



Fig 2: The effects of candlelight, Paris (c1630). By Abraham Basse from *Marriage a la ville* (Bibliothèque Nationale, Paris).

Much can be learned about early forms of lighting and about the first experiments and uses of electricity by looking back at the paintings, drawings, engravings and prints of the period. Often the main subject or topic of the picture is nothing to do with lighting or electricity and one has to focus on the background or detail to uncover the information. At other times, pictures may be found in technical publications or popular magazines of the day which specifically illustrate an important engineering event or a new piece of apparatus.

While the lamp is known to be a product of the early Stone Age, the American author, Thwing, in his book *Flickering flames: a history of domestic lighting* (1958), states that the oldest picture of a candle is probably that shown in a seventh century miniature in the Bibliothèque Nationale in Paris. Other candles are shown in the *Exultet Roll*, painted in the 11th century. Another picture of this period, depicting the act of ordination to the priesthood, shows a short taper on a tall ceremonial candlestick when, to the Church, the word *candela* (now the SI unit of luminous intensity) meant a lamp. But we begin with the 16th century.

16th century: Luminary of glasse (fig 1)
It was realised as long ago as the 16th century that certain tasks demanded a higher level of illumination than commonly obtained from a simple candle or candles. Certainly, the use of water

FLICKERING FLAMES

Brian Roberts, in the first of three articles, traces the history of lighting and electricity through the paintings, engravings and prints of bygone days. Part one: up to 1800.

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Fig 1: A scholar reading by candle and water lens (16th century). Contemporary woodcut.

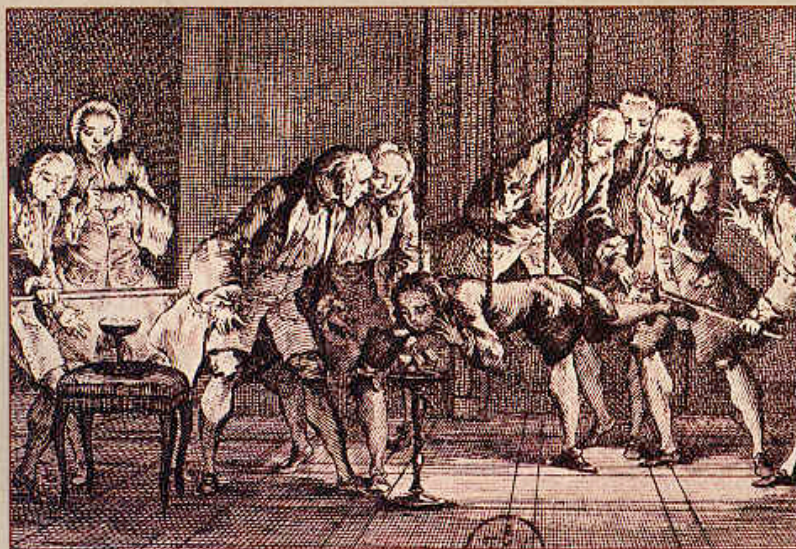


Fig 4: An experiment with electricity (c1739). Engraving by Charles-Nicolas Cochin Fils.



Fig 3: A platform stage with footlights (1673). Frontispiece to Francis Kirkman's *The Wits; or, Sport upon Sport*.



Fig 5: Electricity (c1750). Engraving by Hubert-Francois-Gravelot.
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lenses or refractors dates from this time, when they were used by lacemakers, cobblers, and scholars to aid reading. As shown, a spherical flask filled with water, placed in front of the candle flame, acted as a condenser lens, producing a small area of relatively bright illumination (described as a new devised luminary of glasse).

1630: *Paris wedding night* (fig 2)

This shows a rich house where the newlyweds and their guests are in the bedchamber, which is illuminated by a candle in the sconce on the wall (right), with its brass reflector plate, and by a candlestick (left) on the dressing table. The couple are trying to get their guests to go home so that they can be alone.

