources: William Sugg & Co, History [accessed 28 April 2010] and *JGL*, March 5, 1907, p.595

¹⁵⁶ Of the Offer of 40,000 shares, only 6,571 shares were taken up: Dillon, *Domestic Lighting in Britain*, p.196

¹⁵⁷ Sugg's wife, Marie Jenny Sugg wrote a cookery book which also described gas appliances and how to use them: Goodall, *The British Gas Appliance Industry*, p.87

¹⁵⁸ Dillon, *Domestic Lighting in Britain*, p.202

Appendix 2

Syllabuses for examinations by the City and Guilds of London Institute in Gas Engineering and Gas Supply

June, 1907

[APPENDIX.]

The following are the syllabuses for the examinations by the City and Guilds of London Institute in "Gas Engineering" and "Gas Supply" referred to in the preceding report.

GAS ENGINEERING.

The examination will include questions founded on such subjects as the following:—

ORDINARY GRADE.

- 1.—The construction and setting of retorts for the destructive distillation of coal, and the furnaces or producers for heating them.
- 2.—The methods of charging and discharging retorts, and the machine and other tools employed; the fittings of the retort-bench, including the hydraulic (or dry) main.
- 3.—The effects of modifications of carbonizing temperature upon the quantity and quality of gas yielded by the coal.
- 4.—The description of apparatus for the manufacture of water gas (uncarburetted or carburetted), and the practical working of the plant.
- 5.—The principles and methods of gas condensation, with descriptions of apparatus employed.
- 6.—The exhaustor—its construction, its use or object, and the means by which it is actuated and controlled.
- 7.—The methods of removing the gaseous impurities present in the gas after condensation, together with the apparatus and materials employed. The chemical reactions involved.
- 8.—The various instruments used in gas-works for ascertaining and recording pressure and exhaust, and their practical employment and significance.
- 9.—Usual methods and apparatus employed for testing coal gas, water gas, producer gas, waste gas, &c., including the usual tests for illuminating power, calorific value, specific gravity, and purity of the gas supplied to the public, and those for ascertaining the value of the bye-products.
- 10.—The simpler physical and chemical principles involved in the ordinary processes of gas manufacture and the formation of the bye-products.
- 11.—The general principles involved in the construction of the gas-holder and its tank. The advantages of the holder in gas distribution. The laying of mains and services. The necessary methods for securing an adequate supply of gas throughout the area of a district. The methods and instruments employed at the works for the due control of the pressure in the street mains.
- 12.—The fitting up of premises for the supply of gas for light, heat, and power. The construction, testing, and fixing of gas-meters. The influence of temperature and pressure on the volume of gas.
- 13.—The construction of various types of gas-burners. The simpler physical and chemical principles involved in the combustion of gas. The economy and efficiency of incandescent lighting as contrasted with luminous flames. High-pressure lighting.

HONOURS GRADE.

In the Honours examination more difficult questions will be set in the subjects named in the syllabus of the Ordinary Grade, and, in addition, a knowledge will be required of—

- 1.—The characteristic properties of the various kinds of coal, and their value for gas-making purposes.
- 2.—The effects of temperature upon the production of residuals.
- 3.—Chemical composition and physical properties of coal gas, and the influence of each component upon the illuminating power and calorific value of the gas.
- 4.—The principles of combustion, and their application to the working of retort-furnaces.
- 5.—The more advanced physical and chemical principles involved in the processes of destructive distillation of coal, and in the condensation and purification of the resulting gas.
- 6.—The methods of complete gas analysis, including those for ascertaining the amount of impurities in the crude gas. Method of testing oil to be used in the manufacture of carburetted water gas.
- 7.—Theory and practice of photometry, calorimetry, and pyrometry. Full details of apparatus employed.
- 8.—Gas lighting. High and low grade gases. Illuminating power.

- 9.—Application of power and labour-saving appliances in gas-works.
- 10.—The construction of gas-works plant generally.
- 11.—The management of the various portions of the plant in order to obtain the best efficiency of the apparatus, with due regard to economy in working.
- 12.—The method of dealing with such emergencies as are of more common occurrence in gas-works through breakdown of machinery or other failure of plant.
- 13.—Working up of ammoniacal liquor and treatment of waste products.
- 14.—Gas in competition for light, heat, and power.
- 15.—The construction, working, and efficiency of the gas-engine.
- 16.—Flow of gas in mains, theory and practice. High-pressure distribution.
- 17.—Structural capacity. Working costs.
- 18.—Such important recent developments of the gas industry as have been fully described in the Technical Press.

[Here follows the list of works of reference.]

GAS SUPPLY.

The examinations will include questions founded on such subjects as the following:—

ORDINARY GRADE.

1. *Mains and Services.*—Station and district governors. General principles of distribution. The various kinds of pipes and fittings used, and testing of same. Methods of laying. Joints and jointing. Maintaining supply during alterations to existing mains and services. Causes of corrosion and preventives. Unaccounted-for gas. Leakage, causes of and testing for. Syphons. Valves. Pressure-gauges. Maintenance.
2. *Gas-Meters.*—Principles and construction of gas-meters, including slot and stop mechanism. Repairing, testing, and fixing of meters.
3. *Plumbing.*—Properties and composition of various alloys, such as brass, gun-metal, &c., used for valves, cocks, gas-fittings, &c. Solders, their composition, preparation, and uses. Methods of soldering.
4. *Interior Fittings.*—Description and size of pipes in relation to requirements. Distribution of light. Testing of installations. Anti-vibrators. Moveable pendants. Other fittings and accessories. Simple principles of ventilation. Method of governing pressure beyond the meter.
5. *Luminous and Bunsen Flames.*—Theory and application of.
6. *General Lighting.*—Construction of flat-flame, argand, regenerative, and incandescent burners. Regulation of gas and air supply to burners. Causes and prevention of mantle breakages. Influence of shades, globes, wall-papers, &c., on light efficiency.
7. *Outside Shop and Street Lighting.*—Types and construction of lanterns. Principles of windproof lanterns. Suspension brackets and lamp-pillars.
8. *Use of Gas for Heating Purposes.*—Construction, types, and fixing of cookers, boilers, fires, irons, &c. Hot-water circulating appliances. Geysers. Flues for waste products.
9. *Gas Power.*—Construction and practice of the gas-engine.
10. *Tools and Appliances.*—A full knowledge must be obtained of all the tools and appliances necessary for repair and extensions from the works' governors to the point of combustion.

