London and the steam engine. Part 2: The engine builders

by David Perrett

London, although no longer considered a centre for heavy engineering, was throughout the 19th century able to rival the Black Country, Clydeside, etc. with the range, quantity and particularly the quality of the machinery produced. The Thames was for much of the century at the forefront of world shipbuilding and there is a considerable literature on that subject. The related areas of machine tool production and steam engine manufacture are at present poorly documented, although here too London held an important place. The Royal armament factories fostered the machine tool industry whilst the public utilities, shipbuilders and brewers supported the steam engine builders. London-built engines were used not only in the Capital but throughout Britain and its Empire. They ranged from small beam engines to railway locomotives and the largest marine engines. Some of the builders of stationary steam engines are well known, but of others there remains little except maybe a note in a trade journal or possibly a surviving example of their work. This article summarizes the development of the industry and then briefly details those firms whose stationary steam engines are known to survive.

The first builders

The *Post Man* for 19–21 March 1702 directed all those interested in seeing Captain Savery's engine at work to visit his 'workhouse in Salisbury Court' (near St. Bride's Church off Fleet Street). Although few pumps are known to have been constructed there, Savery's workshop was the first steam engine manufactory in London, and the world. Thomas Newcomen does not appear to have constructed engines in London, but following Savery's death in 1715 until the expiration of Savery's master patent in 1733, Newcomen's invention was financially controlled by a committee based at the Apothecaries Hall just a short distance from Salisbury Court[1]. Of the 2000 atmospheric engines constructed during the 18th century only 11 are known to have worked in London[2], and consequently steam engine construction in the capital would have been limited. Recent research has shown that Newcomen employed the foundry of Harrison & Waylett in Southwark, which was capable of casting large steam engine cylnders[3]. Our knowledge of other engine bulders in London before the expiry of Watt's patent is minimal, but at the end of the century the situation changes.

The post-Watt period

When John Farey came to write his classic work *A Treatise on the Steam Engine* he published details of the engines in London in 1805 (see Part 1 of this article), and stated that by that date 'a number of persons had begun to make steam engines'[4]. The new firms had been quick to assess the potential business, probably having had experience of constructing Newcomen engines, e.g. Thomas Hunt, or of pirating Watt's designs like Hornblower & Maberley. Immediately after 1800, there was a considerable demand for steam engines in London, particularly rotative engines for factories and breweries[5]. In 1796 Arthur Woolf (1766–1837) was employed by the firm of Hornblower & Maberley to erect an engine at Meux & Reid's Griffin Brewery in Clerkenwell. This engine was the subject of a successful injunction brought by Boulton & Watt against Hornblower & Maberley. Woolf was then employed by the brewery and from 1796 to 1808 was Meux's resident engineer[6]. In 1804 Woolf constructed the first of the two cylinder compound engines which now commonly take his name. Convinced of the value of his design, Woolf entered into partnership with Humphrey Edwards, a millwright of Mill Street, Lambeth. A number of such engines with various refinements were made in Mill Street. Simon Goodrich saw Woolf engines at work in Mr White's brickfield, Rotherhithe and at Mr Parker's mill, Fareham[7]. By 1811 the compound engine had been so improved that, in an observed trial against a Boulton & Watt engine, the Woolf engine was found to be twice as efficient at grinding corn[8]. In May 1811 the partnership was dissolved and Woolf returned to his native Cornwall to become a mine engineer. Edwards continued building engines in Mill Street until 1819 when he left to establish an engine works in France.

It is difficult to discover how many builders of steam engines established themselves in London during the early years of the 19th century since the directories of the period do not distinguish between steam engineers, millwrights and various other engineers. For example, for 1817, Johnstone's London Directory lists 61 engineers, machinists and millwrights, some of whom, e.g. Braithwaite and Dickson, are known to have made steam engines. The Henry Ford Museum at Dearborn, U.S.A. possesses examples of their work. The Dickson engine there is a single-cylinder beam engine, built about 1811 and which from 1823–1928 powered a silk mill in Somerset. The geared table engine by Braithwaite was built about 1825 for the Stanmore Brewery. Another builder represented in the Ford Collection is Robert Legg with a small table engine obtained from a tobacco factory in Leeds.

Some firms already established in engineering apparently expanded into engine building. Loyd & Ostell, crane makers, had by 1810 erected an engine in London for rolling lead[9]. Similarly Jukes, Coulson & Co., anchorsmiths of Upper Thames Street, had applied a beam engine to a sugar cane crusher for the West Indies. In other instances engineers employed by the public utilities, seeing the potential of steam power in industry, established their own businesses in a similar manner to Arthur Woolf. Thomas Simpson (1754–1823) was engineer to the Chelsea Water Co. and from 1790 also ran his own business. He was later joined by his son James (1799–1869). This firm continued to supply pumping engines to water companies into the 20th century.

Undoubtedly the most famous mechanical engineering firm of the first half of the 19th century was that started by Henry Maudslay, an ex-Woolwich Arsenal metalworker. Maudslay's first works were established in 1797 in Wells Street, off Oxford Street, and then in Margaret Street, Cavendish Square. From 1812 Maudslay took on various partners, the business becoming Maudslay, Sons & Field in 1831. The firm was renowned for the quality of workmanship. The workshops were on the site of Lambeth North Tube Station, and are commemorated in a plaque

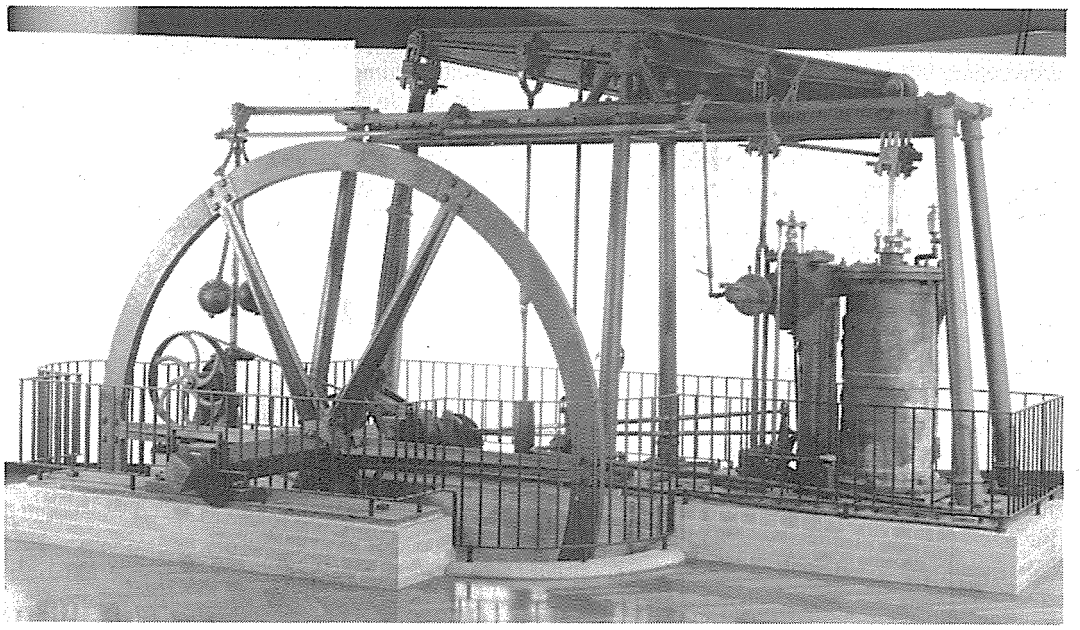

Plate 1. *1811 rotative beam engine by Jonathan Dickson, formerly in Pearsall's mill, Somerset; now in the collection of Greenfield Village and Henry Ford Museum, Dearborn, Michigan, USA.*