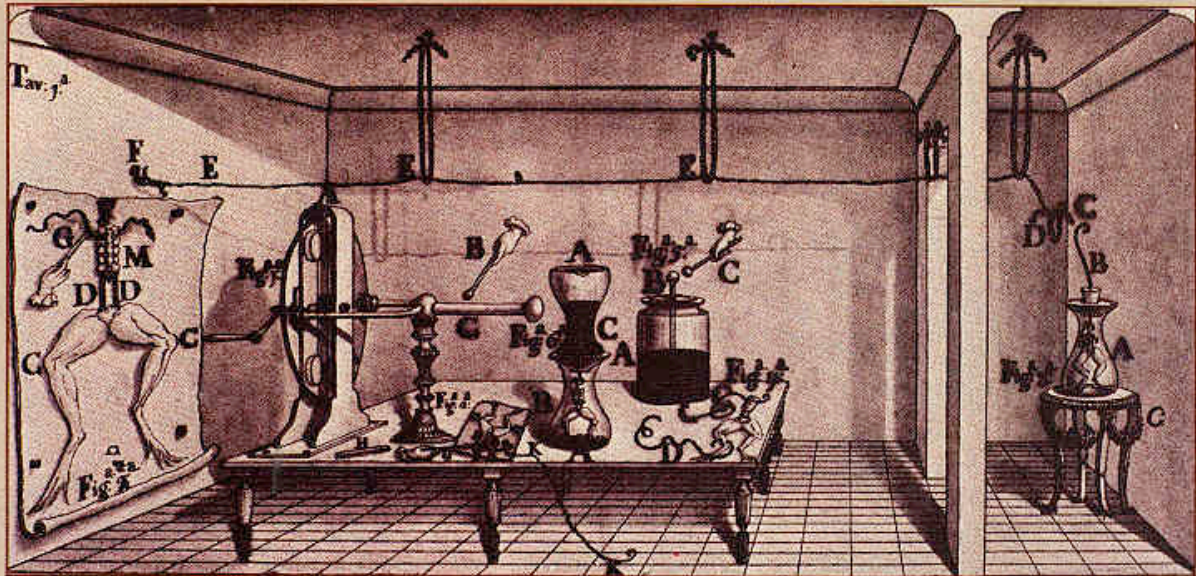
1673: *Footlights* (3)

The first permanent theatre in London was built by a carpenter, James Burbage, in 1576 and was known simply as *The Theatre*. Other Elizabethan theatres followed: *The Curtain*, *The Rose*, *The Swan* and *The Globe*. This illustration shows a platform-stage with footlights, found for the first time on an English stage. There are also overhead chandeliers. Theatres of this time were always burning down, probably because of carelessness with the candle lighting.

1739: *Electrical experiments* (fig 4)

This French engraving shows what appears to be an experiment with static electricity. One poor unfortunate is suspended by ropes from the ceiling to insulate him from the floor. His colleagues are touching him with charged rods and little scraps of paper are being attracted to the face of the hanging body from the table below his chin. The character on

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the extreme left appears to be charging a rod, but by what means?

1750: *Electricity* (fig 5)

The man on the right of the picture is hand-cranking a piece of electrical apparatus, apparently to deliver an electrical shock to the unsuspecting maiden stood on an (insulating?) tub. Judging from the text, the machine may have been used to check on the virtue of young beauties by looking into their eyes through the magic of electricity. But the artist was once known to have asked a collector how far should one go with ones jesting?

1781: *Supper, the French way* (fig 6)

Four young people are dining in a small private bed chamber. The room is lit by two three-branch candle holders on the wall, while the central illumination is provided, not by a chandelier, but by a decorative lantern containing several candles. It has a disc above to protect the cord and tassel from heat. Presumably it can be raised and lowered to make it easy to service the candles.

1790: *Frog's legs* (fig 7)

Galvani's electrical experiments with frog's legs are shown here in a contemporary illustration. Little hands, B & C, wearing neat cuffs and hanging in the air on their own, demonstrate how a metal bar was charged by being held against an electric machine. The bar was then brought into contact with the frog's legs, which had been arranged in various ways.

Above Fig 7: Galvani's experiments with frog's legs (c1790). Contemporary illustration.

Below Fig 6: A private supper, Paris (1781). Engraving after a drawing by J M Moreau from *Le Monument de Costume* (Victoria & Albert Museum).



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BURNING THE MIDNIGHT OIL

Brian Roberts continues his journey through the evolution of lighting and electricity via the canvass and film plates of the times. Part two: 1800-1870.