HONOURS GRADE.

In the Honours examinations more difficult questions will be set in the subjects named in the syllabus of the Ordinary Grade, and, in addition, a knowledge will be required of—

1. *Mains and Services.*—Flow of gas in mains, theory and practice. Comparative advantages of wrought-iron, cast-iron and steel. Various methods of jointing. Electrolysis and electric fusion. Methods of dealing with naphthalene and other stoppages. Pressures and pressure-recording instruments. Main-laying costs and relation to prospective income. First aid in cases of "gassing." High-pressure distribution. Fans, blowers, and compressors. Subways, advantages and disadvantages of. The carrying of mains over bridges, and under rivers and canals. Explosive mixtures.
2. *Interior Fittings.*—Specifications. Principles and construction of various types of burners lighting and plant for intensified lighting. Lighting of churches, factories, and other large buildings. Theory and practice of ventilation by gas. Lighting for special purposes, such as billiard-tables, &c. Switch lighting.
3. *General Lighting.*—Efficiency of flat-flame, incandescent, and other burners. Low and high pressure lighting. Theory, manufacture, composition, and testing of the incandescent mantle. Illuminating effect of different methods of lighting. Flame temperature. Air supply. The hygiene of gas.
4. *Outside Shop and Street Lighting.*—Public lighting. Testing for illuminating power and illuminating effect. Influence of reflection. Advertising and illuminating devices. Automatic lamp-lighting appliances.
5. *Gas used for Heating Purposes.*—Industrial and domestic uses of gas. Testing and heating appliances. Influence of air supply and flame temperature.
6. *Gas Power.*—Calorific power. Comparative costs and thermal and mechanical efficiencies of the gas-engine, and competing power agents. Gas-driven electricity plants.
7. *Gas in competition for light, heat, and power, and the chief legal obligations affecting gas supply.*
8. *Such important recent developments in any of the foregoing subjects as have been fully described in the Technical Press.*

The examination in both grades will be held on Saturday, May 9, 2.30—6.30 p.m. The fee for the examination in either grade is one shilling and sixpence.

[Here follows the list of works of reference.]

Mr. W. E. Chambers, who was for some time the Chairman

Appendix 3: Subscribers to The Gas Institute's fund for the Crystal Palace Exhibition

Name of Subscribing Company	Amount £	s	d	Name of Subscribing Company	Amount £	s	d
Accrington Gas Company	50	0	0	Chertsey Gas Consumers Company	1	1	0
Airedale Gas Company	5	0	0	Chester Gas Company	10	0	0
Aldershot Gas and Water Company	10	0	0	Chesterfield Water & Gas Company	3	3	0
<i>American Gaslight Journal</i>	5	0	0	Clayton, Allerton & Thornton Gas Co.	10	0	0
Arundel Gas Company	2	2	0	Colchester Gas Company	50	0	0
Ashton Gas Company	50	0	0	Colney Hatch Gas Company	10	0	0
Barnet District Gas and Water Co.	5	5	0	Commercial Gas Company	150	0	0
Barnsley Gas Company	5	5	0	Continental Union Gas Company	100	0	0
Barrow-in-Furness Gas Committee	20	0	0	Croydon Commercial Gas Company	100	0	0
Bath Gas Company	50	0	0	Crystal Palace Company	250	0	0
Bedford Gas Company	10	0	0	Daventry Gas and Coke Co. Ltd	1	1	0
Bilston Gas Company	3	3	0	Derby Gas Company	30	0	0
Birkenhead Corporation Gas Committee	25	0	0	Daventry Gas Company	1	1	0
Blackburn Corporation Gas Committee	20	0	0	Dorchester Gas Company	5	0	0
Bolton Corporation Gas Committee	100	0	0	Dover Gas Company	25	0	0
Borrowstounness Gas Company	5	0	0	Dublin Gas Company	100	0	0
Bradford Corporation Gas Committee	50	0	0	Eccleshill Gas Company	2	2	0
Braintree Gas Company	5	5	0	Edinburgh Gas Company	100	0	0
Brentford Gas Company	50	0	0	Edinburgh and Leith Gas Company	50	0	0
Bridgewater Gas Company	5	0	0	Elland Gas Company	25	0	0
Brighton Gas Company	50	0	0	European Gas Company	100	0	0
British Gaslight Company	100	0	0	Falmouth Gas Company	1	1	0
Broadstairs Gas Company	2	2	0	Faversham Gas Company	20	0	0
Bromley Gas Company	10	10	0	Fleetwood Gas Company	1	1	0
Calne Gas Company	2	2	0	Folkestone Gas Company	10	10	0
Cambridge Gas Company	25	0	0	Frome Gas Company	5	0	0
Canterbury Gas Company	10	0	0	Gibraltar Gas Company	5	5	0
Cardiff Gas Company	10	0	0	Gloucester Gas Company	25	0	0
Carlisle Gas Committee	50	0	0	Gorleston and Southtown Gas Co.	5	0	0
Chartered Gas Company	500	0	0	Great Yarmouth Gas Company	50	0	0
Chelmsford Gas Company	3	3	0	Harrogate Gas Company	5	0	0
Cheltenham Gas Company	50	0	0	Halifax Corporation	50	0	0
Chepstow Gas Company	1	1	0	Halstead Gas Company	1	1	0
Harrow District Gas Company	5	5	0	Rowley Gas Company	1	1	0

