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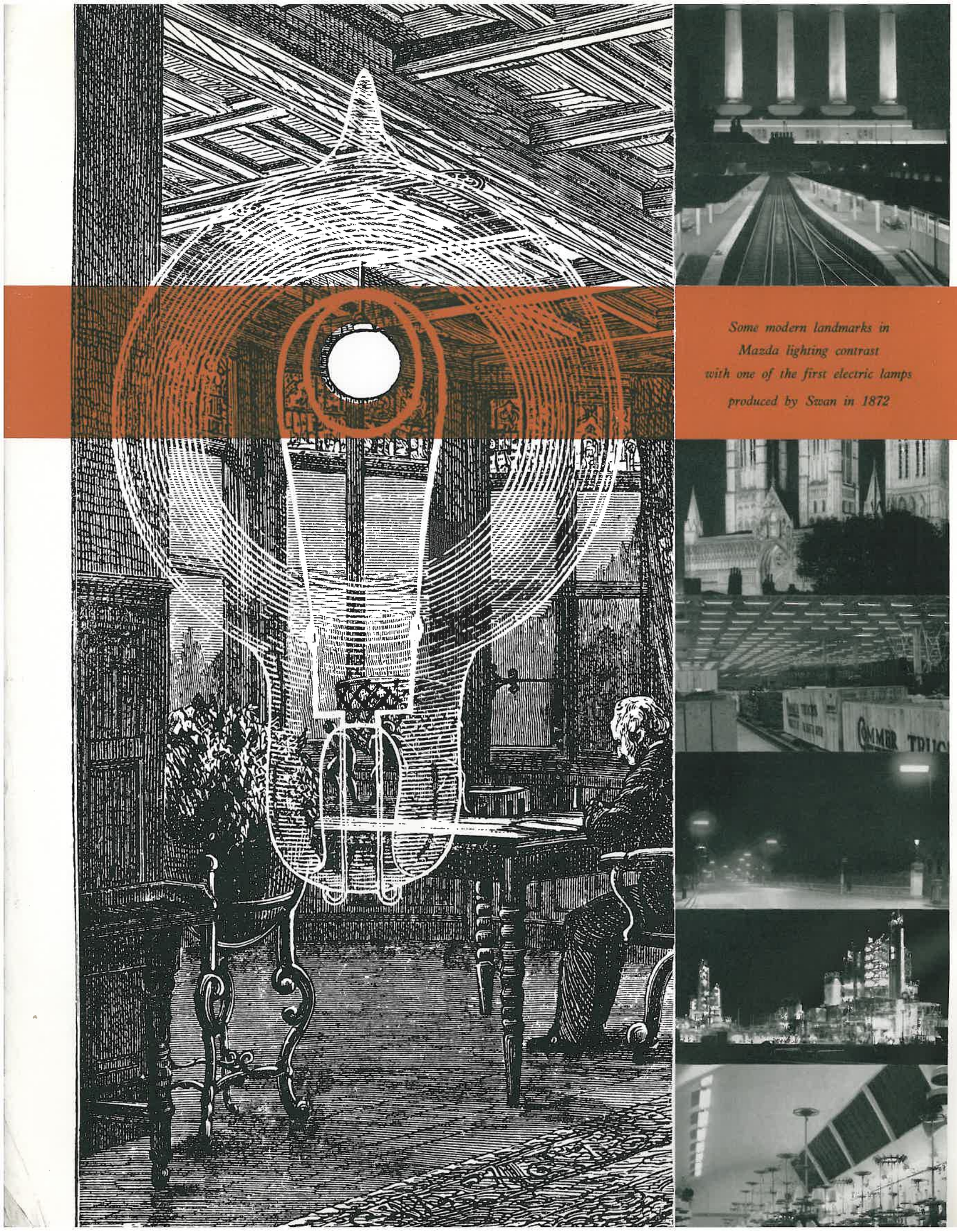
ONE HUNDRED & SEVENTY-FIVE YEARS OF LIGHTING EXPERIENCE

175

THE JOURNAL OF THE A.E.I. LAMP & LIGHTING COMPANY LIMITED

VOLUME 4 NUMBER 1



Some modern landmarks in Mazda lighting contrast with one of the first electric lamps produced by Swan in 1872

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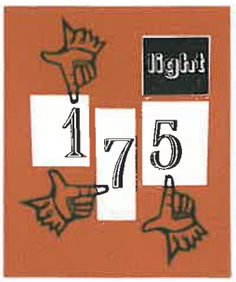
Landmarks in over 175 years of Lamp and Lighting experience



THIS ISSUE of 'Light' magazine is the first to be published since the A.E.I. Lamp and Lighting Company commenced to operate as a sales and distribution unit for lamps and lighting equipment previously marketed by The British Thomson-Houston Co. Ltd., Metropolitan-Vickers Electrical Co. Ltd. and the Edison Swan Electric Co. Ltd.

The name of the A.E.I. Lamp and Lighting Company may not be as well-known as the names of the companies whose lamp and lighting resources it has taken over—but it inherits the tradition and 'know how' of their vast experience in the manufacture of lamps and lighting equipment. That combined experience, gained over a period of more than half a century and stemming from the invention of the electric lamp itself, amounts to 175 years. This issue of 'Light' is devoted to a record of a few of the outstanding achievements of that period.

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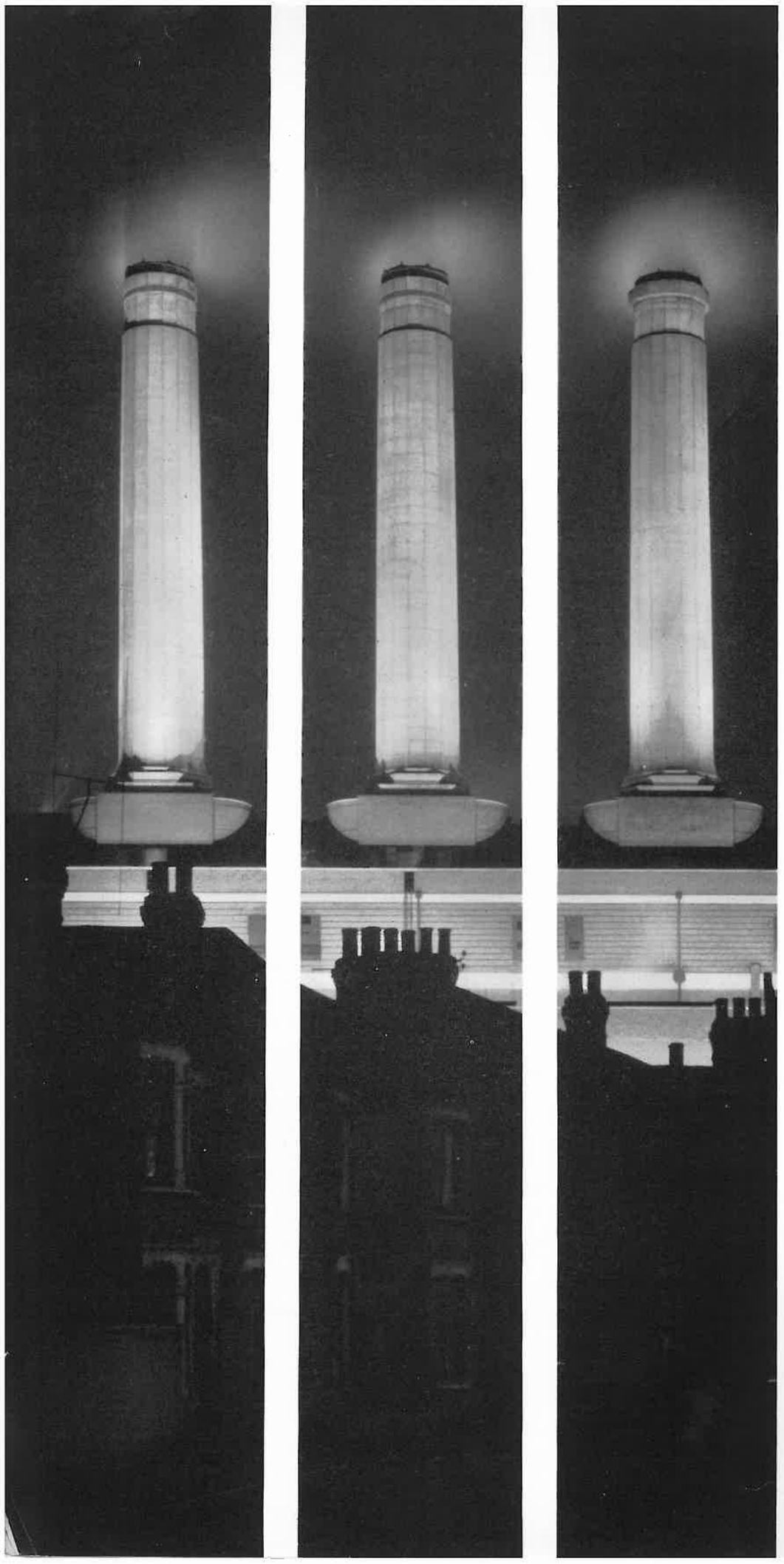