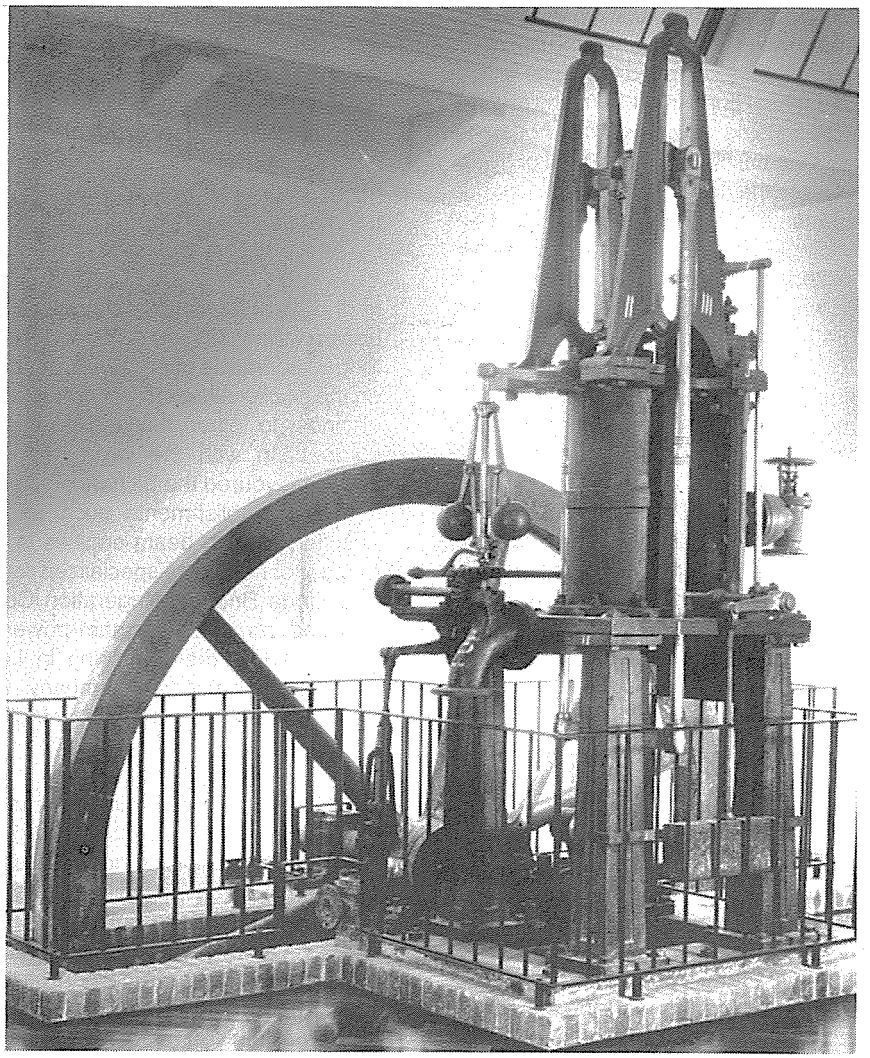

Plate 2. *Maudslay table engine of* c. *1825,* ex *Beales Mill, Dunstable (Collection of Greenfield Village & Henry Ford Museum, Dearborn, Michigan, USA).*

fixed in the tube station ticket office. Following his important work on the Portsmouth blockmaking machinery and improvements to the screwcutting lathe, Maudslay in 1807 patented a compact (table) engine ideal for workshops. Many of these engines were built and a number survive, one in the Science Museum, South Kensington and two in the Henry Ford Museum in the States. The firm then began manufacturing marine steam engines and provided equipment for the *Richmond*, which in 1815 was the first steam vessel to carry passengers on the Thames. From 1808, H. Maudslay also supplied large stationary engines of which only two beam engines are known to survive, one of 1837 now in the Museum of Applied Arts & Sciences, Sydney, Australia, and the 1838 engine at Kew Bridge Pumping Station.

The development of compact engines for the purpose of powering mobile vehicles occurred during the first 30 or so years of the 19th century. A great deal of the pioneering work on the railway locomotive emanated from the Newcastle area and George Stephenson and his colleagues, and their only serious rivals were to be found in London. At the Rainhill Trials in 1829 the popular favourite for the prize was Braithwaite & Ericsson's *Novelty*. John Braithwaite, engineer, coppersmith and millwright of London, whose Stanmore Brewery engine has already been mentioned, had met the Swedish engineer John Ericsson (1803–1889) in the previous year and together they took out a number of patents including some relating to steam power. For all its 'compactness and beautiful workmanship' the vertical boilered *Novelty* was a failure being well beaten by the *Rocket*[10]. At the same time Braithwaite & Ericsson used the same type of design for a fire-engine capable of pumping 30/40 tons of water per hour to a height of 90ft using a two-cylinder horizontal engine[11]. This device, too, they called *Novelty*. A total of five of these engines were built before the design was abandoned due to complaints by the insurance companies that the force of the water jet damaged the buildings! The fire-engines do not appear to have been self-propelled but the technology for steam powered road vehicles was being developed in London. Between 1820 and 1840, engineer-authors such as Sir Goldsworthy Gurney, Colonel Maceroni and Walter Hancock were constantly proposing steam road services and building experimental road locomotives[12]. The attempts at commercial operation were invariably unsuccessful, but the experimental work of these engineers led to many advances which were important to stationary steam engine design, rail locomotives, and later the motorcar. These developments included the direct connection of the cylinder to the crank without the use of a beam, i.e. the horizontal engine. The compact horizontal engine was to become standard and the London firm of Taylor & Martineau was, from 1825, one of the first to regularly manufacture this type.

In the field of marine engine construction, Maudslay, Sons & Field had, by the time of Maudslay's death in 1831, engined 40 vessels; following the success of this firm a number of other engine builders were established on the Thames. Firms such as John Penn of Deptford, Humphrey, Tennant & Dykes Ltd, founded in 1852 also at Deptford, and John and George Rennie at Blackfriars supplied their engines to the various shipbuilders on the Thames, e.g. The Thames Ironworks & Shipbuilding Co. and R & H Green of Blackwall Yard[13]. The Thames Ironworks eventually bought the engine building firm of Penn to gain the expertise. As shipbuilding on the Thames declined during the last third of the 19th century, many of the engine builders and shipbuilders diversified their activities. Marine engines, and in particular the later highly efficient compact versions such as the triple-expansion engine, were found to be suitable for land use, e.g. water pumping, with very little modification. A Thames Ironworks' (Penn) triple-expansion engine of 1911 still *in situ* at Walton Pumping Station, Surrey was illustrated in the first part of this article. The two Royal Navy Dockyards, at Deptford and Woolwich, were major customers for the engines of the local builders. Up to 1835 all engines for the Navy came from Maudslay; in that year Seaward & Capel of the Canal Ironworks, Millwall, Miller & Barnes of Ratcliffe and John Penn received Admiralty approval.

Of the many thousands of engines constructed by the marine engine builders of the Thames only a very few are known to survive. In the period 1822 to 1878, J. Penn engined 735 ships, but only one of their marine engines still exists: the oscillating engines from the P.S. *Empress* now in the Southampton Maritime Museum. This ship was built in 1879 by Samuda & Co. at Millwall and operated from Weymouth until about 1956. Non-marine engines by 'Penn' and J. & G. Rennie also survive.

The Great Exhibition to the end

The international exhibition held at the Crystal Palace in Hyde Park in 1851 presented British industry to the world at the height of British technical supremacy: 'the oscillating, the trunk, the pendulous, the beam, the horizontal, the vertical, and a whole army of rotary engines' confronted the visitor[14]. Some hundred engines by British and foreign builders were exhibited in the Machinery Hall and the top award, the Council Medal, went to two engine builders. One medal went to Mr J. Cockerill of Belgium for a collection of five engines, and John Penn & Sons received their award for an oscillating marine engine. Another nine London builders also exhibited their products. The big firms of Maudslay, Donkin and Rennie were represented alongside minor concerns like William Joyce of Greenwich, with his pendulous engine, Burnett of Deptford, Henry Perry of Bromley-by-Bow and C.A. Deane of Hampstead[15].

In the years following the exhibition, steam power rapidly became the main source of industrial power but London was no longer a principle user[16]. The London firms, although still relying on the public utilities for for their major market, started to supply engines to other fields, like mining, where they were in competition with the large northern companies. This new climate favoured the bigger companies and many of the earlier smaller establishments such as Wentworth & Sons, who supplied the two beam engines in Youngs Brewery, closed. A number of new more specialized companies opened in London. The Linde British Refrigeration Co. claimed in 1889 to have supplied some 3500 steam-powered ammonia compressors since starting manufacturing in London in 1875. The giant American Worthington company, which specialized in small duplex pumps, opened an establishment in Upper Thames Street.

With the growth of their businesses many of the firms with premises in central London found that pressure of space limited their expansion. The company established in the Strand in 1822 by James Easton moved first to the Grove, Southwark and then in 1864 to a purpose-built works at Erith. They manufactured under a variety of names, e.g. Easton, Amos & Anderson, until 1909 when they became part of the Pulsometer Co. A large number of engines by this firm still exist whilst at least part of the works at Erith can be identified[17]. A similar story of growth is to be found with the firm of Simpson mentioned earlier. The firm expanded until it outgrew London altogether and opened a new works at Newark, Nottinghamshire in 1901. During the first World War it amalgamated with the Worthington Co. becoming

In 1863 Barry illustrated his book *'Dockyard Economy & Naval Power'* with 31 photographs of engine works and shipyards. He took these himself and prints are pasted into some copies of the book. Those reproduced here are from the copy in the Greenwich Local History Collection, and are reproduced with the kind permission of the Librarian.