Name of Subscribing Company	Amount £	s	d	Name of Subscribing Company	Amount £	s	d
Hastings Gas Company	25	0	0	Rugby Gas Company	5	0	0
Hebden Bridge Gas Company	5	5	0	Runcorn Gas Company	20	0	0
Hemel Hempstead Gas Company	2	2	0	Ryde Gas Company	20	0	0
High Wycombe Gas Company	5	5	0	Salford Corporation Gas Committee	50	0	0
Holyhead Gas Company	10	0	0	Salisbury Gas Company	20	0	0
Hong Kong Gas Company	25	0	0	Sevenoaks Gas Company	3	3	0
Ilford Gas Company	1	1	0	Shanklin Gas Company	5	0	0
Imperial Continental Gas Association	250	0	0	Sheffield United Gas Company	200	0	0
Isle of Thanet Gas Company	5	5	0	Sherborne Gas Company	3	3	0
Jersey Gas Company	20	0	0	Shipley Gas Company	3	3	0
Keighley Gas Committee	20	0	0	Slough Gas Company	2	2	0
Kidderminster Gas Company	20	0	0	Southampton Gas Company	50	0	0
Lancaster Gas and Water Committee	10	0	0	South Metropolitan Company	500	0	0
Leicester Corporation Gas Department	100	0	0	South Shields Gas Company	50	0	0
Lincoln Gas Company	50	0	0	Shrewsbury Gas Company	50	0	0
Liverpool United Gas Company	250	0	0	Staffordshire Corporation Gas Committee	5	0	0
London Gaslight Company	250	0	0	St Alban's Gas Company	5	5	0
Lytham Improvement Commissioners	10	0	0	Staines & Egham District Gas Co.	10	10	0
Maidenhead Gas Company	3	0	0	Stalybridge Gas Company	50	0	0
Maidstone Gas Company	50	0	0	Sunderland Gas Company	50	0	0
Mansfield Gas Committee	10	0	0	Swansea Gas Company	10	10	0
Mirfield Gas Company	2	2	0	Taunton Gas Company	5	0	0
Morecambe Gas Company	5	0	0	Tunbridge Wells Gas Company	21	0	0
Newark Gas Company	10	0	0	Uxbridge & Hillingdon Gas Co.	5	0	0
Newcastle-on-Tyne Gas Company	50	0	0	Ventnor Gas and Water Company	10	10	0
North Shields Gas Company	5	0	0	Wakefield Gas Company	5	5	0
Corporation of Nottingham Gas Dept	150	0	0	Walker & Wallsend Union Gas Co.	5	5	0
Oriental Gas Company	50	0	0	Warminster Gas Company	5	0	0
Osset Gas Company	2	2	0	West Ham Gas Company	25	0	0
Oswestry Gas Company	5	0	0	West Hartlepool Gas and Water Co.	25	0	0
Peterborough Gas Company	5	5	0	Warwick Gas Company	10	0	0
Plymouth and Stonehouse Gas Co.	50	0	0	Weston-super-Mare Gas Company	5	5	0
Pontefract Gas Company	10	10	0	Weymouth Gas Company	3	3	0
Reading Gas Company	50	0	0	Windsor Royal Gas Company	10	10	0
Red Hill Gas Company	5	5	0	Worcester Gas Company	25	0	0
Richmond Gas Company	10	10	0				

Name of Subscribing Company	Amount £	s	d	Name of Subscribing Company	Amount £	s	d
Rochester, Chatham & Strood Gas Co.	26	5	0				
Worksop Gas Company	5	5	0				
Wrexham Gas Company	5	0	0				
Yeovil Gas Company	3	3	0				
York United Gas Company	25	0	0				
T. S. Borradaile	5	5	0				
Mr C. R Mead for several small Companies	100	0	0				
TOTAL	5594	14	0				

Source: Compiled from *JGL* issues between 22 August and 12 December 1882

It appears that one or more subscribers may be omitted from the names published in the *JGL* since the total amount reported as having been raised is slightly more than the sum of the donations.

In 1882 The Gas Institute had 650 Ordinary Members (see Table 1, p.40), and the list of 146 subscribers to the Institute's fund for the Crystal Palace Exhibition gives an indication of their geographic spread. The largest London gas companies, the South Metropolitan and the Chartered each contributed £500, principal regional companies such as the Edinburgh and Dublin gas companies contributed £100, and small private companies such as the Arundel and Broadstairs gas companies contributed 2 guineas. Municipal authorities also contributed varying amounts ranging from £150 given by the Corporation of Nottingham Gas Department, to £5 given by the Staffordshire Corporation Gas Committee.

The funds were used to pay for installation and gas consumption of lighting in the South Nave, using lamps borrowed from traders. The *JGL* reported that the lighting was planned for brilliancy of effect rather than economy.¹⁵⁹ The funds also paid for the extended process of judging for awards (see p.34). Exhibitors paid all the costs of their stands.

¹⁵⁹ *JGL* November 21, 1882, p.905

Appendix 4

Progressive name changes for the gas industry professional body

1863-1881 The British Association of Gas Managers

(this was the first national body to represent the gas industry, although the Scottish Association of Gas Managers was established in 1862)

1881-1890 The Gas Institute

1890-1902 The Incorporated Gas Institute

1890-1902 The Incorporated Institution of Gas Engineers

(both the Institute and Institution applied to the Board of Trade for Incorporation in order to limit the liability of their members to the amount of 1 year's subscription, and to enable them as corporate bodies to sue and be sued.)