Ediswan Tungsten Lighting, Piccadilly Circus, 1951.

LANDMARKS

IN LIGHTING

WITH THE reconstruction of certain buildings in Piccadilly Circus in 1931, the Edison Swan Electric Company was given the opportunity of carrying out one of the most comprehensive outdoor lighting schemes since the invention of the electric lamp.

Lanterns were spaced so as to give, according to the specification of the Westminster City Council, 'a minimum intensity of illumination at any point on paved surfaces of two candles per square foot'. 1500 watt G.L.S. Lamps were used. The new lighting scheme, illuminating the roadway, pavements and surrounding buildings to an intensity which had never before been equalled, changed the face and enhanced the fascination of Piccadilly.

That was in 1931, however. It was in 1879 that Sir William Armstrong took advantage of the work of his friend Sir Joseph Swan and had *the new lighting* installed in his home, electricity being generated by water power. Within 50 years great power stations and thousands of miles of cable were carrying electricity from one end of the country to the other, feeding the lamps which were installed in millions of homes—rich and poor, old and new.

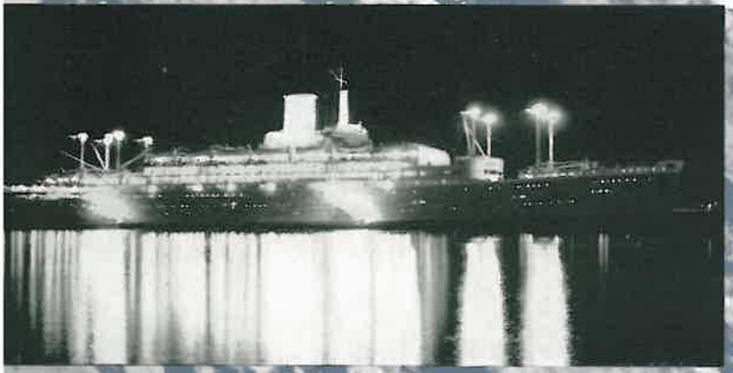
Transport, factories, public buildings, theatres and offices soon followed suit.

The days of darkness had disappeared within the lifetime of the man who had created the means to dispell them. 'The days of my youth', wrote Joseph Swan 'extend backwards to the dark ages, for I was born when the rushlight, the tallow dip or the solitary blaze of the hearth were the common means of indoor lighting . . . . The common people, wanting the inducement of indoor brightness such as we enjoy, went to bed soon after sunset'.

Such as we enjoy! The great inventor was writing before the first motor car, the first underground train, before mass production and the aeroplane. Yet the progress made before his death must have seemed incredible to those who remember the rushlight and tallow dip. What, had they belonged to a generation which can scarcely remember gas lighting, a generation whose great hydro-electric schemes and atomic power plant point to a future of universal electric lighting, would they have thought of the illuminated football stadium, the control and navigating lights of a car or an aeroplane, the lighting of the modern factory, office and street ?

Sir William Armstrong's Staircase, 1879

FROM PLACE TO PLACE



British Railways

WHAT WOULD it be like to make a night-time journey in the modern underground, or in a bus or a motorcar, in absolute darkness ? The frivolity of the question emphasizes its importance. For it underlines the simple fact that without artificial light there would be no transport system as we know it.

Among the earliest contributors to transport lighting was the British Thomson-Houston Company. The vast experience which the engineers of that Company had gained through supplying electrical equipment for municipal transport schemes, was put to good use when the London underground system came to be electrified. So was that experience used when the tram came onto the roads and, later, when the motor car and the bus arrived.

In a sense it was lighting which made possible speed in the vehicle of the 20th Century, just as it was the prerequisite of comfort and safety in travel. Soon after the open wooden boxes of the underground gave way to closed carriages, Londoners were able to journey at night time and, such was the marvel of the lamp, were able to see each other and even read as they did so.

Travelling home from the office or from a social occasion, the citizen of today is a study in easy concentration. What must the evening newspaper industry owe to the electric lamp!

The pre-focus headlamp of the modern car gives perfect vision at high speeds on unlit roads. Panel lights enable the driver to keep a watch on all his gauges and meters. Indicator lights give unerring warning to other road users. In aircraft, buses and other means of transport, similar lamps perform the same vital tasks. Railway colour-light signals, again, mean travel under conditions of speed and safety which would otherwise be impossible.

In recent years, however, the improvements in public and private transport brought about by the filament lamp have been extended beyond measure by the introduction of the fluorescent lamp with its good colour rendering, high efficiency and low intrinsic brightness. In 1945 some of London's underground station platforms were equipped

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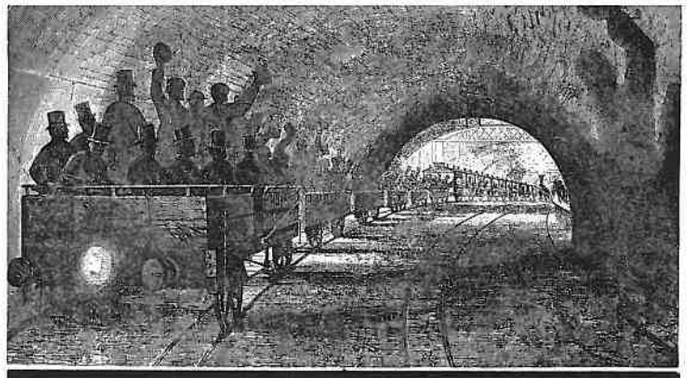