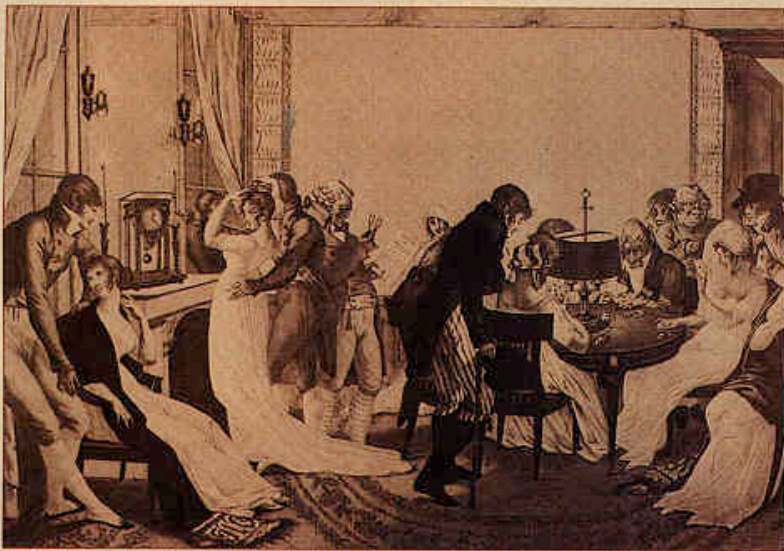


Fig 8: An evening at cards, Paris (c1805). By Jean-Francois Bosio (Bibliothèque Nationale, Paris).



Fig 10: Billiards (c1815). By W H Pyne, engraved by G Hunt (British Museum).

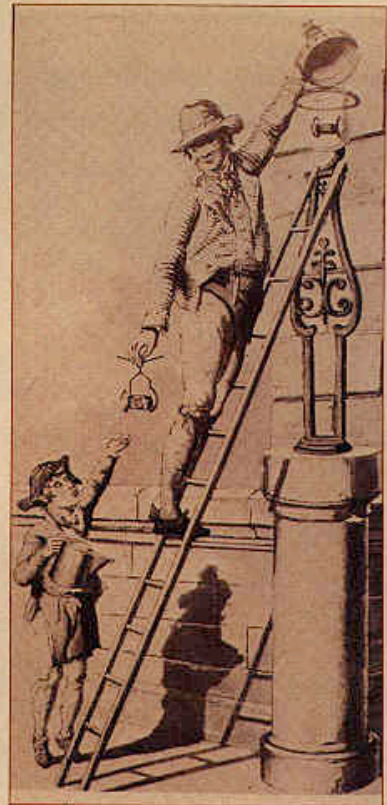


Fig 9: A Regency lamplighter at work (1808). Aquatint by W H Pyne from *Costume of Great Britain*.

It has been said that until 1782, with the introduction of the Argand lamp, there was practically no improvement in lighting from the earliest times. Its tubular wick, which allowed air to be drawn up into the middle of the flame to assist more rapid and complete combustion, was a significant advance. In 1784 Argand added the glass chimney; this permitted a higher flame temperature without smoking. The 19th century saw the introduction and development of a whole range of oil lamps.

The early 1800s also saw the introduction of gas lighting, including its adoption for street lighting, and the formation of numerous gas-light, heat and coke companies for its production and distribution.

1805: Cards, and other games? (fig 8) On either side of the chimney glass (left) is an Argand lamp; below are two ordinary candlesticks, while on the table (right) is a shaded twin-branch candlestick. Maintaining Argand lamps was difficult and dirty since the viscous oil tended to block the feed, especially when the pressure decreased as the reservoir emptied. The spring-operated mechanism introduced in the Carcel lamp in 1798 was devised to overcome this difficulty.

1808: The old lamplighter (fig 9) Until 1738 London by night was almost as dark as in medieval times. But night