1903-1928 The Incorporated Institution of Gas Engineers

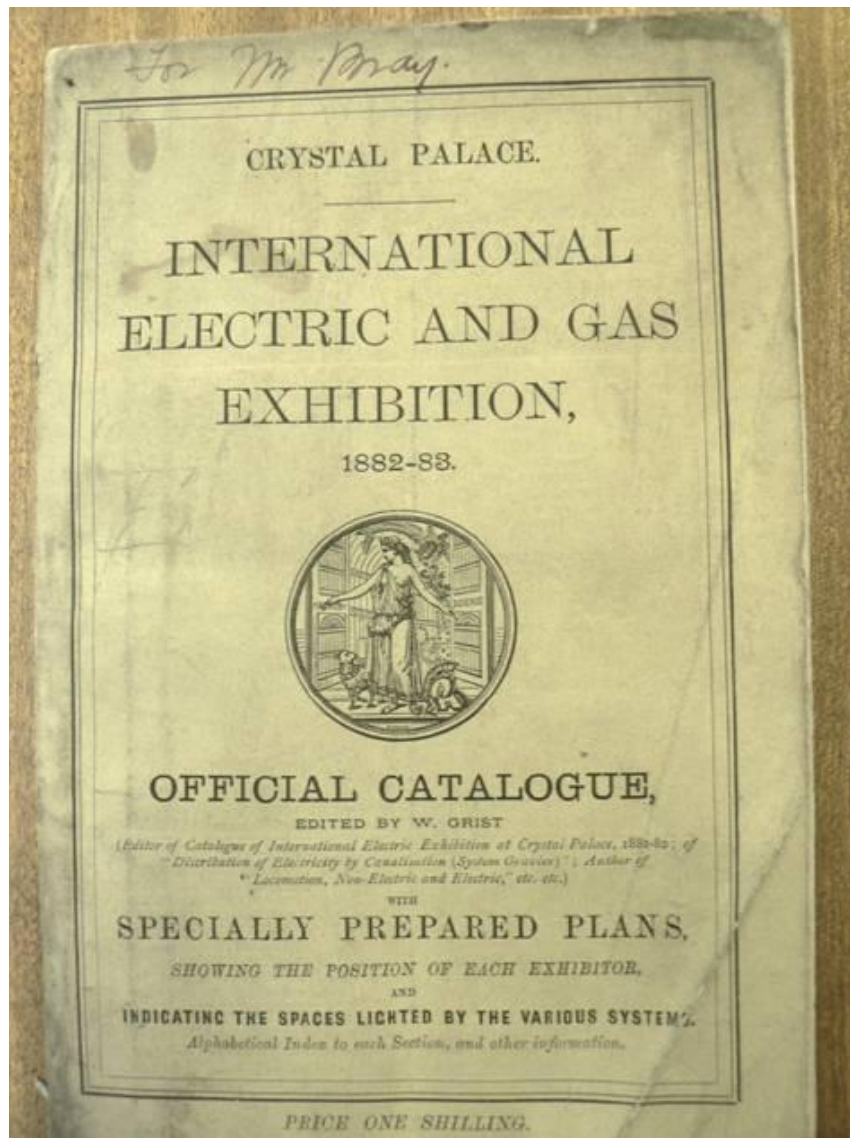
(the new united organisation, somewhat confusingly, kept the same name as the previous Institution)

1929-1963 The Chartered Institution of Gas Engineers

2001 The Institution of Gas Engineers and Managers

Appendix 5

Exhibit listings and advertisements from the Official Catalogue of the International Electric and Gas Exhibition, 1882-83



Front cover of George Bray's copy of the **Official Catalogue of the International Electric and Gas Exhibition, 1882-83**, Source: WYAS, WYL1207/12

The catalogue includes a plan identifying the location of each exhibitor's stand, and also a plan showing which companies provided the lighting for different parts of the exhibition space. The plans are reproduced on pages 31 and 32.

wire gauze, within which the gas is perfectly consumed after mixing with air; there is no visible flame, as the light is due entirely to the incandescence of the platinum, and consequently no globe or chimney is required. These lights can be fitted to any ordinary chandelier, bracket, or lantern. The Lewis and Grimston Lights are exhibited for the Gas Burning Improvements Company, Limited, who purchase the patents.

West Corridor and Birmingham Court, South Nave.

39.—GEORGE BRAY & CO., Gas Lighting Engineers, Blackman Lane, Leeds. A collection of Bray's Patent Flat Flame Burners, adapted for every kind of street and of interior lighting, made in our non-corrosive material, "Enamel," viz.: Bray's "Special" Union Jet Burners, screwed for holders; sizes, 0 to 9. Bray's "Special" Slit Union Burners, screwed for holders; sizes, 2 to 9. Bray's "Special" Union Jet Burners, without screw, for holders; sizes, 0 to 9. Bray's "Special" Slit Union Burners, without screw, for holders; sizes, 2 to 9. Bray's "Special" Batswing Burners, without screw, for holders; sizes, 2 to 9. Bray's "Regulator" Union Jet Burners, without screw, for holders; sizes, 0 to 8. Bray's "Regulator" Slit Union Burners, without screw, for holders; sizes, 2 to 9. Bray's "Regulator" Batswing Burners, without screw, for holders; sizes, 2 to 9. Bray's "Non-Regulator" Union Jet Burners, without screw, for holders; sizes, 2 to 9. Bray's "Non-Regulator" Slit Union Burners, without screw, for holders; sizes, 2 to 9. Bray's "Non-Regulator" Batswing Burners, without screw, for holders; sizes, 2 to 9. Bray's "Market" Burners; sizes, 19 and 20 only. Bray's "Rat Tail" Burners; sizes, 0 to 6. Bray's "Slit Union" Burners, of 30, 40, 50, 60, and 80 candle power, with and without patent "wings" or "projections." Bray's "Double Flame," sometimes called "Duplex" Burners. Bray's "Adjustable" Burners. (*See ADVS.*, pp. 131 and 132.)