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1 & 2 *London underground railway of 1863 contrasts with the Metrovick fluorescent lighting on the platforms of Twickenham railway station.*

3 *The British Railways control room at Chadwell Heath, Essex, lit by Ediswan fluorescent fittings.*

4 *Mazda lamps in the first railcar fluorescent lighting scheme: Blackpool 1946.*

5 *Mazda lighting in the world's first propellor-turbine airliner—the Vickers Viscount.*

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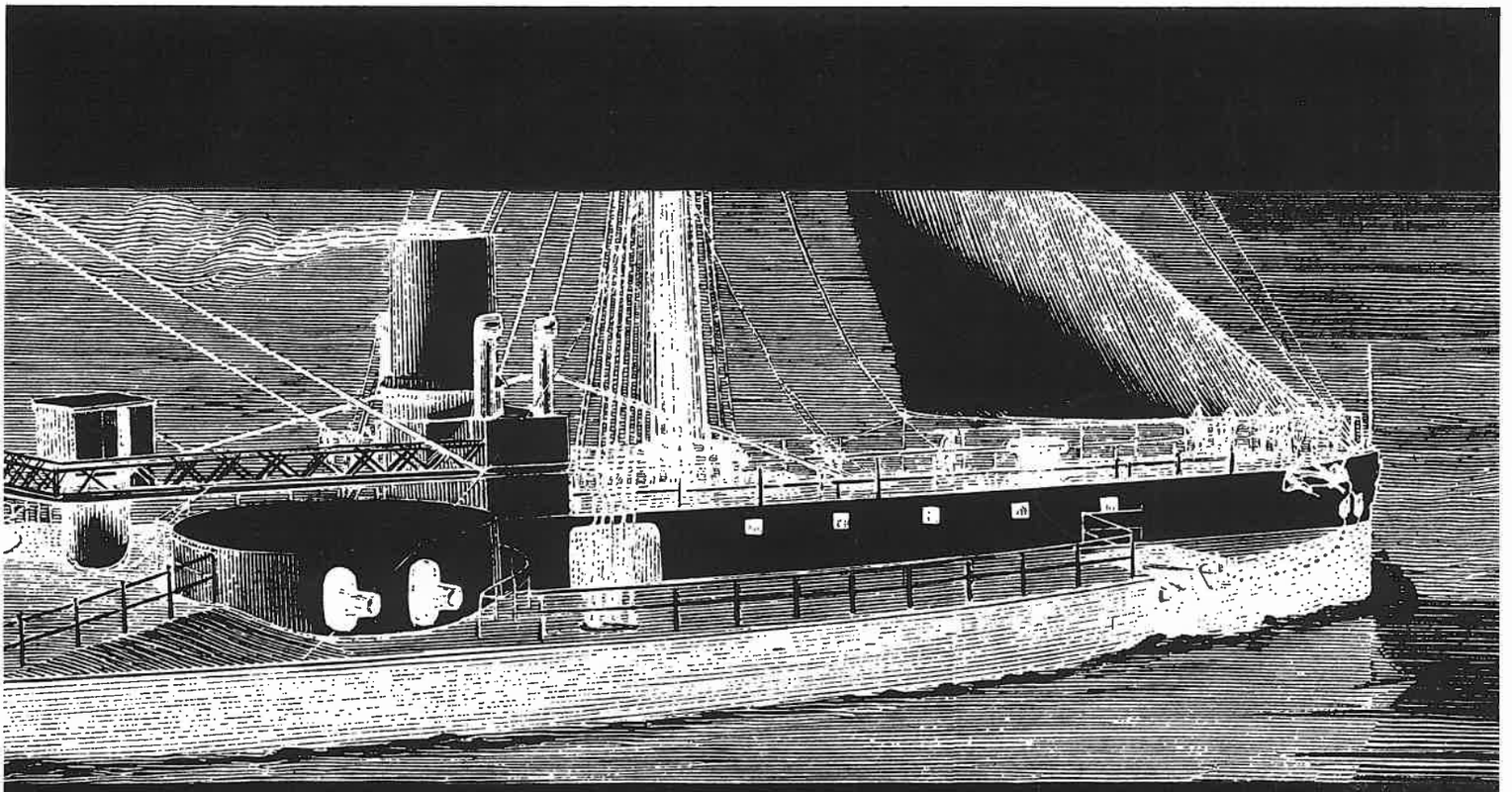
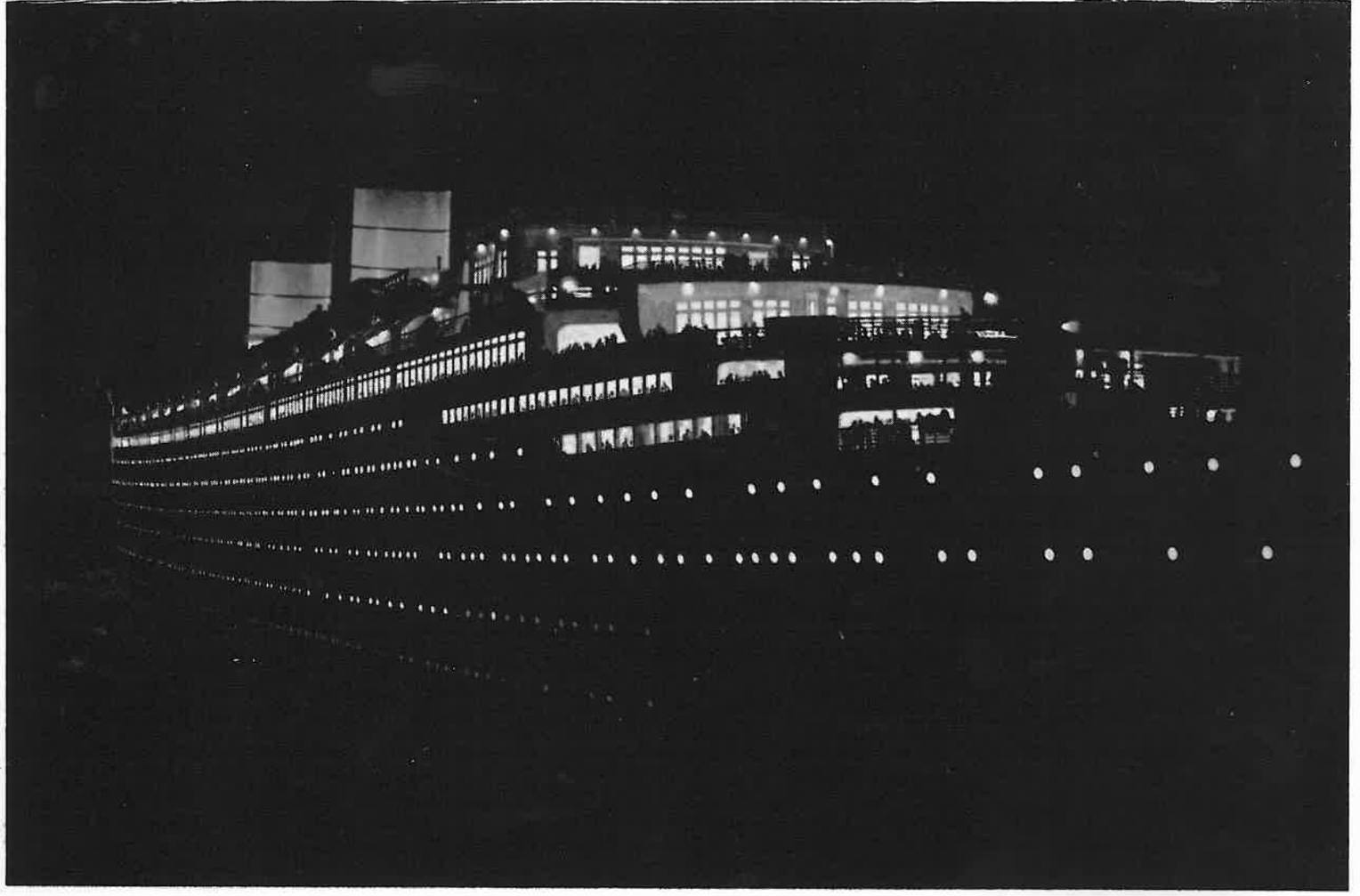