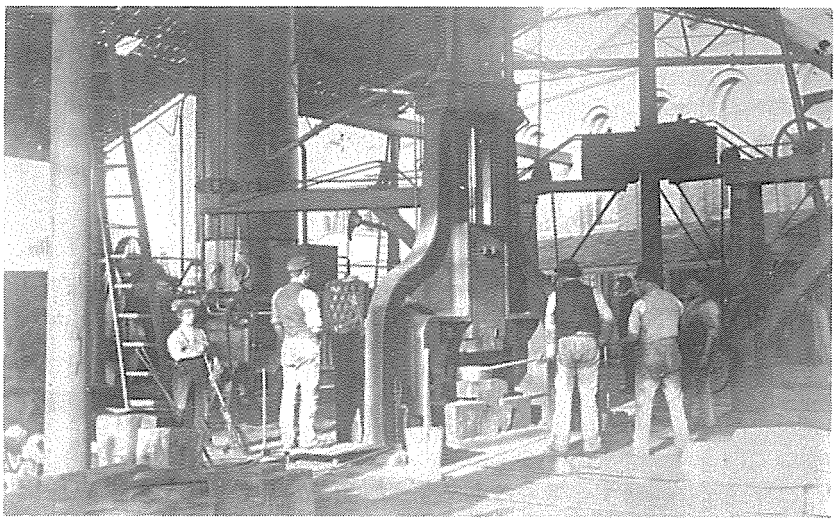

Plate 3. *The scrap forge at Penn's works, Blackheath Hill*

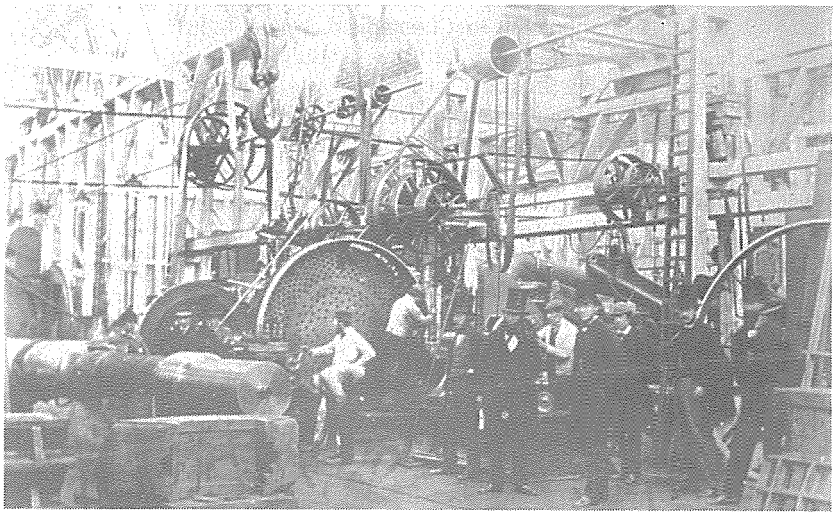

Plate 4. *The heavy turnery at Penn's works; the centre person would appear to be John Penn himself.*

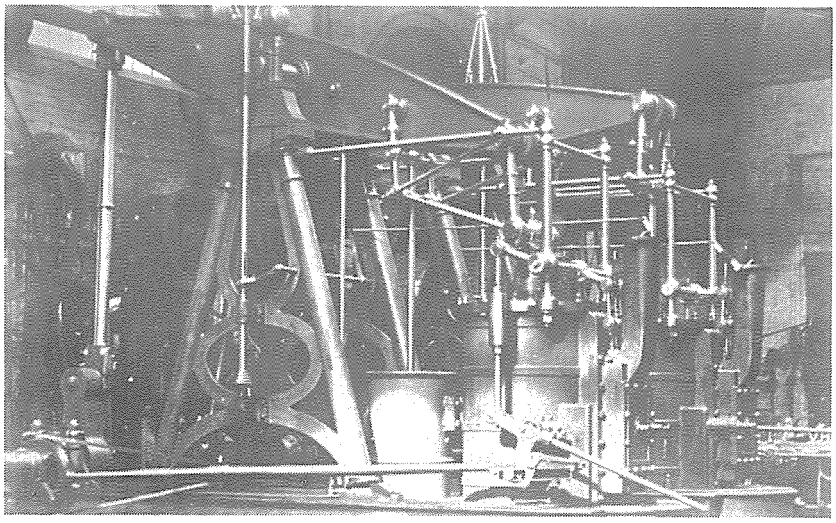

Plate 5. *Engines for Copenhagen Dock under construction in the Lambeth Works of Maudslay, Sons and Field.*

Worthington-Simpson Ltd. This company erected its last triple-expansion engine for water pumping at Dover Waterworks as late as 1951, although the engine had been manufactured in 1939 and its commissioning delayed by the war.

Both the firms of Easton and Simpson are represented by a number of engines in this country, but the majority of the output from other major engine builders of this last period was exported. Situated less than a mile from the works of Easton, Amos & Anderson in Erith was the works of Fraser & Chalmers, which between 1893 and 1936, built 108 large winding engines for mines, 75 of which were for export. Tom Chalmers and David Fraser, both Scots, had established an engineering company specializing in mining in Chicago in 1847. In 1891 the De Beer mining and banking group decided to invest in mining technology and established an English branch of Fraser & Chalmers. Fraser returned home, and designed and erected the new works on land purchased from the Maxim Nordenfeldt Gun Co. A number of winding engines by Fraser & Chalmers are still at work in English collieries, but with the N.C.B.'s present modernization schemes they are rapidly being replaced by electric haulage systems. A large number of the firm's winding engines were exported to mines in the Empire: one is known to exist in Australia and it is very likely that some survive in South Africa.

After 1918 only the remnants of the London steam engine building industry remained. Prior to the war the firm of Simpson had left London, in 1902 the old-established Bryan Donkin & Co. had moved from Bermondsey to Chesterfield, where it still exists, and Hunter & English had left Bow for Barkingside in Essex. These moves were typical of the heavy engineering industry in London. The high municipal rates, expensive land, high wage rates and the loss of skills forced the industry to move to the North and Midlands. For the steam engine builders, in addition to these factors, there was the simple fact that at least for their smaller products the market was fast disappearing. Gas and oil engines, mains hydraulic power and the electric motor reduced the demand for smaller steam engines. Both the firms of Easton and Fraser attempted to enter the electrical engineering trade, but whereas Easton & Co. failed Fraser & Chalmers were sufficiently successful with their electric colliery winders to become part of the G.E.C. group in 1918 (they made 392 electric winders from 1905 to 1936). Both firms also developed steam turbines, and some by Fraser are still at work at Kempton Park Pumping Station in West London. The firm of Easton also became major suppliers of electric lifts; they claimed in 1901 to have already supplied 'half the big hotels, public offices, and mercantile establishments in London', and were making lifts for the New Brighton Tower[18].

The marine engine industry died with the collapse of the Thames shipbuilding industry in the first decade of this century. With the launching of HMS *Thunderer* in 1911 from the Thames Ironworks yard the high cost of London-built ships became the centre of a public row and in the following year saw the closure of the giant Thames Ironworks. The last major firm to close was J. & G. Rennie which in 1915 left East Greenwich for Wivenhoe on the East Coast.

In January 1934 Fraser & Chalmers supplied its last steam winder to a British colliery; a 30" x 6' stroke engine to Hamstead Colliery was to be followed by ten to South Africa between 1934 and 1936. The final South African winder was probably the last large steam engine to be constructed in the London area. Engine building survived a little longer outside London, and high-speed enclosed engines were being built recently.

London had been the home of a major industry, and produced tens of thousands of steam engines with an accumulated power of millions of horsepower. At the peak in the 1890s some 10,000 men were employed by the steam engine companies along the Thames. Now only a few buildings remain and about 100 engines. These engines are to be found in all parts of the world – a prime indication of the importance of the London steam engine builders and their workers.

Acknowledgements

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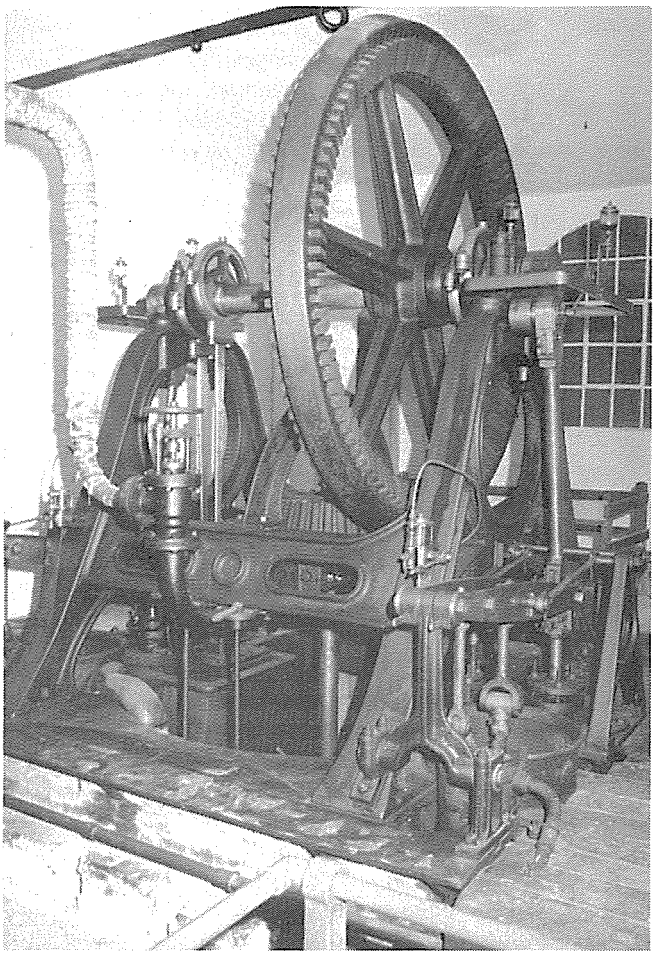

Plate 6. *Vertical Duplex engine by Easton & Amos 1861 at Westonzoyland, Somerset (photo Colin Bowden, 1974)*