South Nave.

40.—BROWNE & Co., 186, Piccadilly, London. Gas Burners and Fittings.

South Nave.

41.—F. BROWN, 44, Upper George Street, W. Various forms of Air and Gas Ring and Block Burners, as originally made by the Patentees. *Avenue between Birmingham and Chinese Courts.*

42.—ARTHUR CLARKE, 8, North Buildings, Eldon Street, London. "A. C. Illuminator" Gas Burners for interior lighting.

Source: WYAS, WYL1207/12

The catalogue shows the comprehensive range of burners that George Bray took to the exhibition. There are different types of burners, including Flat Flame Burners, Bray's 'Special' Slit Union Burners, Bray's 'Market' Burners and Bray's 'Adjustable' Burners. The burners are shown with and without screws, for holders; of both the 'Regulator' and 'Non-Regulator' variety; in a range of sizes from 2 to 9 and some large burners in sizes 19 and 20 only. By contrast, F. Brown listed below Bray, simply states that he is exhibiting 'Various forms of Air and Gas Ring and Block Burners'.

Alizarine, for Dyeing and Printing Cotton, Wool, and other substances. Importation and Preparation of Timber by the Creosoting Process. *South Nave.*

Division H.
ACCESSORIES.

121.—GEORGE BRAY & Co., Gas Lighting Engineers, Blackman Lane, Leeds. A display of improved Globes for various kinds of fittings. Chandelier and Brackets, showing the effect of Bray's "Special" Flat Flame Burners, and the improved forms of globes. Bray's improved Flat Flame Ventilating Chandeliers. Bray's Patent Flat Flame Shadowless Lanterns, with and without our "double service" arrangement. A display of these lanterns, in white and coloured glass, for lighting streets, open spaces, bridges, public buildings, shop fronts, hotels, railway stations, public parks, promenades, works, landing-stages, docks, &c. (*See ADVTS.*, pp. 131 and 132.) *South Nave.*

122.—BROWNE & Co., 186, Piccadilly, London. Electrolier and Fittings. *South Nave.*

123.—ARTHUR CLARKE, 8, North Buildings, Eldon Street, London. Various pattern Polished Gas Brackets; Street Lamps; Pendu Lights, price from 5s. *Avenue between Birmingham and Chinese Courts.*

124.—J. GARNER, Stanstead Road, Forest Hill. Chandeliers; Hall Lamps; Bracket Lamps; Gas Globes; Improved Asbestos Circulating Boilers; Asbestos Gas Fires; Screw Cutting Machinery for Gas Tubes. *West Corridor*

125.—HENRY GREENE & SON, 153-155, Cannon Street, E.C. Gas Chandeliers, Gas Brackets, Gas Standards, and other accessories for domestic lighting, which are specimens of their own manufacture. The exhibits in this department have been carefully selected, with a view of meeting the wants of general purchasers, as examples of excellence of design and workmanship combined with moderate price. (*See ADVT.*, p. 161.) *South Nave.*

126.—D. HULETT & Co., 55 & 56, High Holborn, W.C. High-class Gas Fittings, consisting of Chandeliers, Hall Lights,

Source: WYAS, WYL 1207/12

The list shows that Bray was exhibiting his Flat Flame Shadowless Lantern (illustrated on p.14) in white and coloured glass, for lighting streets, public buildings, railway stations, docks etc as well as globes and chandeliers. The *JGL* reported 'several striking specimens of street and other lanterns' among Bray's exhibits including 'a pillar with three globular lanterns fitted with 80-candle lights': *JGL* Feb 6, 1883, p.222

BRAY'S
PATENT
Flat-Flame Gas Burners

Made in our non-corrosive material, "Enamel."

BRAY'S

"SPECIAL"	BURNERS,
	With and without Screw for Holders.
"REGULATOR"	BURNERS.
"ADJUSTABLE"	BURNERS.
"MARKET"	BURNERS.
"STANDARD"	BURNERS.
"NON-REGULATOR"	BURNERS.
"DOUBLE-FLAME"	BURNERS.
"RAT-TAIL"	BURNERS.

About THREE-FOURTHS of the Burners used for Lighting Purposes in the United Kingdom are of Bray's manufacture, and they are extensively used in the Colonies, the United States, and in every other country throughout the world where Gas is employed.

A collection of nearly 200 different kinds and sizes of BRAY'S PATENT FLAT-FLAME "ENAMEL" BURNERS may be seen at our Stand in this Exhibition.

BRAY'S
PATENT
FLAT-FLAME "ENAMEL" BURNERS

Are adapted for every description of Interior and Street Lighting. They have excelled all other Burners, both Argand and Flat-Flame, with Cannel Gas, and all other Flat-Flame Burners, with common Gas, in every public competition for several years past. See the Reports on Gas Burners published by the British Association for the Promotion of Science in 1878 and 1880; the "Special Award" voted by the Executive Committee of the Exhibition of Artificial Light Appliances at Glasgow in 1880, to Geo. Bray & Co., Leeds; the United States Government Inspector of Gas Annual Official Report for the year 1881; the tests made by Professor A. Vernon Harcourt, M.A., F.R.S. (Gas Referee to the Board of Trade), for his Lecture on "Improvements in Gas Illumination," delivered before the Society of Arts on the 8th of March, 1882.

GEO. BRAY & CO.,
Gas-Lighting Engineers,
LEEDS. (See next page)

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BRAY'S
PATENT
FLAT-FLAME
SHADOWLESS LANTERNS

From 30 to 1,100 Candle Power,

FOR
Lighting Streets, Open Spaces, Bridges, Public Buildings,
Shop Fronts, Hotels, Railway Stations, Public Parks,
Promenades, Works, Landing Stages, Docks, &c.