H.M.S. Inflexible



R.M.S. Queen Elizabeth

with fluorescent lighting and it was, perhaps, appropriate that BTH, which had done so much to improve early transport lighting, were the first to provide fluorescent platform lighting in the 'tube'. Metrovick supplied the first fluorescent lighting for carriages on the underground. Now the same lamps are making their appearance in the interiors of trains and even buses.

In talking of transport lighting we should not forget ships. Famous liners in every ocean of the world are lit by Mazda, Ediswan and Metrovick equipment. The standard set by these famous names in marine illumination — in lighting the public spaces and the crews' quarters of ships such as the *Queen Mary*, the *Queen Elizabeth*, *Orcades*, *Caronia*, *Orsova* and *Orion* — is unsurpassed anywhere in the world.

It is 75 years since a sailor first saw electric lighting aboard his ship, and the story of how it happened is worth recalling.

Captain J. A. Fisher, R.N. had seen Sir Joseph Swan's lamps in operation over the latter's dinner table, and asked if they could be demonstrated before his Admiral.

Unfortunately the Admiral was an irrascible old sea dog with a suspicion of new fangled notions. He demanded to know what would happen to his ship if one of these 'little glass bubbles burst during a broadside'.

'Nothing', said the rather nervous demonstrator.

'Nothing ?' countered the Admiral. 'How do you know ? You've never been in a ship in a broadside'.

Worse was to follow. A tray of gun cotton was sent for and the Admiral challenged the demonstrator to break a light lamp over it. Armed with a chisel and waning confidence in the laws of physical science, the latter smashed the lamp. The pieces, mercifully cooled before they reached the tray, fell harmlessly among the explosive. H.M.S. *Inflexible*, the Admiral's appropriately named ship, became the first vessel afloat to be equipped with electric light.

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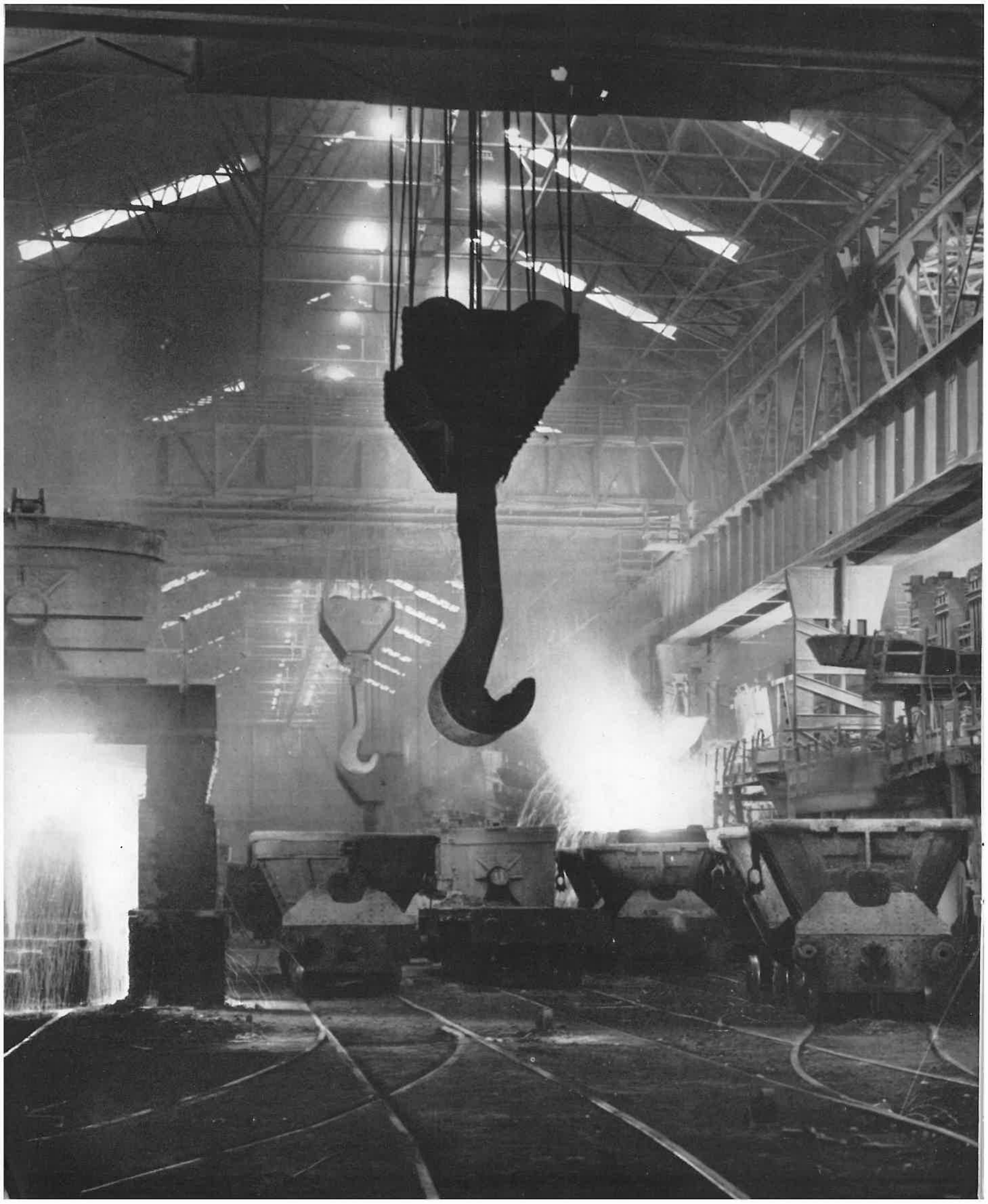
1 *Mazda lighting on the 'Queen Elizabeth' sets a high standard in marine lighting. Unfussy, subdued, the lighting in this first class dining saloon comes from typically sturdy and simply designed fittings of the Mazda marine range.*

2 *In the 'Orsova', an outstanding example of design in post-war British ships, lighting is used in all spaces—public rooms and cabins—to enhance their bright spacious appearance. For reading, eating, drinks at the bar, walking on deck—lighting levels are carefully planned to suit every requirement. Superbly conceived cornice lighting in the dining saloon and* **3** *'box' fittings in the lounge illustrated right, demonstrate the quality and thoughtfulness of the entire lighting scheme. Metrovick lamps and fittings are used.*



Thomas Firth, John Brown Limited.

LIGHT & PRODUCTION

AUTOMATION, TIME AND MOTION STUDY, efficiency committees, accident committees, production committees; they are all prominent terms nowadays.