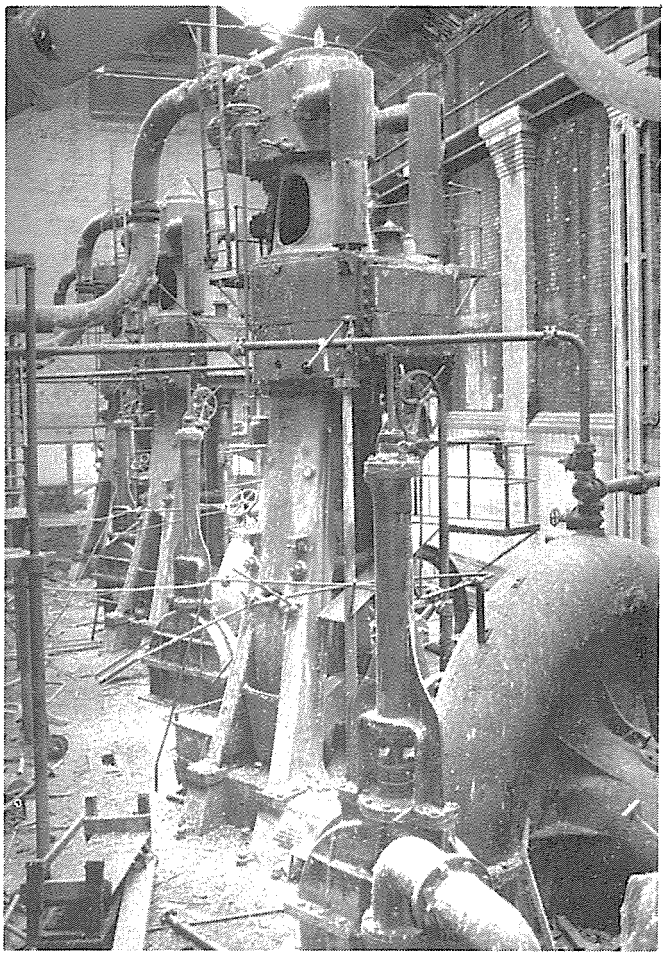

Plate 7. *Disused pumping engines by Gwynnes at Huskisson Dock, Liverpool (photo Colin Bowden, 1978)*

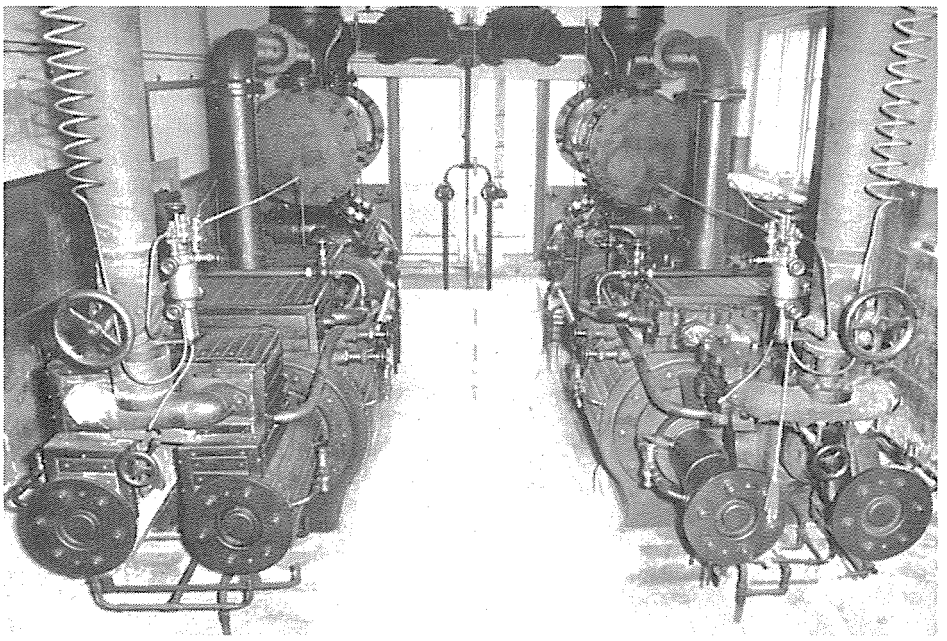

Plate 8. *Two non-rotative triple-expansion engines by James Simpson, which are preserved workable at Folkestone (photo Colin Bowden 1973)*

Appendix: The builders and their surviving engines

All builders of steam engines with works in London are included provided at least one example of their work is known to survive, either *in situ* or in a museum. A brief history, where known, is given plus sources. Addresses were usually obtained from London Directories unless more specific details are given.

Engine particulars are listed in the following order: cylinder diameter(s) x stroke(s); horsepower; working steam pressure; speed. Locations are those of the engine's original site, and current site if different. Where appropriate the present ownership is also given.

Benham & Co.

This firm is now a manufacturer of bulk catering equipment. Their original offices were in Wigmore Street, W1 but they now have manufacturing plant in various parts of London.

Engine

*c.*1895 small horizontal engine; 5⅝" x 10", 8 hp, 100 rpm.
ex Mylees Workhouse, Salisbury.
Present location: Kew Bridge pumping station museum (TQ 188780).

John Braithwaite

The firm was founded by John Braithwaite Senior, a pioneer maker and user of diving-bells, at 1 Bath Place, New Road, Fitzroy Square. John Braithwaite Junior (1797–1870) and his brother Francis took over the firm on their father's death in 1818. When Francis died in 1823, John alone continued the engineering business, but diversified to include the manufacture of high-pressure steam engines. In 1828 he met John Ericsson, a Swedish engineer, and together they built the *Novelty* locomotive, which competed in the Rainhill trials in 1829. They also constructed a series of steam-driven water pumps for fire-fighting. In 1834 John Braithwaite ceased to be involved in the engine works. The firm continued under his brother Frederick as Braithwaite, Milner & Co. and built a number of railway locomotives before failing after a couple of years. John Braithwaite became a consulting civil engineer and was involved, in particular, with the Eastern Counties Railway.

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Engine

*c.*1825 geared single-cylinder table engine with flywheel; power take-off *via* bevel gears.
ex Stanmore Brewery, Watford, removed 1929.
Present Location: Henry Ford Museum, Dearborn Michigan, USA.

Jonathan Dickson

Dickson appears in directories of 1811 and 1820 firstly as a manufacturer of steam engines, patent tuns, cool vats and backs (i.e. small vats), with address 76 Gravel Lane, Southwark; he is then simply listed as engineer of Holland Street, Blackfriars. The firm appears to have ceased by 1830.

Engine

1811 single-cylinder rotative beam engine; 17" x 36", 9' beam.
ex James Pearsall's silk mill, Launton, Somerset, where it drove machinery from 1823 to 1928 (see Plate 1).
Present location: Henry Ford Museum, Dearborn, Michigan, USA.

Easton, Amos & Anderson

Although commonly known by the above title this firm took a variety of names during its 70 year history. In 1822 James Easton started a business manufacturing hydraulic rams at 281 Strand. He moved to the Grove, Southwark, where until 1829 a Mr Leahy was his partner. In 1836 Easton took on a new partner, Charles Edward Amos (1805–1882), a paper-mill engineer, and the company became Easton & Amos. The Grove works produced equipment for all types of mills, developed a compact grasshopper engine and in 1844 built the waterworks for the Trafalgar Square fountains. Easton's three sons and Amos's son were taken into the partnership, which was now entitled Easton, Amos & Sons. In 1864 a branch works at Erith was planned and erection commenced under (Sir) William Anderson (1834–1898). When the two senior partners retired in 1866 the firm became Easton, Amos & Anderson. By 1873 the manufacturing had been concentrated at Erith, but the offices continued at the Grove until *c.*1877, when they moved to 3 Whitehall Place, SW. Following the retirement of James Amos in 1871, the firm changed its title to Easton & Anderson, and became a limited company in 1888. During this period the nature of the business changed; the manufacture of steam engines continued but the firm also became involved in armaments and marine engines. In 1889 Anderson was appointed Director-General of Ordnance Factories. In 1893 there was an amalgamation with W.T. Goolden & Co., electrical engineers, forming Easton, Anderson & Goolden Ltd, which extended the firm's range of products. In 1895 the Erith works employed some 750 workers and occupied about 17 acres with a river frontage of 800ft. The pattern shop, erecting shop, electrical shop, foundry, etc. were at right angles to the river (see back cover). At this time the company's catalogue details 56 beam engines, many of which were supplied to waterworks, whilst 100 other pumps and 6 marine engines went to customers located as far afield as Broadmoor (Hospital) and Buenos Ayres (sewage works). The firm also produced waterwheels, turbines, Appold's centrifugal pumps, hydraulic and electric lifts, electric lights, etc. In 1901 the business was taken over as a going concern to manufacture Schmidt superheated steam engines, under the name Easton & Co. The venture failed and the works were sold off *c.*1905. This important firm certainly deserves a fuller treatment than is possible here.