MORE THAN 600 OF BRAY'S PATENT LANTERNS
ARE NOW IN USE IN LONDON.

BRAY'S PATENT FLAT-FLAME LANTERNS have been adopted by more than 250 of the principal Corporations, Vestries, Local Boards, and Gas Companies in the United Kingdom; they have been extensively adopted throughout the Colonies, India, the United States, and on the Continent.

BRAY'S
Patent "Colonnade" Lantern

With Ball Diffuser acting as automatic door, closing the opening at the bottom of the Lantern.

Especially adapted for the Lighting of Railway Stations and other interiors where Lanterns fitted with opaque tops may be used to advantage.

BRAY'S
Patent "Works" Lantern.

Strong, compact, powerful, expressly designed for lighting Ironworks, Ship-Building Yards, Sheds, Sidings, &c., fitted with Burners from 40 to 200 candle power.

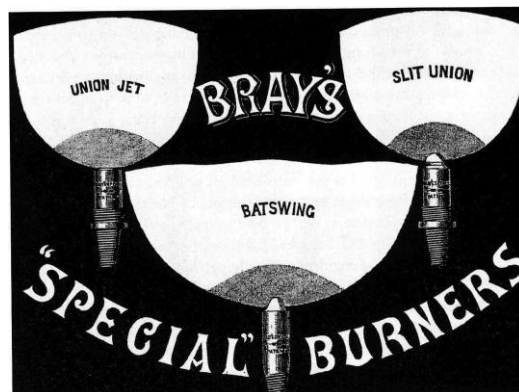
SEE DISPLAY OF LANTERNS AT BRAY'S STAND IN THIS EXHIBITION.

GEO. BRAY & CO.,
Gas-Lighting Engineers,
LEEDS.

See previous page.] 132

Source: WYAS, WYL1207/12

The advertisement on the left claims that 'About THREE-FOURTHS of the Burners used for Lighting Purposes in the United Kingdom are of Bray's manufacture' and that 'A collection of nearly 200 different kinds and sizes of BRAY'S PATENT FLAT FLAME "ENAMEL" BURNERS may be seen at our stand in this exhibition'.



Advertisement c.1870 showing different burner tips and comparing the shapes of flames produced
Source: Dillon, *Artificial Sunshine*, p.137

Catalogue entry for William Sugg & Co., Limited. Engineers and Contractors for Lighting, Heating and Ventilating by Gas

61.—WILLIAM SUGG & Co., LIMITED. Engineers and Contractors for Lighting, Heating, and Ventilating by Gas. Vincent Works, Westminster, 182, Grand Hotel Buildings, Charing Cross, and 19, Rue des Pyramides, Paris. Sugg's Simple Steatite Flat-flame Burners; Sugg's Duplex Burners; Sugg's Patent Table-top Burners, from 0 to 9; Ditto for street-lighting, single and in combinations, from 10 to 100 feet per hour; Winsor Screw Regulating Burners, 1 to 8 feet per hour; Sugg's Patent Self-

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acting Governor Burners for open lights; Sugg's Patent Flat-flame and Argand Lanterns, from 30 to 1200 candle-power, for lighting streets, open spaces, promenades, parks, parades, markets, bridges, hotels, shop-fronts, railway-stations, landing-stages, docks, &c.; Sugg's Patent Argand Lantern, fitted with Argand of 1000 candle-power; Sugg's Patent Ventilating Lights, fitted with Argand and Flat-flame Burners; Sugg's Patent Christiania Governor Burners, fitted with Christiania Shades originally devised and introduced by William Sugg, double-annealed and hand-painted in great variety, for every form of interior lighting; Sugg's Patent "London" Argand Burners, fitted with double-annealed chimneys and shades, &c., specially adapted for library, office, window-lights, &c.; selection of Chandeliers; Sugg's Patent Sun Burners, for lighting and ventilating large halls, saloons, &c.; Standard Burners, according to various Acts; Joslin's Patent Indicator; Sugg's Improved Conservatory Lights, &c. Detailed lists on application. (See ADVTs. pp. 61 & 155.)

South Nave.

62.—WILLIAM SUGG & Co., LIMITED. Engineers and Contractors for Lighting, Heating, and Ventilating by Gas. Vincent Works, Westminster, 182, Grand Hotel Buildings, Charing Cross, and 19, Rue des Pyramides, Paris. Sugg's Patent Palace Suspension Lamps, fitted with Patent Table-top Governor Burners, each lamp giving a light of 600 candles. (See ADVTs., pp. 61 & 155.)

South Nave, Orchestra End.

Source: WYAS, WYL1207/12

The listing refers to William Sugg's showrooms in Westminster and Charing Cross London, and also in Paris. His burner exhibits include Table-top Burners, Argand Lanterns for streets, promenades, bridges, railway stations etc, and Christiania burners with shades 'hand-painted in great variety, for every form of interior lighting' and a selection of Chandeliers (see Christiania advertisement p.18). The *JGL* reported that all Sugg's lanterns 'are beautiful in design, most of them being on Indian models, and surpassing in grace...anything of the kind previously seen' (*JGL*, Dec 19, 1882, p.1078)

Advertisements for William Sugg & Co., Limited in the Exhibition Catalogue

Only Gold Medal for Gas Burners.
 PARIS EXHIBITION, 1878.

WILLIAM SUGG'S PATENT
"London" Argand Burners.

Fitted with a great variety of Shades and Screens, and with Self-Acting Governors, which prevent waste and flaring. The Crystal Chimneys are double-annealed and of best quality.

"The best Burner ever constructed."—*Gas Referee's Report.*

WILLIAM SUGG'S PATENT
"Christiania" Flat-flame Burner.