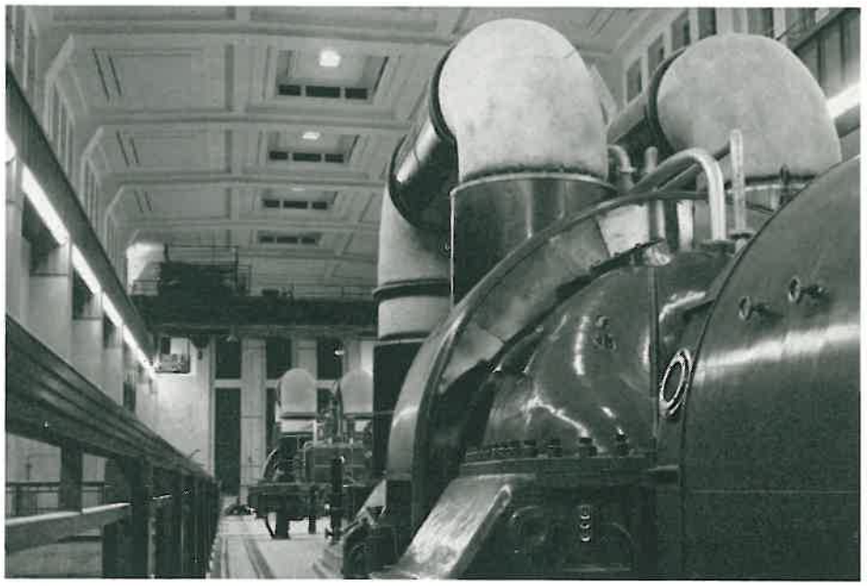
But out of the tangled web of words and programmes, at least one thing emerges with certainty. Whether it be a manual process or a master machine which controls the making and assembly of goods, the watchful eye of man will always be necessary; and light, whether it shines on the craftsman or the dials of an electronic brain, will always be essential to production.

With few exceptions the efficiency of an industry is directly related to the standard of its lighting. No operative can work well or safely in semi-darkness. No technician or research worker can carry out the often intricate and minutely adjusted tests which are necessary in modern industry without the aid of properly planned lighting.

Early in the history of the electric lamp industrialists saw its advantages. Before the turn of the century a number of workshops were proudly exhibiting the new lamps alongside their still flourishing counterpart — the gas mantle. But it was not until the first World War that the need for large scale illumination became urgent enough to bring the filament lamp into wide-scale use and to compel the installation of electric power supplies. Many people alive today will remember the advent of the first electric lighting systems in their workplaces.

It took another conflict to produce what was perhaps the biggest advance ever in the science of artificial illumination. The outbreak of war in 1939, with Britain and other allied countries largely unprepared for the emergency, meant that factories would have to produce essential goods at a vastly greater rate than hitherto if the country was to survive. One of the most urgent requirements was a form of lighting that would

Craft and automation. The extremes of industry, one barely surviving into the present age, the other making its tentative, controversial appearance. Both need light.



In 1947 the BTH Company devised a method of lighting from the crane rails at Staythorpe Power Station. This method of lighting greatly enhanced the efficiency of power station lighting and has been adopted in many other turbine halls including Skelton Grange, Bankside, Brunswick Wharf and Brighton 'B', illustrated above.

1

enable personnel to work for long hours, often unrelieved by any kind of rest from the job, without eye-strain.

Thus the fluorescent lamp came into use. Glare was immediately reduced to an insignificant level. Shadows were no longer cast over the work if the nearest lamp happened to be behind the operative. British Thomson-Houston, in whose laboratories much of the early development works on these lamps was carried out, were responsible for many of the fluorescent lighting schemes of this period. Metropolitan-Vickers and Edison Swan also played an important part in bringing to industry the only form of lighting able to meet the crying need for mass production.

Armament factories obviously took priority. But wars cannot be waged on arms alone and for six years the three famous lighting firms made a prodigious effort to produce the tubular lamps and fittings needed by thousands of manufacturers — from pharmaceuticals to food — who were working, in many cases, round the clock.

Now, industrial lighting has advanced far beyond the purely utilitarian. Planned illumination has become an integral part of the modern factory; even, indeed, of the modern coalmine.

Lighting must serve a great variety of tasks. Colour rendering, spacing of fittings, efficiency and flexibility of reflectors, mounting height and wiring facilities — all have to be considered in relation to any one lighting scheme, whether in a small workshop or a textile mill, over a potter's wheel or a car production line. In the following pages we show some of the landmarks in lighting achieved by the members of the A.E.I. Lamp and Lighting Company: landmarks which demonstrate in impressive detail the importance of light to today's industry, and the part played by these three great companies in providing light of the highest quality.

The 8 ft. fluorescent tube has been applied extensively to industrial establishments in recent years. Where large scale products are being handled in factories with high bays or ceilings, the fitting with a long light-source, capable of giving powerful illumination with the minimum of glare, comes into its own. **1** At the Hollinwood works of Ferranti Ltd., for instance, a high level of vertical illumination was demanded. Another requirement was good colour rendering. To clear overhead travelling cranes, fittings had to be mounted at 64 feet in high bays and 40 feet in low bays. In the final scheme, devised by Metropolitan-Vickers in collaboration with works power engineer Mr. E. Morris, 1800 lamps of the 125 watt 8 ft. type are housed in metal trough reflectors to give an average intensity of light on the working plane of 15 lumens per sq. ft. Colour rendering, ease of maintenance, shadowless, glare-free light are outstanding features of the installation.

Probably the most universally effective means of factory lighting, however, is the standard 5 ft. fluorescent lamp, together with the great variety of fittings designed to accommodate it by the A.E.I. Lamp and Light Company. **2** A war-time application, which gave rise to many subsequent advances in the simulation of 'daylight' conditions in factories, was the use of fluorescent lamps in artificial skylights at the BTH foundry casting shop in Rugby. An area of over 4000 sq. ft. was illuminated so that by day and night the same natural lighting conditions prevailed. BTH lighting engineers were the first to apply fluorescent lamps to the continuous-strip method of factory illumination. **3** Again during the war, continuous-trough fittings were devised for the aero engine assembly shop of D. Napier & Son Ltd., of Acton. In this installation, too, banks of fluorescent fittings are used to simulate the effect of natural light through laylights.