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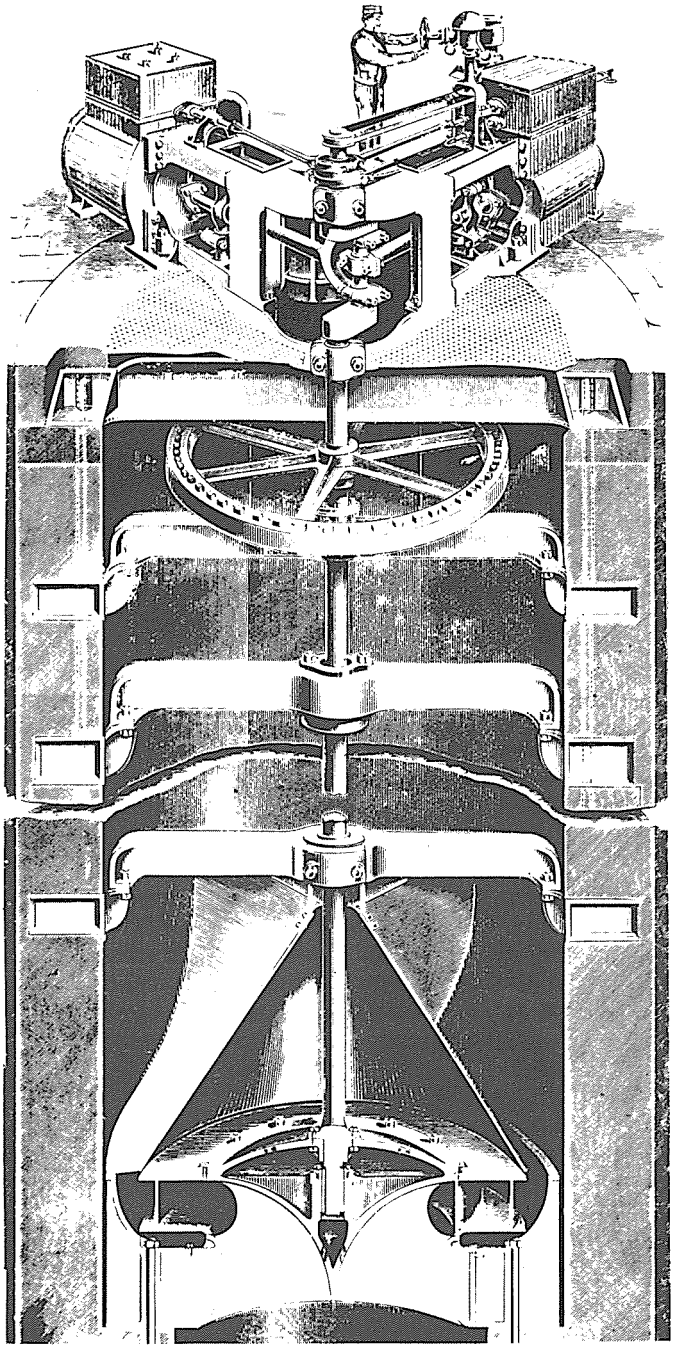

Fig.1. *Centrifugal pumping engines, 1881, for Devonport Dockyard by Easton, Anderson & Goolden. With cylinders of 18" and 30" x 18" stroke, two of these pumps could empty 39,000 tons of water from dock in 4 hours. The engine layout is similar to Rennie engine at Chatham dockyard (to be erected in Brunel Engine House, Rotherhithe). (Source 1895 Company catalogue.)*

Engines

*c.*1845 single-cylinder grasshopper beam engine; 8" x 14", 9' flywheel
ex water supply to Osborne House until 1904, then haulage engine at West Cowes shipyard; purchased in 1979 by Isle of Wight County Council.

1854 two single-cylinder grassshopper beam engines; 15" x 2', 28 hp, 60 psi, 35–40 rpm.
Lound Pumping Station, Lowestoft, Suffolk (TG 502006), East Anglian Water Co.

*c.*1856 single-cylinder grasshopper beam engine; *c.*8" x 18", 5' beam; disused.
Wrotham Park Estate workshops, Potters Bar (TQ 247986).

*c.*1856 Woolf compound beam engine; 50 hp, 100 psi, 40 rpm.
ex Pearsall's silk mill
Present location: Somerset County Museum, Taunton

1860 single-cylinder grasshopper beam engine; 8" x 12", 7½ hp, 25 psi.
ex Sussex County Asylum, Hayward Heath, where it drove well pump by gearing until 1929.
Present location: Royal Scottish Museum, Edinburgh.

1861 single-cylinder grasshopper beam engine; 10¼" x 16", 50 psi.
ex Royal Horticultural Gardens to 1870, then 1870–1921 Royal Albert Hall on well.
Present location: Science Museum, South Kensington London.

1861 vertical duplex engine coupled to Appold pump; 20" x 2', 40 psi, 50 rpm (Plate 6).
Disused from 1950, undergoing restoration by Somerset Industrial Archaeological Society.
Westonzoyland Pumping Station Somerset (ST 340328), Wessex Water Authority

1863 compound rotative beam pumping engine; 17" x 41" & 30" x 60", 50–60 psi, 15' beam, 18 rpm.
ex Cliftonville Pumping Station, Northampton
Present location: Kew Bridge Pumping Station Museum (TQ 188780), workable from 22 Feb. 1978.

1864 Woolf compound rotative beam engine; 10" × 25" & 17" x 36", 14' flywheel.
ex Battersea Gas Works
Present location: Science Museum, Newhall Street, Birmingham.

1864 vertical duplex engine coupled to Appold pump; 20" x 2', 150 hp, 60 psi, 50 rpm.
Stopped *c.* 1954, preserved.
Curry Moor Pumping Station, Somerset (ST 345288), Wessex Water Authority

1864 diagonal (inverted vee) duplex engine; 10½" x 21", 40 hp, 40 psi, 50 rpm.
ex Stanmoor Pumping Station, Somerset.
Present location: preserved at Aller Moor Pumping Station, Somerset (ST 357306).

1866 Woolf compound rotative beam engine; 28" x 64¾" & 46" x 96", 130 hp, 50 psi, 13 rpm.
Disused from 1950, partly dismantled to be made workable.
Goldstone Pumping Station, Brighton & Hove Engineerium, Hove, Sussex (TQ 286066).

1866 vertical duplex engine drove centrifugal pump; 13" x 23".
ex Somerton West Drainage Mill, Norfolk.
Present location: Strumpshaw Hall Steam Museum, near Norwich.

1867 single-cylinder grasshoper beam engine; 12" x 16", 10 hp, stopped 1905.
ex Farlington Waterworks, Hampshire
Present location: Eastney Beam Engine House Museum, Portsmouth.

1869 vertical duplex engine driving centrifugal pump; 13½" x 2', 75 hp, 60 psi, 50 rpm.
Stopped 1955, preserved.
Aller Moor Pumping Station, Burrow Bridge, Somerset (ST 357306), Wessex Water Authority.

1869 inverted duplex engine coupled to centrifugal pump; *c.*9" x 12", 40 rpm.
ex Southlake Pumping Station, Somerset
Present location: preserved at Aller Moor (see above).

1870 vertical duplex engine drove centrifugal pump; 13½" x 22", 50–60 psi.
ex Haddiscoe Drainage Mill, Norfolk
Present location: Strumpshaw Hall Steam Museum, near Norwich.

1875 small single-cylinder rotative beam engine; *c.*16" x 36", 60 psi, 28–30 rpm.
Pumped water from well; disused but able to be steamed.
Banstead Hospital, Sutton Lane, Banstead, Surrey (TQ 262612).

1875 Woolf compound rotative beam pumping engine; 28" x 64¾" & 46" x 96", 150 hp, 60 psi, 16 rpm.
Disused from 1954, preserved,workable from 1976.
Goldstone Pumping Station, Hove (see above).

1888 Woolf compound rotative A-frame beam engine; 20" x 4' & 34" x 6', 125 hp, 100 psi, 16–20 rpm.
Stopped 29 June 1975, preserved to be removed to Chessington Zoo.
Addington Well Pumping Station, Croydon (TQ 371627).

1891 Woolf compound beam pumping engine; 14" x 3' & 20" x 4', 120 psi, 20 rpm.
Preserved.
Roall Pumping Station, near Knottingley (SE 568244), Yorkshire Water Authority

Fraser & Chalmers

Thomas Chalmers (1816–1903), born at Dronley, Dundee, emigrated to the United States in 1843 where he worked for a number of companies. In 1849, he, David Ross Fraser (a fellow Scot who had recently emigrated), Robert Anthony and David Merchant founded Fraser & Chalmers in Chicago to exploit the Californian gold mining boom. The firm slowly developed a reputation for manufacturing mining equipment such as compressors, mills, concentrators and steam plant of all descriptions. In 1890 under the leadership of the De Beer mining group, a new manufacturing company was formed in London, which in turn acquired the parent American company. Fraser returned to Britain and bought a suitable site in Erith from the Maxim Nordenfeldt Gun Co. on 29th May 1891. He supervised the erection of the works, which supplied their first order in 1893; by 1901, 7491 orders had been completed of which 99% were for export. The 32 large steam winders made in this period were all exported. The firm made 108 steam winders between 1893 and 1936 compared with 392 electric winders between 1905 and 1965. The maximum number of employees at Erith was 1032 in 1894, but the average was about 750. In 1901 the remaining American interests were sold and regrouped to form Allis Chalmers, later to become a major company. The Erith works continued as Fraser & Chalmers even after acquisition by G.E.C. in 1918.The company continued to specialize in mechanical handling, and built all the aircraft lifts in H.M. aircraft carriers.

Sources

Smith, Douglas Macleod, *Fraser & Chalmers; the first hundred years.* 1967 unpublished manuscript in local history library, Old Hall Place, Bexley.
Fraser & Chalmers (Chicago) trade catalogue 1895; copy in Science Reference Library (Annexe), Kean Street, WC2.
Power (U.S.) 1903 , August, p.469.

Engines

1903 horizontal cross-compound winding engine; 32" & 53" x 66", 150 psi, driving 11'6" – 16' diameter bi-cylindro conical drum; working.

1903 horizontal duplex winder; 26" & 54", 150 psi, 16' parallel drum; working
Sherwood Colliery, Mansfield, Notts. (SK 537625).