Fitted with Self-Acting Governor, which maintains constant rate of consumption under varying pressures.

Double-annealed Albatrine Globes, with wide openings, originally invented and introduced by WILLIAM SUGG.

Over 200 Patterns of White and Hand-Painted Globes to select from.

These Burners are pronounced by all who use them to be "the perfection of Flat-flame Burners."

WILLIAM SUGG'S PATENT
Flat-flame Governor Burners.

For use in Kitchens, Passages, Warehouses, &c., for developing the fullest amount of light without waste.

THE SILVER MEDAL (Highest Award) was awarded to the above Burners as being the "best for Domestic Lighting," at Stockport, November, 1882.

The adoption of these Burners at once removes the cause of many complaints which are made against the quality of the Gas throughout the United Kingdom.

Three-fourths of the Burners now used destroy half the illuminating power of the Gas supplied to the public; in fact they are made to sell.

WILLIAM SUGG & CO., Limited,
 Engineers,
 GRAND HOTEL BUILDINGS, CHARING CROSS;
 Vincent Works, Westminster;
 19, RUE DES PYRAMIDES, PARIS; AND AT THE CRYSTAL PALACE.
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SIXTEEN PRIZE MEDALS HAVE BEEN AWARDED, including Two Gold, Paris, 1878; Two Silver, Melbourne, 1881; One Silver, Eastbourne, 1881; and Three Silver, Stockport, 1882. The HIGHEST AWARD for Gas Illumination (SILVER MEDAL) at the Tynemouth Naval and Marine Exhibition was gained by William Sugg's "SURREY" BULL'S-EYE LAMP (see below); LARGE LAMPS for Dock Entrances and ARGANDS OF HIGH ILLUMINATING POWER for Harbour Lighting and other purposes.

WILLIAM SUGG'S
PATENT FLAT-FLAME SHADOWLESS LAMPS
 From 30 to 1,200 Candle Power.
 For Lighting Streets, Open Spaces, Bridges, Public Buildings, Shop Fronts, Hotels, Railway Stations, Public Parks, Promenades, Works, Landing Stages, Docks, &c.
As used in Whitehall, Parliament Street, Strand, Fleet Street, and Surrey Commercial Docks Entrances.

WILLIAM SUGG'S PATENT "LAMBETH" LAMP
 Especially adapted for the Lighting of Railway Stations, and other interiors.
Derby, Bristol, St. Pancras, and other Stations are Lighted by these Lamps
Give more Light for Gas consumed than any other.

WILLIAM SUGG'S PATENT "WORKSHOP" LAMP
 Strong, Compact, Powerful, expressly designed for the Lighting of Ironworks, Ship-building Yards, Sheds, &c. Made to any required power.
AS USED BY MESSRS. MOWLEM, BURT, AND CO.

WILLIAM SUGG'S "SURREY" BULL'S-EYE LAMP
 For Illuminating Holds of Vessels, for Unloading, &c., by Night.
SILVER MEDAL, TYNEMOUTH NAVAL & MARINE EXHIBITION.
Supplied to the Surrey Commercial Docks.

WILLIAM SUGG'S PATENT
FLAT-FLAME TABLE-TOP STEATITE BURNERS
 Are adapted for every description of Street and Interior Lighting, and give a higher result in Illuminating Power than any other Flat-Flame Burners in existence.

WILLIAM SUGG'S PATENT
SUN BURNERS AND VENTILATING LIGHTS.

WILLIAM SUGG & CO., Limited,
 ENGINEERS,
 Grand Hotel Buildings, Charing Cross; Vincent Works,
 Westminster;
 19, Rue des Pyramides, Paris; and at the Crystal Palace
[SEE ALSO PAGE 155.]

Source: WYAS, WYL1207/12

The advertisements give prominence to the awards that William Sugg has won. The left hand advertisement proclaims that Sugg received the only gold medal award for gas burners at the 'PARIS EXHIBITION, 1878'. The right hand advertisement states that Sugg was awarded two silver medals at Melbourne in 1881, and also awarded silver medals at Eastbourne and Stockport. The illustration on p.27 shows how Sugg used these awards as a form of advertising on his company headed notepaper.

Appendix 6

Development from Mechanics Institute to University of Leeds

It may be questioned why the Institution of Gas Engineers, which was a London-based organisation, chose the University of Leeds rather than one of the London Colleges to endow a professorship in the name of George Livesey, who had lived all his life in London. This Appendix gives a brief summary of how the University of Leeds became a centre for gas industry research from its beginnings as a Mechanics Institute, and how George Bray came to be involved.



Leeds Mechanics Institute, 1868 (now a Museum)

Source: J. F. C. Harrison, *Learning and Living 1790-1960*, Figure 10

Mechanics Institutes were initially established to give working class men with little or no formal education, an understanding of the theory of science and technology. (It was considered that practical aspects of trade were best learned in workshops.) The

first Mechanics Institute was established in Edinburgh in 1821, followed by Glasgow and London in 1823, after which the movement spread with astonishing speed.¹⁶⁰ In less than 3 years, every large town and many small ones had its Institute. The Leeds Institute was founded in 1824 to provide opportunities for the study of various branches of science which were of practical application to the trades and occupations of artisans in the town, primarily in mechanical or chemical operations. Larger Institutes such as Leeds displayed models of machines and had chemistry laboratories, and this was where George Bray first saw a demonstration of gas lighting. The classes and lectures, which were given in the evenings, included the higher branches of mathematics, mechanical drawing, and the principles of mechanics and chemistry.¹⁶¹

By the 1830s, classes were being attended by middle rather than working class people, and the scope of lectures was broadened to include a variety of popular literary, historical and statistical subjects. Cardwell argues that one of the reasons for this change was that Institutes were unable to provide any sort of diploma that could be recognised in consideration of promotion by employers, and being self-supportive had to cater for public tastes.¹⁶² In Yorkshire the Mechanics Institutes formed a Union to pool resources for books and lectures, including courses in mechanics, chemistry, economics and statistics. It was hoped to achieve general recognition from employers by awarding a diploma of merit.¹⁶³