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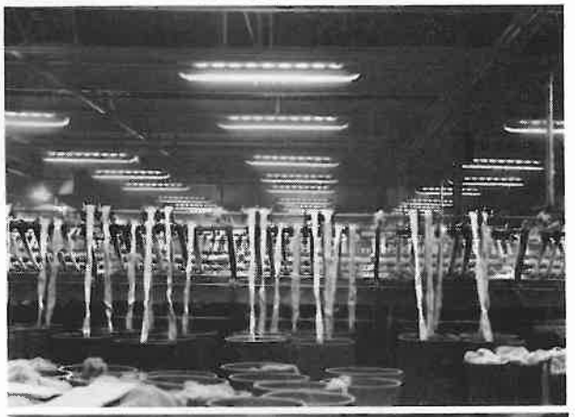

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5 Similar 5 ft. fittings are used at the lace manufacturing mill of J. C. Small and Tidmas, Nottingham. In the bobbin winding shop illustrated opposite an almost dramatic clarity is given to the minute strands of fabric as they are wound on to the machines.
6 Dundee, centre of the jute industry, might almost be regarded too as the centre of outstanding industrial lighting schemes. In the jute mills of this area more than 3500 Ediswan fluorescent reflector fittings are used.
7 In premises such as the Rolls Royce factory at East Kilbride, where both intricate work and an enviable reputation could be affected by badly planned illumination, the need for highly efficient lighting is obvious. Here cold-cathode lighting, designed and installed by Ediswan, is used.
8 Equally obvious is the role of first rate lighting in the precision work of the Ultra Electric laboratories where electronic and microscopic tests of the most exacting kind are carried out. Ediswan reflector fittings, each housing a single 5 ft. lamp, are mounted individually over the work benches.
9 Administration, as much as production, needs good lighting. The general office, managers' and directors' offices, even corridors, should be lit to the appropriate intensity and to a uniform level if work is to be carried out efficiently. The drawing office of AC-Delco at Southampton, illuminated by Ediswan fluorescent lamps, shows how an effective lighting scheme can form an attractive part of the interior.

Eregli Mines, Turkey

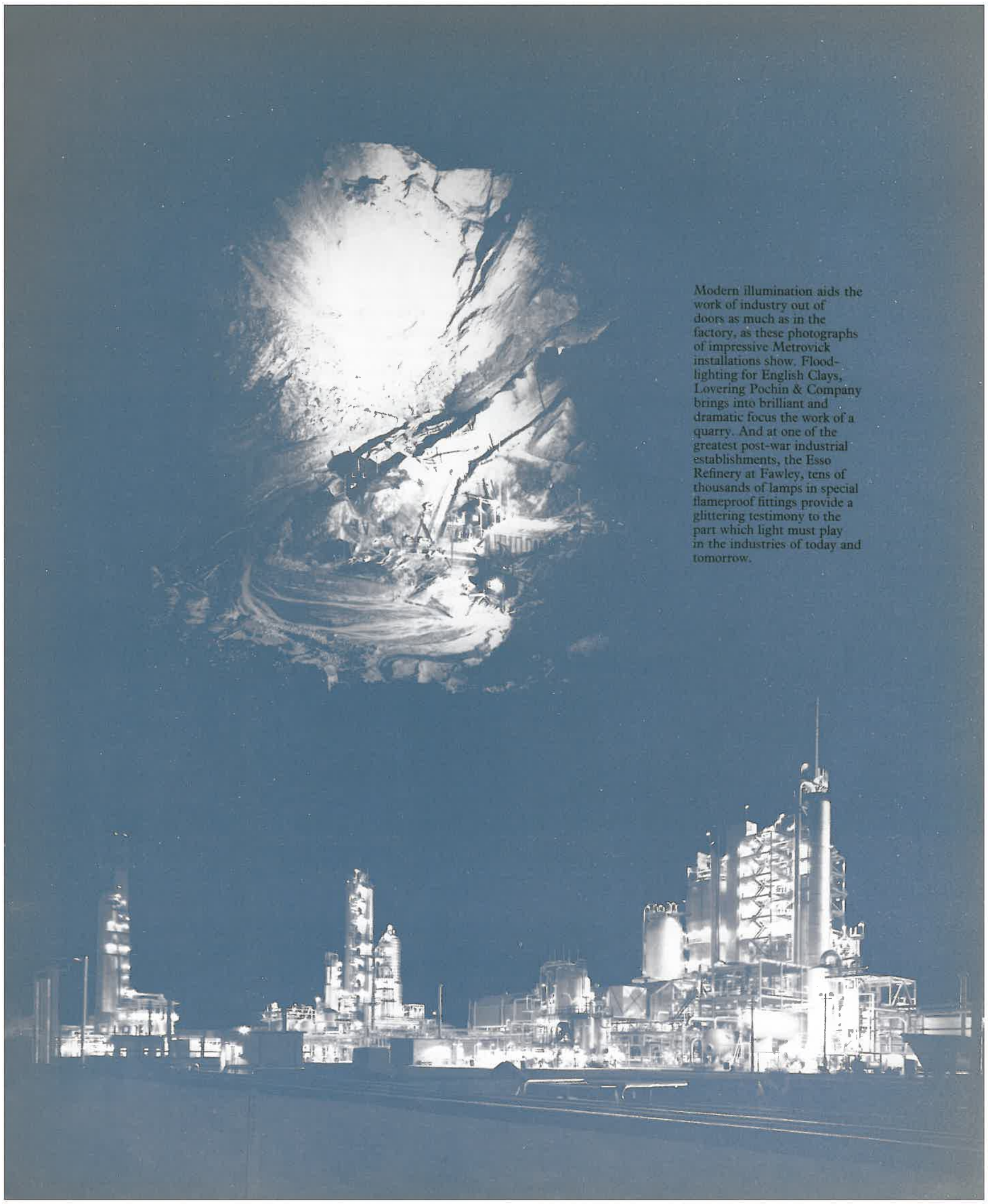
Corsham Caves

Below ground and above. Wherever there is production, power—and the raw materials of power—are necessary to sustain it. With ever diminishing coal seams, high-level illumination has become as important to the mine as to the factory. Mazda fluorescent fittings were the first lighting units of this type to be installed at the coal-face. The fittings which developed from that original scheme at Birch Coppice Colliery in 1945, were the first to be given a flameproof certificate for use in the dangerous atmosphere below ground. Now they are helping the miner in his work in many pits, at home and abroad.