1907 horizontal cross-compound winding engine; 28" & 46" x 5', 150 psi, 16' parallel drum; working
Sutton Manor Colliery, Lancashire (SJ 518908).

1908 horizontal cross-compound winding engine; 35" & 58" x 6', 150 psi, 13' to 19' cylindro-conical drum.
Working mid–1979 but due to stop summer 1979.
Identical engine of 1906 broken up in June 1978.
Bentley Colliery, Doncaster, Yorkshire (SE 570075).

1910 horizontal duplex winder; 28" x 60";
horizontal double tandem compound winder; 36" & 60" x 72".
Both engines stopped 1956, disused, believed scrapped 1977.
Thorne Colliery, Thorne, Yorkshire (SE 706160).

1912 winding engine. Preserved
Gwalia Mine, Australia

*c.*1920 horizontal single-cylinder winding engine
ex Ellistown Colliery, Leicestershire.
Present location: Lounds Hall Mining Museum, near Retford.

Gwynnes

There were two firms of similar name building the same types of engines in London during the second half of the 19th century. John & Henry Gwynne established an engine works at Queens Road, Hammersmith in 1866 on a 1½ acre site fronting onto the Thames. In 1873 they completed their first large order, which was for eight steam-driven centrifugal pumps for the drainage of the marshes at Ferrara in Italy. By 1894 at least 74 of these large drainage sets had been supplied along with many other engines for lesser and more varied jobs.

The other firm was Gwynne & Co. This was established in 1852 – with works at Essex Street, Strand, and Blackfriars – by James E.A. Gwynne. Later the works moved to Brooke Street, Holborn. This firm too sold vast numbers of simple steam engines with directly coupled pumps, mostly the centrifugal pump patented in 1851 by James Gwynne. After a long period of insisting they were 'the original firm', the similarity of product led to a merger with J. & H. Gwynne in the 1890s. The new firm was called Gwynnes Ltd and the manufacturing was mostly at Hammersmith. The name is still carried by Allen Gwynne Pumps of Bedford, part of Amalgamated Power Engineering Ltd, which also incorporates W.H. Allen, Sons & Co. and Belliss & Morcom.

Sources

'Engineering Works on the Thames II: J. & H. Gwynne'. *Engineer* **77** (1894) pp. 283–6.
(James) Gwynne & Co. Illustrated Trade Catalogue 1879 in Science Reference Library (Annexe), Kean Street, WC2.
Watkins, G. *The Steam Engine in Industry 1, The Public Services.* Moorland, 1978, p. 96.

Engines

1879 horizontal engine driving centrifugal pump; preserved.
Cruquis Cornish Engine Museum, Haarlem Mere, Holland.

1900 three inverted vertical tandem compound engines driving 51" diameter *Invincible* centrifugal pumps; 22½" & 42" x 30", 100 psi, disused (Plate 7).

1908 one inverted vertical tandem compound engine driving 54" pump as above; 22" & 40" x 30" 100 psi, disused.

1900/8 four inverted vertical single-cylinder engines driving centrifugal pumps; disused.
Huskinsson Dock Impounding Station, Liverpool (SJ 332930), Mersey Docks & Harbour Co.

Hayward Tyler

Hayward Tyler was formed in the second part of the 19th century and produced a wide variety of compact engines for small firms and public utilities. Their works were at 90–92 Whitecross Street, E6.

Source

1896 trade catalogue in Science Reference Library (Annexe), Kean Street, WC2.

Engines

*c.*1890 single-cylinder horizontal engine; 6" x 6", 6 hp, 60 psi, 120 rpm; preserved
King & Barnes Brewery, Horsham, Sussex (TQ 168307).

1896 inverted vertical single-cylinder engine.
ex Britannia Royal Naval College Dartmouth.
Present location Poole I.A. Society, in store.

Thomas Horn

T. Horn was typical of the smaller firms producing small to medium sized engines of a high standard of workmanship. The firm operated from a number of addresses in the Westminster area; their first location appears to have been Marsham Street in 1850. From 1857 to 1870 they had works at Grosvenor Wharf and at other addresses in the area. From 1870–1877 they had premises at Grosvenor Road, and then moved south of the Thames to Gray Street, Waterloo, where their last directory entry was in 1909.

Engines

*c.*1840 compound mill engine.
ex Paine & Co. St. Neots.
Present location: Museo Nazionale della Scienza e della Technica (Leonardo da Vinci) Milan, Italy.
Ref. *Industrial Past*, Autumn 1978.

*c.*1855 Woolf compound beam engine; 21' beam.
ex Britannia Lead Mills, Battersea, removed 1930.
Present location: Henry Ford Museum, Dearborn, Michigan USA.

*c.*1860 Woolf compound rotative beam engine; 8¼" x 17¾" & 16" x 26", 40 psi, *c.*6 hp, 45 rpm.
ex flour mill, Ifield, Sussex.
Present location: Science Museum, South Kensington.

*c.*1870 Woolf compound rotative beam engine.

1881 similar to above; *c.*8" x 18" & 14" x 27".
Both engines preserved.
Henwood pumping station, Ashford, Kent (TR 021429).

Hunter & English

In 1797, two Scots, Walter Hunter (died 1852) and William English (1775–1850) came to London and established the firm that carried their names well into the 20th century. From 1797 to 1921 the firm occupied the same premises, at 202 Bow Road, near St. Mary's Church. A, now lost, cost book of 1808–10 recorded that a considerable amount of business consisted of pattern making and repairing beam engines. This last aspect of the business continued for many years and in January 1889 the firm supplied a beam for the Maudslay engine (*q.v.*) at the Grand Junction company's station at Kew. Cocks and valves for water pipes were also a major product until the trade went to Midland firms in the 1870s. During the 1890s and prior to the establishment of his own firm at Rugby, the high-speed enclosed engines designed by P.W. Willans were manufactured in quantity at Hunter & English's Bow works. The firm's principal, Walter Hunter, in 1890 designed a floating jib crane. This became a major product of the company, and several, with names like *Hercules*, were sold to the Port of London. In 1897 Walter Hunter was appointed joint engineer to the Staines Water Co. and left the firm, which continued under James and Sidney Hunter. The firm became a limited company in 1907, and in 1921 left the Bow site for new premises at Barkingside, Essex.

Source

'London's Oldest General Engineers', *Machine Shop Mag.* March 1947, pp. 61–7.

Engines

1900 two single-cylinder vertical engines; 45 hp.
ex Poplar Gas Works.
Present location: Forncett Steam Museum, Forncett St. Mary, Norfolk.

Kittoe & Brotherhod

A firm of this name existed at 56 Compton Street, Clerkenwell for a short period *c.*1868–71. From 1861 the premises had been occupied by Kittoe & Jackson, engineers, millwrights and ironfounders, and then from 1871 by Kittoe & Co. By 1873 Peter Brotherhood was in partnership with a Mr Hardingham but after a year or so he was the sole proprietor. Brotherhood was trained at King's College, London, and then at the GWR's Swindon Works and at his father's engineering works in Chippenham. The success of his three-cylinder hydraulic engine invented in 1872 led to a move to Belvedere Road, Lambeth in 1881. The firm still exists but is now based in Peterborough.

Engines

1867 single-cylinder rotative beam engine; *c.*21" x 4'6", 90 hp, 30 psi, 30–33 rpm.
ex Watney Mann's Albion Brewery, London E1; removed 1978.
Present location: in store at Trowbridge, Wiltshire, where it will be used in a textile museum.

J.J. Lane

Although advertising that they specialized in engines of 1–25 hp, and had sold more than 8000 by 1881, few other details of the firm are known. Lane appears to have been in partnership with a Mr Reynolds and in the 1880s the firm of Lane & Reynolds occupied the Phoenix Engine Works, Cranbrook Place, Old Ford, Bethnal Green.

Engines

*c.*1901 horizontal single-cylinder engine; *c.*12" x 15".
Disused: probably to be removed for preservation.
Present location: Penzance & District Steam Laundry, Penzance (SW 474303).

*c.*1910 horizontal single-cylinder engine.
ex: Helston Workhouse, where it drove laundry equipment.
Present location: Wendron Forge Museum, near Helston, Cornwall

Robert Legg

The small firm of R. Legg was established around 1860 to manufacture machinery for tobacco processing with premises at 11 Lower Ashby Street, EC. After a few years at Owens Court & Owens Road (Goswell Road), the firm moved to the City Engine Works, 49 Eagle Wharf Road, N, where they remained from 1880 to 1965; the directories described them as 'engineers and tobacco & snuff machinery makers'. In 1965 they became part of AMF Inernational.

Engines

*c.*1840 small table engine; 8' high.
ex Radford's tobacco factory, Leeds, Yorkshire, from where it was removed in 1932.
Present location: Henry Ford Museum, Dearborn, Michigan, USA.

Linde British Refrigeration Co.

Originally Linde British Refrigeration Co. produced ice and ice-making machinery using the Lightfoot system, but following an invention of Prof. Linde in 1875 they rapidly took up a more efficient method. This system involved the compression and controlled evaporation of anhydrous ammonia, the power source being steam. In 1890s the ice-making works at Shadwell could produce 700 tons of ice per day – the largest plant in Europe. By 1899 the firm had sold over 4000 sets of ice making machines: 50% to breweries, 18% to cold stores such as the large plant at Woodside Lairage, Birkenhead, 10% to ice makers, and 8% to ships including the Atlantic liners *Teutonic* and *Majestic*.