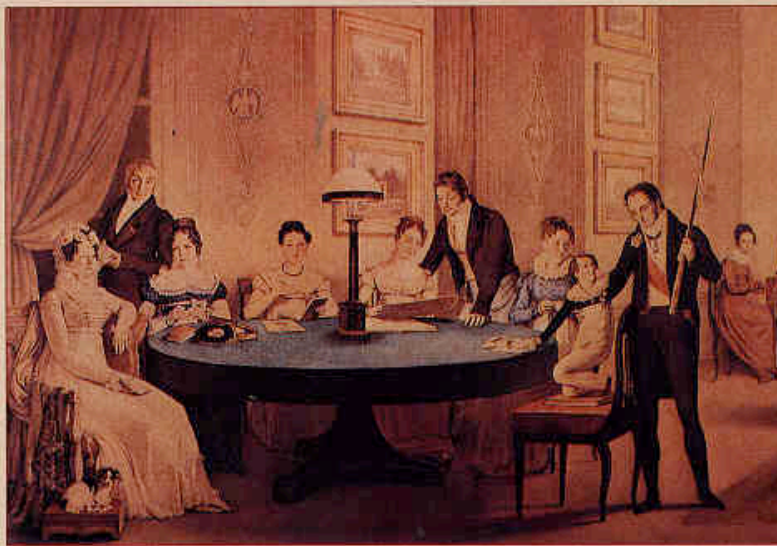


Fig 11: An evening round the table, Vienna (1819). By Louis Dupre (Galerie Carroll, Munich).



Fig 12: Regent Circus (1822). Aquatint by T H Shepherd (British Museum).

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crime and suspicion of debauchery in the dark led to the erection of some 15000 street lamps which were set burning from each sunset to sunrise. These oil lamps, as shown in the picture, consisted of cotton twist floating in a tin of crude oil, tended by lamplighters and their assistants.

1815: Billiards (fig 10)

Billiards was an outdoor sport, played on the ground, until the 15th century. By the Elizabethan era there were many public tables in London. Although indoor sports are not well documented in paintings, the game of billiards (and later snooker) is an exception, and many pictures clearly show the lighting over the tables, candles, oil-lamps, gaslights, through to electric. In this print, the Regency dandies are wearing top hats and illumination of the table is by candle-light.

1819: Viennese evening (fig 11)

The new Astral lamp produces a relatively strong light. It casts little shadow because its oil reservoir is annular and supports the glass shade. This made it possible for several people to sit round it and read or sew. (The man with the red sash is King Jerome of Wurtemberg, the younger brother of Napoleon.)

1822: Streetlights (fig 12)

By now gas lighting in the streets was becoming quite common in the West End of London. This view, with rows of elegant lamp-standards, shows Regent Circus (now Piccadilly Circus) looking south towards Lower Regent Street.

1828: Evening in Russia (fig 13)

In the salon of a Countess is a curious stand with twin Argand oil-burning lamps. On the oval table stands a new Astral or

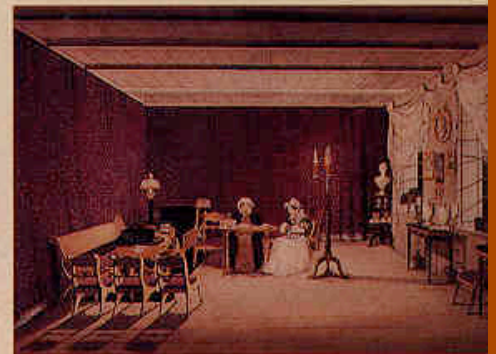


Fig 13: A salon in the Ukraine, Aleksandria (1828) (Jagiellonian University, Cracow).