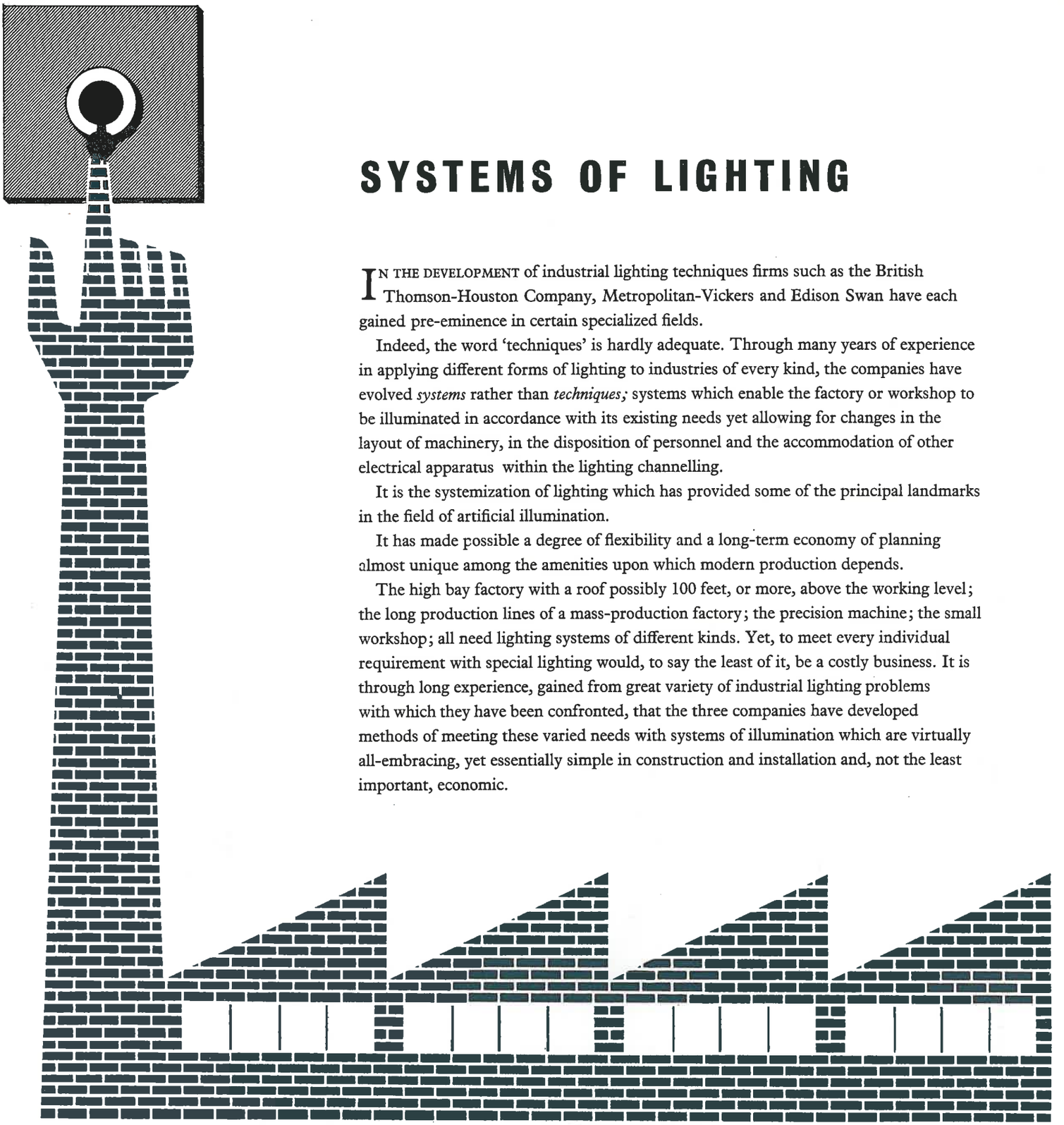
A remarkable application of fluorescent lighting underground enabled aircraft production to go on unimpeded in the famous Corsham Caves during the war. The lighting of these caves was probably the most romantic lighting story of the war. The illustration shows a section of the subterranean quarry factory where millions of square feet were devoted to wartime aircraft production. Nearly 19,000 Mazda five-foot fluorescent fittings were required but at the time no fitting was available that would give a measure of upward light and be suitable for transport in bulk. BTH devised a simple reflector requiring the minimum materials and labour for manufacture and capable of nesting for storage and transport. Upward lighting was provided to relieve the depression of confinement within the caverns. Catenary suspension was used, the control gear being hung as a separate unit near the reflector. In addition to the 19,000 fluorescent fittings used at Corsham, BTH supplied a great deal of lighting of the same type to many other temporary wartime factories.

In 1947 at North Wilford Power Station BTH produced one of the first schemes of control room lighting fully integrated with the architecture. Many other similar schemes have been prepared since then, including those at Uskmouth, Bankside, New Brunswick, Staythorpe and Grangemouth. The Grangemouth scheme which is illustrated here employed an octagonal lighting feature corresponding to the layout of the instrument panels.

Grangemouth Power Station



Modern illumination aids the work of industry out of doors as much as in the factory, as these photographs of impressive Metrovick installations show. Flood-lighting for English Clays, Lovering Pochin & Company brings into brilliant and dramatic focus the work of a quarry. And at one of the greatest post-war industrial establishments, the Esso Refinery at Fawley, tens of thousands of lamps in special flameproof fittings provide a glittering testimony to the part which light must play in the industries of today and tomorrow.



SYSTEMS OF LIGHTING

IN THE DEVELOPMENT of industrial lighting techniques firms such as the British Thomson-Houston Company, Metropolitan-Vickers and Edison Swan have each gained pre-eminence in certain specialized fields.

Indeed, the word 'techniques' is hardly adequate. Through many years of experience in applying different forms of lighting to industries of every kind, the companies have evolved *systems* rather than *techniques;* systems which enable the factory or workshop to be illuminated in accordance with its existing needs yet allowing for changes in the layout of machinery, in the disposition of personnel and the accommodation of other electrical apparatus within the lighting channelling.

It is the systemization of lighting which has provided some of the principal landmarks in the field of artificial illumination.

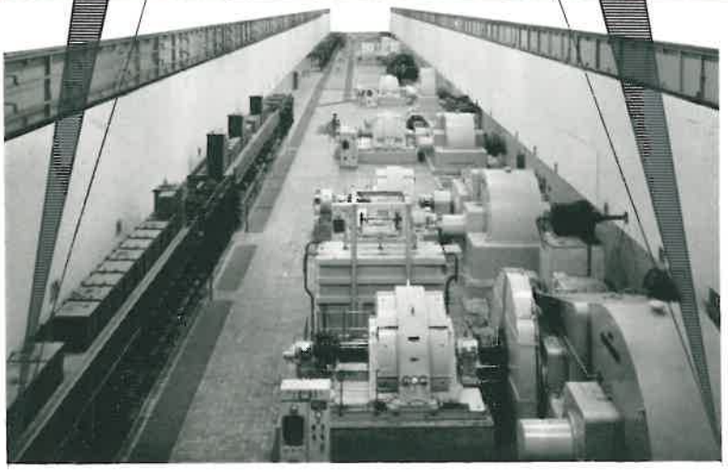
It has made possible a degree of flexibility and a long-term economy of planning almost unique among the amenities upon which modern production depends.

The high bay factory with a roof possibly 100 feet, or more, above the working level; the long production lines of a mass-production factory; the precision machine; the small workshop; all need lighting systems of different kinds. Yet, to meet every individual requirement with special lighting would, to say the least of it, be a costly business. It is through long experience, gained from great variety of industrial lighting problems with which they have been confronted, that the three companies have developed methods of meeting these varied needs with systems of illumination which are virtually all-embracing, yet essentially simple in construction and installation and, not the least important, economic.

Lighting for Heavy Industry

One of the most important post-war landmarks in the lighting of heavy industry was the introduction of the famous Mazda T 891 combined tungsten and mercury fitting illustrated on left which consisted of a multiple fitting carrying two 400-watt mercury discharge lamps and one 1-kW G.L.S. lamp. This fitting was used in most of the production areas of the Steel Company of Wales plants at Margam, Abbey and Trostre. The necessity to use two mercury discharge lamps was overcome with the help of the BTH Research Laboratory who had been working on the development of a 2½-kW high pressure horizontal mercury discharge lamp and were recently able to produce a similar 1-kW lamp giving nearly the same light output as three 400-watt MA lamps for use in the latest Mazda blended light units which were first installed at Velindre Steel Works. The new units consist of a horizontal reflector housing the 1-kW MA/H mercury discharge lamp and an associated tungsten G.L.S. reflector fitting carried on a steel tray with a wire mesh floor which may be cantilevered out from catwalks and provides easy access for cleaning or repair. Applications for the 1-kW MA/H have now been extended to many other famous Steel Works in this country and abroad.

1950. Mazda T 891 Blended Light Unit housing a 1-kW G.L.S. lamp and two 400-watt mercury discharge lamps.



1957. Mazda blended light unit incorporating a 1-kW high pressure mercury lamp of the type first used in the experimental installation at Trostre, Steel Company of Wales, illustrated above.