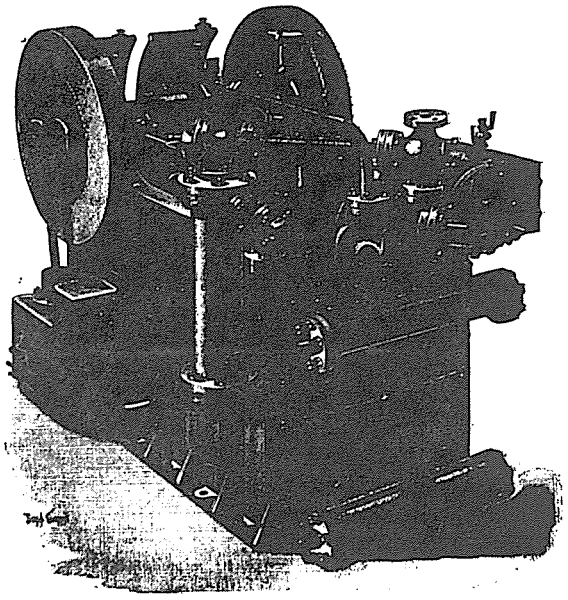

Fig.2. *Linde British Refrigeration Co. engine of* c. *1893, which could produce 'marvellously cheap ice'.*

Sources

The Thames, The Waterway of the World, Stratten & Stratten, 1893, pp. 104–5.
1899, Company catalogue, copy in the Science Reference Library (Annexe), Kean Street, WC2.

Engines

1902 horizontal single-cylinder (refrigerating) engine; *c.*18" x 24".
Preserved, workable.
Greenall Whitley's Wilderspool Brewery, Warrington, Lancashire (SJ 612866).

Maudslay, Sons & Field

Henry Maudslay (1771-1831) stands pre-eminent among early mechanical engineers and similarly the company which he founded is of the utmost importance; both have been well documented. Maudslay's original workshop was opened in Wells Street, Oxford Street in 1797, but in 1802 he moved to larger premises in nearby Margaret Street, where he eventually employed 80 people. One member of the workforce was Joshua Field (1786-1863), who Maudslay had first met while constructing Marc Brunel's block-making machinery at Portsmouth. Field became a partner in *c.* 1812, together with Thomas Henry Maudslay and John Mendham, when H. Maudslay & Co. was formed. Following Mendham's retirement in 1820, the company became Maudslay, Son & Field, and with the admission of Maudslay's two other sons in 1831 became the famous Maudslay, Sons & Field. In 1810 the growth of the firm led to a move to larger premises fronting Westminster Bridge Road, now commemorated by a plaque in Lambeth North tube station. Although Maudslay patented the table engine in 1807, and many were built, the firm also built large stationary steam engines, supplying beam engines to the Brentford, Chelsea, Lambeth and West Middlesex waterworks, pumping engines to Southampton, Copenhagen and Sebastopol Docks, winding engines for the Euston Station incline, and the stationary engines for the London & Croydon and South Devon Atmospheric Railways. The most important products of the firm were marine engines: by Maudslay's death the company had supplied 45 engines, and by 1880 they had fitted 244 paddle-engines and 334 screw-engines with a total horsepower of 127,443. The engines fitted to the *Great Western* in 1838 are probably the best known set. From 1865 the firm also built ships having acquired a shipyard at East Greenwich. In 1863, P. Barry published photographs of the Lambeth works (see Plate 5). The company became limited in 1889 but by 1900 had gone into liquidation. In 1903 R.W. Maudslay started a motor firm in the Midlands under the title Maudslay Motor Co.

Sources

Barry, P. *Dockyard Economy & Naval Power*, 1863, pp. 261-7.
Gilbert, K.R. *Henry Maudslay, machine builder*, Science Museum pub. 1971.
The Engineer (1881) **52**, p. 253.
Gilbert, K.R. 'Henry Maudslay 1771-1831', *Trans. Newcomen Soc.* (1971-72) **44** pp. 49-62, includes fuller bibliography.

Engines

c. 1825 table engine
ex Beale Flour Mill, Dunstable, Bedfordshire; stopped 1931 (Plate 2).
Present location: Henry Ford Museum, Dearborn, Michigan, USA.

c. 1825 wheel-guide table engine.
ex Malling Flour Mill, Kent, used until 1932.
Present location: Henry Ford Museum, Dearborn, Michigan, USA.

1837 beam engine;
12' 3" flywheel.
ex flour mill at Gloulbarn, New South Wales, Australia, then a local brewery until 1929.
Present location: Museum of Applied Arts & Sciences, Sydney.

1838 beam pumping engine, converted to cornish cycle 1846-8.
65" x 8', 125 hp, 40 psi, 8-10 spm; beam strapped 1862, but fractured 1888 and new beam fitted by Hunter & English in 1889.
Kew Bridge pumping station museum, (TQ 188780), Kew Bridge Engines Trust/TWA.

1840 table engine 12" x 24", 7 hp, 60-80 rpm.
ex Springfield Hospital, Tooting.
Present location: Science Museum, South Kensington, London.

1862 single-cylinder vertical engine; 4.1" x 4.5"
Drove Maudslay, Sons and Fields exhibits at the 1862 International Exhibition.
Present location: Science Museum, South Kensington, London.

Thomas Middleton

This firm first appears in Johnston's London directory in 1817, Middleton being described as an engineer of 5 Stoney Lane, Tooley Street. By the 1830s he was also described as an importer of French burr (hard millstones producing fine flour). In 1840 the firm moved to 3 Loman Street, Southwark, which remained their address until the last entry in 1907.

Engines

c. 1840 single-cylinder beam engine; 10" x 24" delapidated condition.
Baker Street windmill, Orsett, Essex (TQ 633813).

c. 1850 annular compound beam engine.
ex Anscomb's flour mill, East Malling, Kent, where it worked until 1931.
Present location: Henry Ford Museum, Dearborn, Michigan, USA.

John Penn & Sons

John Penn (1805-78) was the son of a Bristol engineering foreman who had come to London and, in 1799, established his own works at Greenwich to manufacture agricultural machinery. In 1825 J. Penn Snr. built a marine engine and the firm took on a new direction. After the death of John Penn Senior in 1843, his son transformed this small firm into a world-famous company. The firm occupied two sites in south-east London: the engine works at Blackheath Hill, Greenwich, and the boiler shop on the river front at Deptford. Penn retired in 1875 leaving the firm in the hands of his four sons, and 14 years later the firm was converted into a limited liability company. At that time the company employed some 800 workers on the two sites, which together covered seven acres. After establishing the firm's reputation with the construction of oscillating engines, the trunk engine and triple expansion engines were developed. Although marine engine work was predominant Penn made other products; for example, in 1868 he built what was probably the first wind tunnel for F.H. Wenham of the (Royal) Aeronautical Society, then based on Blackheath. The company amalgamated with the ailing but massive Thames Ironworks & Shipbuilding Co. (*q.v.*) in 1899 in order that the ships and engines could be produced by the same firm. The Blackheath engine plant continued to supply marine engines, including some of 25000 hp for warships, but with falling orders some land-based engines were also built. As orders declined further motor vehicles were built at Blackheath, but Penn's works closed with the collapse of the project to build *Thames* in 1912.

Sources

'Penn's factory at Greenwich', *Illustrated London News*, Oct. 7th, 1865.
Barry, P. *Dockyard Economy & Naval Power*, 1863, pp. 267-71.
The Thames, The Waterway of the World, Stratten & Stratten, 1893, p. 47.
Smiles, R. 'Model Establishments I: John Penn & Sons' in *Great Industries of Great Britain*, Cassell, *c.* 1883.
Banbury, P. *Shipbuilders of the Thames and Medway*, David & Charles, 1971, pp. 224-9.
London's Indust. Archaeol. (1979) **1**, p. 34.

Engines

1879 oscillating marine paddle engine; 30" x 2'9", 30 psi.
ex P.S. *Empress of Weymouth* built by Samuda & Co. of Millwall.
Present location: Maritime Museum, Southampton.

Pontifex & Wood

It is a difficult task to understand the various ramifications of the Pontifex businesses in Shoe Lane. In 1842, three firms of similar description operated from the area: Pontifex (Edmund & William) & Wood of Farringdon engine works, Shoe Lane; Pontifex (E & W.) & Wood, white lead, colour manufacturer; and Pontifex, Jacklin & Pontifex, millwrights and engineers at 53 Shoe Lane. All these firms continued manufacturing, particularly products related to brewery engineering into the 20th century. H. Pontifex & Sons were then at Farringdon Works and Pontifex & Wood had premises at 34 New Bridge Street and also at Union Foundry, Derby.

Engines

c. 1880 horizontal single-cylinder engine; 9" x 18", 10 hp, 90 psi, 100 rpm; on standby.
Harvey & Sons' Bridge Wharf Brewery, Lewes, Sussex (TQ 419103).