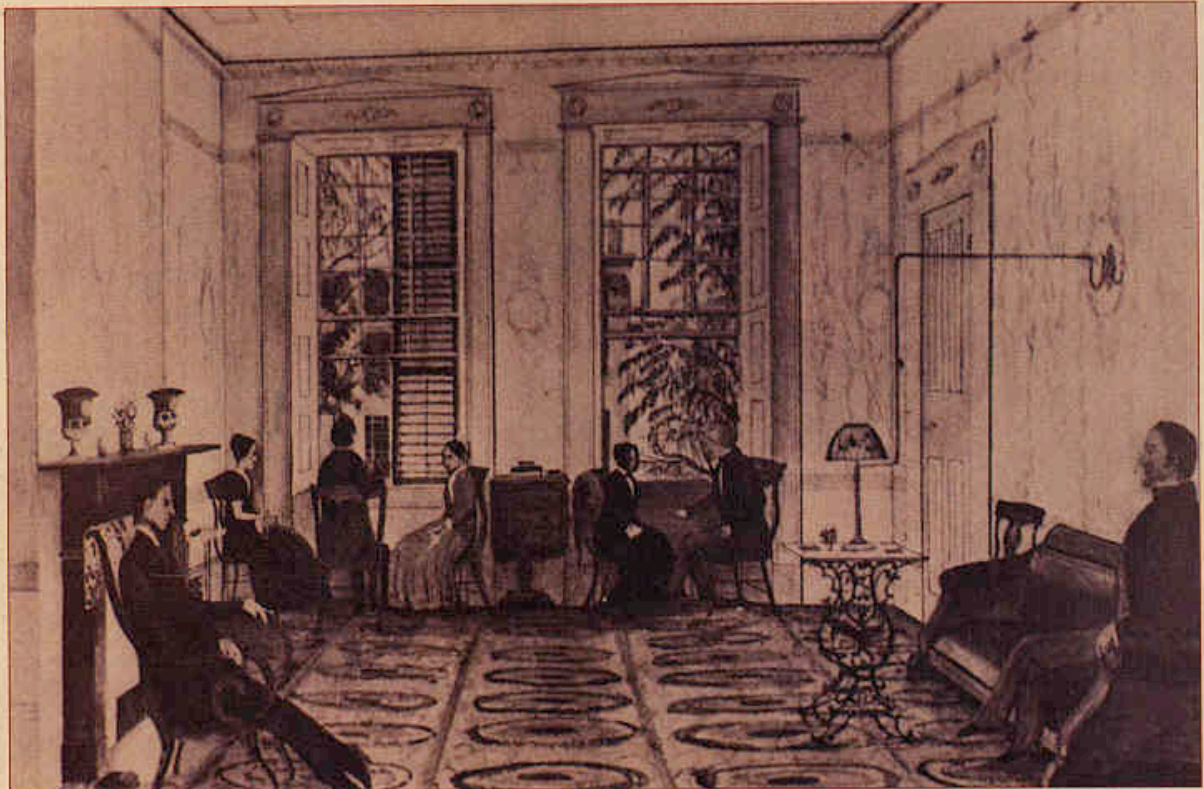


Fig 14: The parlour in a Philadelphia boarding house (1853). By Joseph S Russell (B K & N F Little Collection).

Sinumbra type of lamp.

1853: *The boarding house* (fig 14)

It is assumed this is a private hotel because of the way the two main characters are not speaking to each other and the other groups seem unrelated. There are no pictures and few ornaments – a totally unremarkable room except for the astonishing table lamp burning gas, the metal pipe for which projects far out from the wall before turning down at right-angles to connect into the lamp (a most hazardous arrangement!).

1860: *In the lime light* (fig 15)

Here, the new Westminster Bridge is lit by ten of the new lime lights (about one third of the number of old gas lights), a single jet being equivalent to 40 Argand or fish-tail gas burners, or to about 400 wax candles... a single jet, consuming 4 cu ft of the mixed gases of hydrogen and oxygen, is said to be equal in illuminating power to that obtained from 400 cu ft of ordinary gas.

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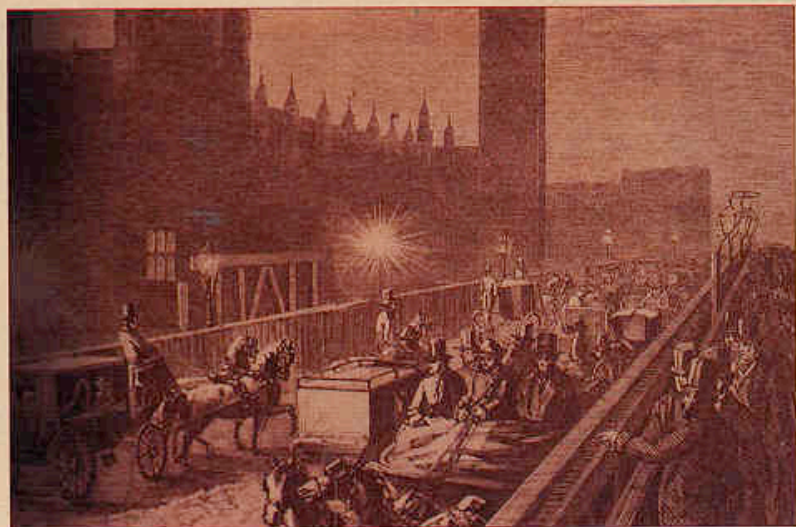


Fig 15: Westminster Bridge illuminated by the new lime light (19 May 1860). From The Illustrated London News.

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LAYING DOWN THE CHANGES

In his third and final article *Brian Roberts* describes the transition from gas lamps to light bulbs and the new consumer age. Part three: from 1870 onwards.