By mid-century, the Yorkshire Union was the largest educational organisation in the country, embracing over 100 Institutes with a membership of nearly 20,000 individuals. It was the first large-scale attempt to systematically teach the 'pure' and

¹⁶⁰ The Edinburgh Mechanics Institute later became Heriot-Watt University, and the London Mechanics Institute became Birkbeck College: D. S. L. Cardwell, *The Organisation of Science in England* (Guildford, reprinted 1980)

¹⁶¹ J. F. C. Harrison, *Learning and Living 1790-1960: A Study in the History of the English Adult Education Movement* (London, 1961), pp.62-3

¹⁶² Cardwell, *The Organisation of Science in England*, pp.71-2

¹⁶³ *Ibid.*, pp.73-4

applied sciences and an impressive new Mechanics Institute building was opened in Leeds in 1868.

From a national perspective, Britain's showing at the Paris Exhibition of 1867 was widely agreed to have been poor, prompting concern about technical education, and in 1874 the Yorkshire College of Science was founded to provide a level of technical education comparable with that in France.¹⁶⁴ Ten years later, the Yorkshire College combined with Owens College, Manchester and University College, Liverpool to become part of a federal north of England university, but Leeds was granted its own Royal Charter to form a University in 1904.¹⁶⁵ George Bray had been a financial supporter and Life Governor of the Yorkshire College and he donated to the Foundation Fund for the University, serving as a member of its Court. One of the departments established by the new University of Leeds was Applied Chemistry (Fuel and Metallurgy), headed by William A. Bone, F.R.S., which had a particular focus on the manufacture and use of coal gas.¹⁶⁶

This development in Leeds was noted with interest by the Institution of Gas Engineers, which was at that time establishing a Special Purposes Fund to enable research investigations to be carried out 'on some subject connected with the chemistry of gases, and combustion.'¹⁶⁷ The Institution decided to use their Fund to provide a Fellowship for research in Gaseous Fuel under Professor W. A. Bone at the University of Leeds. After the death of George Livesey in 1908, the Institution invited contributions to a Memorial Fund for him, and in 1910 when this fund reached £10,500, it was used to endow the Livesey Professorship of Coal Gas and Fuel Industries at the University of

¹⁶⁴ Sanderson, *Education, Economic Change and Society in England, 1780-1870*, p.35

¹⁶⁵ University of Leeds – Heritage [http://www.leeds.ac.uk/info/20014/about/21/heritage, accessed 31 May 2010]

¹⁶⁶ Brauholtz, *The Institution of Gas Engineers*, p.79

¹⁶⁷ *Ibid.*, p.197

Leeds.¹⁶⁸ To administer the Professorship, the Council of the University established an Advisory Committee, which was to comprise no more than 25 members including the Pro-Chancellor, the Vice-Chancellor, not less than 10 nominees from the Institution of Gas Engineers, 4 nominees by the Society of British Gas Interests, and the remaining nominees by the University.¹⁶⁹ In recognition of the work already done by Professor Bone, he was appointed the first Livesey Professor. John William Bray, George's son was a University nominee to serve on the Advisory Committee, George himself having died 5 years earlier.

The Livesey Professorship continued into the 20th century (see page 55), but there has been no response to inquiries as to whether it still exists today.

¹⁶⁸ Brauholtz, *The Institution of Gas Engineers*, p.84

¹⁶⁹ *Copy of Deed Poll founding and endowing the Livesey Professor of Coal Gas and Fuel Industries in the University of Leeds*, dated 1 Nov 1910 (Mary Mills archive)

Bibliography

Research for this dissertation focused on 4 main topics: the history of the gas lighting industry; archival material relating to George Bray and William Sugg; the development of the gas industry professional body; and general contextual material.

The West Yorkshire Archive Service holds an extensive, well-catalogued archive for George Bray, which formed the cornerstone for this study. The William Sugg & Co website provided a useful history of William Sugg, which was supplemented with material from the family archives of Chris Sugg and Maureen Dillon's Ph.D. thesis on *Domestic Lighting in Britain*.

The starting point for information about the gas industry professional body was *The Institution of Gas Engineers* by Braunholtz; much additional material was sourced directly from the *Transactions* of both The Gas Institute and The Institution of Gas Engineers, and also from extensive reading of the *Journal of Gas Lighting*, which reported very fully on proceedings of both bodies, including their Presidential addresses and technical papers. Some editions of *The Gas World* were accessed from the British Library collection at Colindale but their photocopying charges are prohibitive, and the Science Museum's collection, held at Wroughton, is almost entirely 20th century.¹⁷⁰

The main primary source for gas supply undertakings was Newbigging's *Handbook* which provided many useful insights into the industry; the range of secondary sources accessed included *The Engineers* by Buchanan, *Lighting the Town* by Wilson, *Burning to Serve* by Goodall, and *The History of the Gas Light and Coke Company* by Everard.

¹⁷⁰ The *JGL* had close links with The Gas Institute, which it supported throughout the Bray dispute: *JGL*'s founder and first Editor, Thomas Barlow, was also the Institute's first Vice-President in 1864. In the 1880's the *JGL* was edited by Walter King, a friend of Magnus Ohren and William Sugg, who were all members of the same Masonic Lodge. It has not been possible to verify the claim of both Curren-Briggs and Pawson that George Bray financed *The Gas & Water Review* (which later changed its name to *The Gas World*, printed by J. Allan & Sons, London) as a new weekly trade journal to support his case. Efforts were made to access *GW* to obtain a different viewpoint from that of *JGL*.

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