J. & G. Rennie

These two sons of the eminent engineer, John Rennie, established their firm in 1821 at their father's Albion Ironworks in Stamford Street, Blackfriars. In April 1833 they moved to a new site in nearby Holland Street; George (1791-1874) was the mechanical engineer, whilst his brother John (later Sir) (1794-1874) continued in their father's footsteps as a civil engineer. As well as stationary and marine engines they also built 16 railway locomotives upto 1843. In the 1850s they opened their own shipyard at Norman Road, Greenwich, on Deptford Creek. The firm became one of the major engine builders on the Thames, being particularly interested in a curiosity called the Bishopp disc engine. In December 1861 the partnership was dissolved. The family's civil engineering reputation still led to orders for stationary engines in dockyards, etc. as well as ironwork for dock projects. The firm was the last major shipbuilding concern on the Thames; Norman Road yard closed in 1915 when the company combined with Forrest & Co. of Wivenhoe.

Sources

Rennie, G. *History of J. & G. Rennie down to 1850*, manuscript in Rennie Collection, National Library of Scotland, Edinburgh.
Barry, P. *Dockyard Economy & Naval Power*, 1863, pp. 271-80.
Banbury, P. *Shipbuilders of the Thames & Medway*, David & Charles, 1971, pp. 235-41.

Engines

c. 1885 compound horizontal engine, with cylinders at right angles driving onto common crank; *c.* 21" x 30" & 21" x 25".
Drove impeller pump on 56' well for draining entrance lock until 1977, HM Chatham Dockyard, Kent.
At present dismantled for possible removal to the Brunel Engine house, Rotherhithe, London SE16.

N.B. The paddle engines credited to the firm and listed in Part I, which are now in the Henry Ford Museum, are probably incorrectly labelled.

Riley Manufacturing Co.

In 1859 George Riley established a works to manufacture brewery equipment and Riley's patent helical refrigerator at 81, 82 & 83 Railway Arches, Vauxhall Hill Street. After a period of operating from an apparently private address — Elmtree Lodge, Lambeth — the firm moved to Effra Works, 256 South Lambeth Road. This remained their address until the business moved to Eastbourne in the 1950s.

Engines

c. 1880 vertically mounted single-cylinder engine; 6" x 9".
W.H. Brakespears & Sons' brewery, Henley-on-Thames, Oxfordshire (SU 763827).

Shand Mason

Although Shand Mason claimed in their advertisement to have been founded in 1774, this date was in fact the foundation date of the firm of Wm. Tilley, fire-engine maker of 245 Blackfriars Road. In 1852, Mr Shand and Mr Mason took over this old-established company and started to manufacture 'Steam & Hand worked fire engines of every description'. At this time they were called Shand & Mason and could offer brigade engines from £370 to £850. They were also able to manufacture and supply every necessary requisite to the public brigades and the private owner wishing to protect his residence. The firm's immediate success in supplying engines to the London fire establishment was probably due less to the quality of their equipment than the illicit relationship between Shand's daughter and the Chief Fire Officer. The company was absorbed by their arch-rival, Merryweather, in 1923.

Sources

Holloway, Sally. *London's Noble Fire Brigades*, 1883-1904, Cassell, 1973.

Engines

c. 1895 stationary fire-engine pump.
ex Sir J.J. Colman's Crown Point House, Whitlingham, near Norwich.
Present location: Bressingham Steam Collection, Bressingham Hall, near Diss, Norfolk.

Stationary fire-engine pump, drew water from mains and forced this at 80 psi into fire hydrant mains; steam pressure 100 psi; preserved.
Cadbury Schweppes Foods Ltd (formerly Chivers), Histon, Cambridgeshire (TL 441626).

James Simpson & Co.

Thomas Simpson (1754-1823), a native of Carlisle, came to London in 1778, and in 1784 was appointed engineer to the Chelsea Water Co., a position he held until his death. In 1790 he founded his own business, with premises in Eccleston Street, manufacturing pumping engines, fire-engines and mill-work. When the founder died his two sons Joseph and James (1779-1869) took over the firm; James was also appointed successor to his father as Engineer to the Chelsea Water Co. In 1838 they moved to a new purpose-built factory in Belgrave Road on the present site of Victoria Station. When in 1859 the London, Brighton & South Coast Railway purchased the site, still larger premises were erected on the riverfront at 101 Grosvenor Road, which were finally demolished in 1936. Not surprisingly, considering James Simpson's appointment, the supply of pumping engines to water companies was the firm's main line of business, with orders predominantly from London companies but with many from abroad. Following John's death in 1876, James continued in sole charge until in 1886, when the concern was converted into a private limited liability company. At the same date an arrangement was agreed with the Worthington Pumping Engine Co. to manufacture Henry Worthington's pump designs. This arrangement eventually led to a formal merger of the two companies in Britain, Worthington-Simpson being created in 1917. Prior to that, Simpsons had built a new large works at Newark where production was gradually concentrated. The new company manufactured many large triple-expansion engines, including the six 1000 hp sets which were among the largest land-based engines constructed (the surviving pair at Kempton Park pumping station are still working). The firm built engines until the outbreak of World War

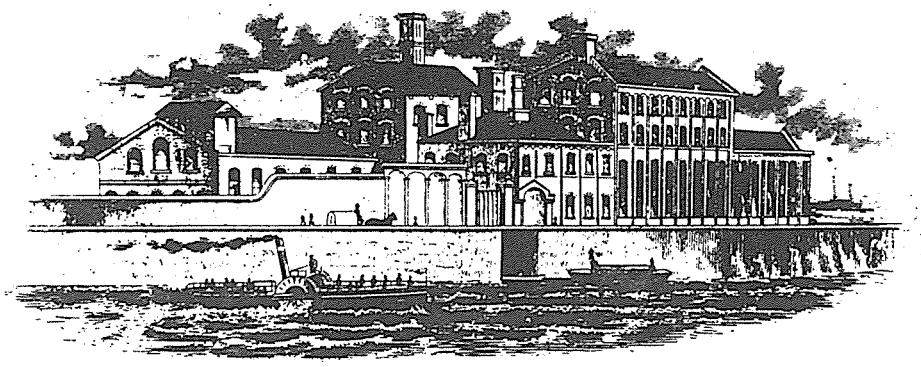

Fig.3. *James Simpson's works at 101 Grovenor Road as illustrated in* The Thames, The Waterway of the World, *1893.*

II, but installed its last triple-expansion engine at Dover Castle waterworks in the early 1950s. In 1969 the company became part of the international Studebaker-Worthington combine, which still produces pumping equipment carrying the Worthington-Simpson name.

Sources

The Thames, The Waterway of the World, Stratten & Stratten, 1893, pp. 94-5.
A History of Worthington-Simpson Ltd and the Simpson Family, published by Worthington-Simpson, *c.* 1970.

Engines

1889 two (Worthington-type) horizontal twin tandem non-rotative triple-expansion pumping engines; 8" & 10" & 16½" x 15"; preserved, workable (Plate 8).
Upper Cherry Garden Waterworks (Folkestone & District Water Co.) Folkestone (TR 210380).

1909 & 1913 two inverted vertical triple-expansion engines; 15" & 25" & 40" x 36" & 15" & 26" & 42" x 36".
Dagenham pumping station (Essex Water Co.), Rainham (TQ 508843)

1910 horizontal cross-compound engine; 21" & 42" x 3', 120 hp, 120 psi, 33 rpm; working.
Waddon pumping station (T.W.A.), Waddon Way, Croydon (TQ 313639).

N.B. Other surviving Worthington-Simpson engines, e.g. the 1915 engine at Waddon, the Uniflow engine at Littleton, and the two triples at Kempton (all detailed in Part I), were built at Newark.

The Thames Ironworks, Shipbuilding & Engineering Co.

This title was only adopted by the old-established shipbuilding company following the merger with John Penn & Sons (*q.v.*) in 1898. Penn's firm provided both the expertise and the facilities that enabled the new company to manufacture marine engines for its own ships and marine and stationary engines for sale. The new company made many things besides ships and steam engines. It had six departments; shipbuilding, boatbuilding, civil engineering, electrical engineering and cranes based at Blackwall, and engines and motorcars at Blackheath Hill. The new combine was successful only for a short period, finally closing on 21 December 1912.

Sources

'The Thames Ironworks', *The Engineer* (1894), **80** pp. 567-77.
The Thames Ironworks Gazette.
Banbury, P. *Shipbuilders of the Thames and Medway*, David & Charles, 1971, pp. 268-76.

Engines

1911 inverted vertical marine-type triple-expansion engine, driving Gwynnes' (Hammersmith) centrifugal pump; 14" & 23" & 38" x 30", 600 hp, 200 psi, 120 rpm; preserved.
Walton-on-Thames pumping station (T.W.A.), Surrey (TQ 118684).

Wentworth & Sons

This firm was apparently founded *c.* 1830, although no directory entry has been found prior to 1845, when James Wentworth & Son had a millwrighting business in Bell Lane, Wandsworth. The firm occupied these same premises in the final entry of 1888.

Engines

1835 A-frame rotative compound beam engine; 12" x 36" & 18" x 44", 12 hp, increased to 16 hp in 1863, 60 psi, 32 rpm; standby.
Ram Brewery (Young & Co.), Wandsworth High Street, London SW18 (TQ 256747).

1845 Woolf compound beam engine; *c.* 12" x 30" & 15" x 40", 40 hp, 30 psi, 25 rpm; preserved.
Beeleigh flour mill (Essex Water Co.) Maldon, Essex (TL 839083).

1867 A-frame rotative compound beam engine; 12" x 36" & 20" x 42", 20 hp, 60 psi, 32 rpm; working.
Ram Brewery (see above).