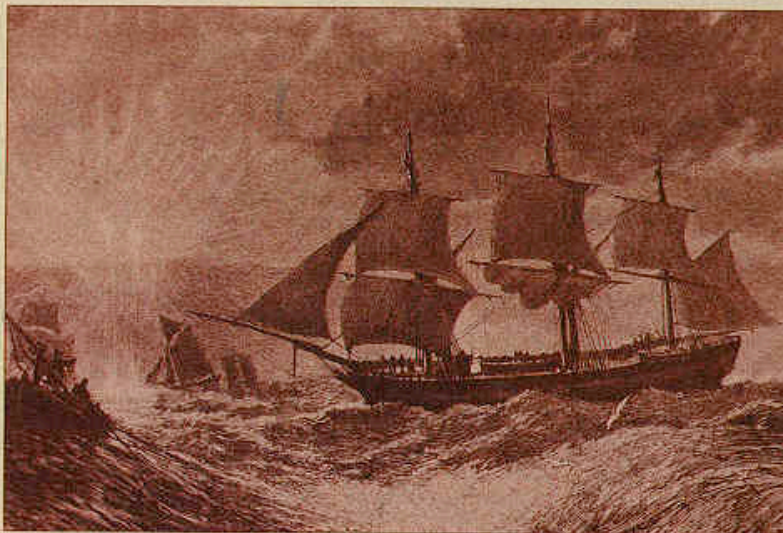


Fig 16: The electric light at the South Foreland lighthouse: provided by a steam-driven magneto-electric generator (3 February 1872). From *The Graphic*.

From the middle of the century, numerous trials with arc lamps were carried out, but the wide scale introduction of electric lighting had to wait for the practical development of the filament lamp around 1880. This in turn led to the growth of the electricity supply industry for both lighting and power.

1872: Trip around the lighthouse (fig 16)
Lighthouses, with their requirement for very powerful lights, provided the best application for arc lighting. Drawing on the earlier work of Professor Nollett, it was Professor Frederick Hale Holmes who pioneered their development. He conducted experiments at Blackwall and at South Foreland (illustrated) from 1857 onwards, at Dungeness in 1862, and at Souter Point, near Sunderland from 1870; the latter installation remaining in service until 1900. The light output achieved was around 1520 cp.

1872: In the gasworks (fig 17)

Gas lighting was a 19th century phenomenon. Its use for street lighting started in the 1800s, but decline was under way by the 1890s with the advent of the electric light. Over this period, The Gas Light and Coke Company dominated London. As the picture shows, the working conditions in its gasworks were grim. Employees were exploited. They worked a 12 hour day and a seven day week. Strikes were met with instant dismissal and punctual and steady attendance during Christmas week was required.

1878: Russian candles (fig 18)

It was P Jablochhoff, a Russian officer working in Paris, who invented the electric candle which bears his name. It comprised two carbon rods placed side by side and an arc formed between them, preferably using an ac supply to prevent unequal consumption of the carbons. The picture shows the Victoria Embankment in London, along the river wall between



Fig 17: The South Lambeth Gasworks at Nine Elms (1872). Engraving by Gustave Doré.



Fig 18: Jablochhoff candles used to illuminate the Victoria Embankment (1878). Wood engraving from *The Graphic* (4 January 1879).

Waterloo and Westminster Bridges. A total of 20 Jablochhoff candles were supplied by a Gramme dynamo and exciter, powered by a steam engine. It appears from the picture that only alternate lamps were fitted with Jablochhoff candles, no doubt so that comparison could be made with the existing gas lighting.

1882: Power-house in New York (fig 19)
The break through in electric lighting came with Edison's introduction of the-

first practicable light bulb. However, his greater contribution was probably the creation of a whole system for electric lighting. This consisted of a steam-engine driven electric generator with cables and conductor joints (see fig 20), as well as other devices necessary for transmitting the current to the consumer: domestic wiring, electricity meters, fuses, switches and screw holders for his light bulb (things that earlier had not existed, mostly de-

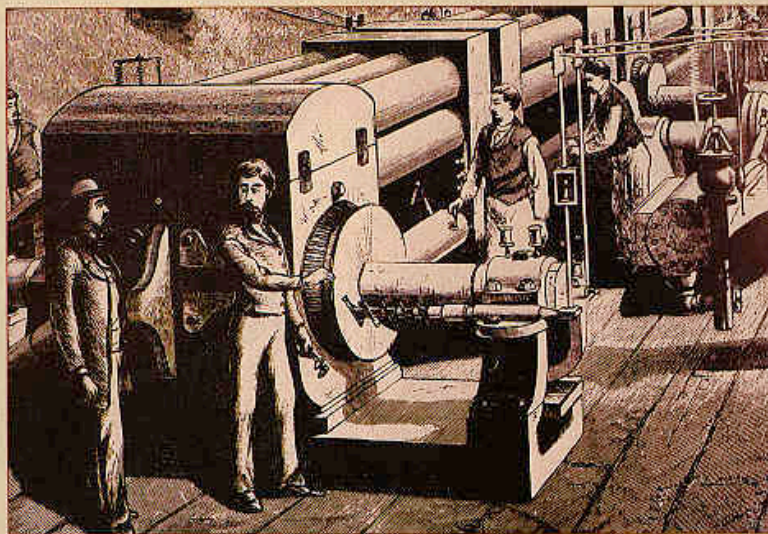


Fig 19: The dynamo room of Edison's electric lighting station, New York (1882). From La Nature.

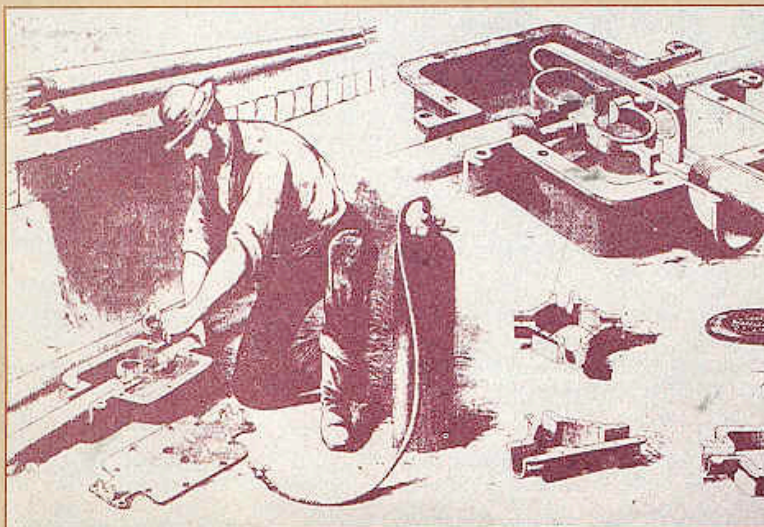


Fig 20: Cable laying in the streets (c1882). Contemporary illustration.

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Fig 21: Bec-Auer gas mantles (1895). Poster by G M Mataloni.

vised and tested by Edison himself). The illustration is of his Pearl Street power-house, with its three Jumbo generators each of 125 horsepower, together feeding 5000 lamps in 225 houses.

1882: Cable laying in New York (fig 20)

It took two years to lay the 22.5 km of electric cable needed for Edison's power station, a section of which is shown (top right) with a conductor junction box (top centre). The cables consisted of double copper wires, insulated with impregnated hemp string and enclosed in iron tubes. This was a direct current system, soon to be superseded in high voltage networks by alternating current.

1895: Beauty by gaslight (fig 21)

Originally, gas lighting made use of luminous flames. The next step was the first gas mantles, sold in Paris in 1849, but having only a short life. It was an Austrian, Carl Auer, who produced a long-lasting mantle with a high light output, which he patented in 1893. These were widely adopted in Europe. The origin of this particular topless advertising poster is not clear; it appears to be of Italian origin but features an address in Brussels.

1930: For electricity (fig 22)

According to the art critics, this poster (which is for a Dutch electrical company) has specific electro-mechanical elements without an identifiable machine; the lightning bolt represents a spark jumping be-

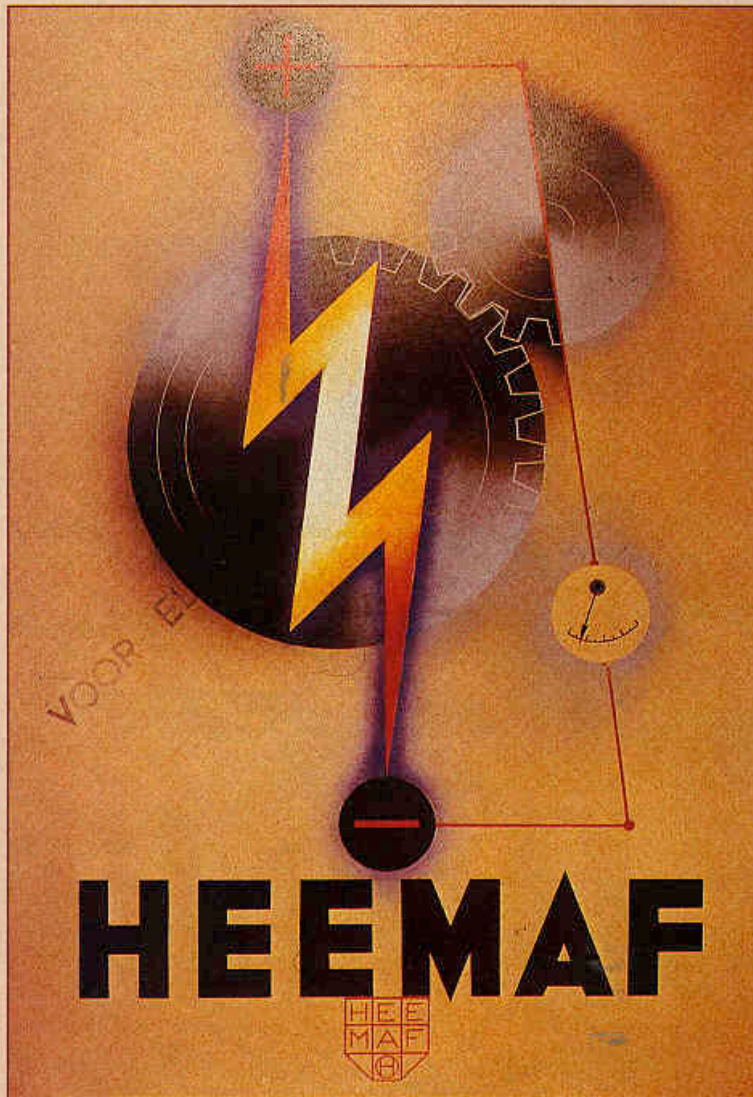


Fig 22: Heemaf (1930). Poster for a Dutch electrical company Gouache by A M Cassandre (Stedelijk Museum, Amsterdam).

tween positive and negative poles, the response being measured by a parody of an electrometer. What engineer can quarrel with that? The letters voor el make the point that the company, Heemaf, is for electricity

1931: An electric hand? (fig 23)

This poster (presumably) represents the hand of the consumer ready to embrace the advantages of domestic electricity, available by means of the two-pin plug

and twisted flex: no doubt very appropriate to the 1930s as new consumer appliances became available in the home, and how different from today's advertisements!

Picture sources

(Fig 1) Billington N S & Roberts B M, Building services engineering, Pergamon Press (1982). (Figs 2, 6, 8, 11, 13, 14) Thornton P, Authentic decor: the domestic interior 1620-1920, Weidenfeld & Nicolson (1984).



Fig 23: Thomson: la main-d'oeuvre electro-domestique (1931). Poster by A M Cassandre for a French electrical manufacturer (S J Pack Collection).

(Fig 3) Hartnoll P, A concise history of the theatre, Thames & Hudson (1968).

(Fig 4, 5) Adhemar J, Graphic art of the 18th century, Thames & Hudson (1964).

(Figs 7, 20) Strandh S, Machines, Mitchell-Beazley (1979).

(Fig 9) Barker F & Jackson P, London: 2000 years of a city and its people, Cassell (1974).

(Fig 10) Wingfield M A, Sport & the artist: Vol.I Ball games, Antique Collectors Club (1988).

(Fig 12) Piper D, Artists' London, OUP (1982).

(Figs 15, 16) Electricity supply in the United Kingdom, Electricity Council (1973).

(Figs 17, 18) Trench R & Hillman E, London under London, John Murray (1984).

(Fig 19) de Vries L, Victorian inventions, John Murray (1971).

(Fig 21) Barnicoat J, A concise history of posters, Thames & Hudson (1972).

(Figs 22, 23) Brown R K & Reinhold S, The poster work of A M Cassandre, Omnibus Press (1980).

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