Stockwell Bus Garage

Brynmawr Rubber Factory

A. Guinness & Son, Dublin

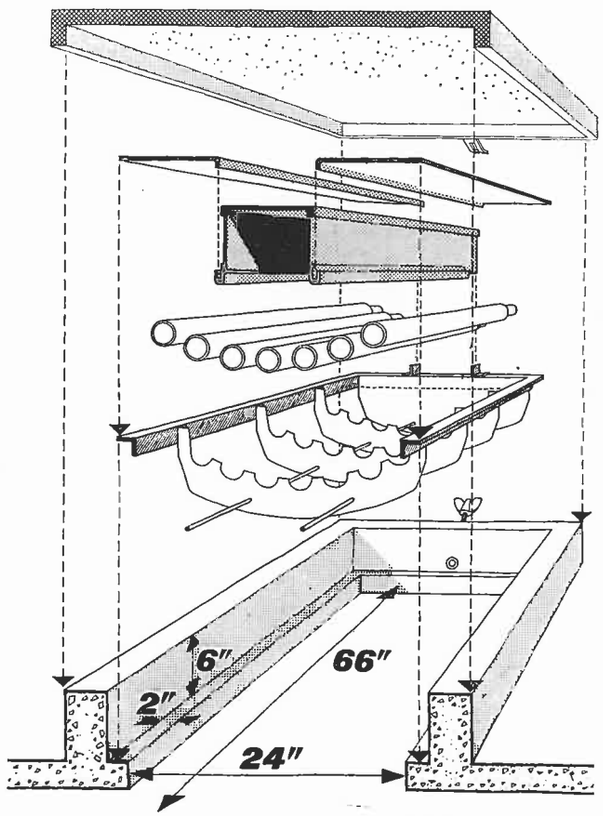
Burroughs Wellcome, Dartford

Lighting Shell Concrete Buildings

Shell concrete construction, allowing for uninterrupted floor areas with graceful (and purposeful) structural lines, demands the most careful integration of services such as lighting. The sweeping concave curves associated with this type of structure dispose of the need for the latticed paraphernalia so often employed as a convenient gantry for light fittings, heating units, loudspeakers and the ever-present network of wires. The effect of such conglomerations in association with a fine 'shell' roof would be indescribable: an undesirable paradox from both practical and aesthetic viewpoints, destroying the value of the underside of the shell as a reflector. This reflective quality can be seen in the illustration of the vast new bus garage at Stockwell, London, where, while a certain amount of 'lattice' is evident, the lighting ignores it and soars with the shell.

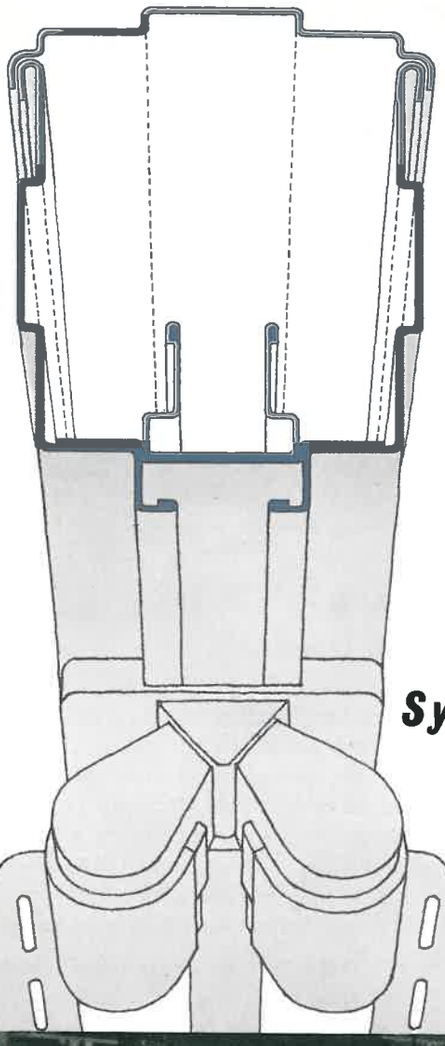
The BTH Company planned the lighting for one of the first large-scale buildings of this nature, the Brynmawr Rubber factory in South Wales. This pioneer lighting scheme made imaginative and intelligent use of the very nature of the structure. Circular apertures in the roof, alternating with similar daylight openings, house six 5 ft. fluorescent lamps in cruciform. Rows of 'Perspex' fluorescent reflector fittings are cantilevered about six feet in from the periphery of each bay to simulate the lighting from the clerestory windows.

Rectangular installations can be used in the same way, and just as effectively. A BTH installation in the printing works of A. Guinness & Sons established a principle which has since been applied in many other works including the Burroughs Wellcome establishment at Dartford—the biggest fluorescent lighting installation in any shell concrete building which demonstrates the incomparably efficient and pleasant working conditions made possible by carefully planned modern lighting in the modern factory.



Vauxhall Motors

Jeremiah Ambler



Systems Providing Flexibility of Layout

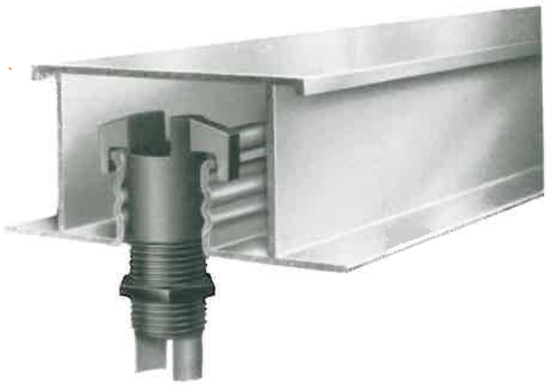
Mazda Universal Trunking

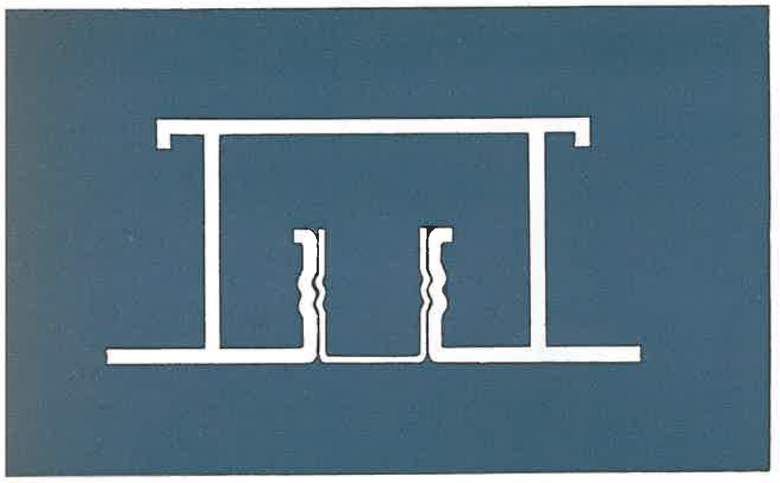
One of the most important and widely applicable systems of industrial lighting, was introduced by BTH in 1950. Suspended box girders form continuous runs on which fluorescent lamps and reflectors can be positioned at any convenient point—without the need for cutting or drilling. All lamp auxiliary gear is housed inside the trunking.

An incidental advantage of Mazda Universal Trunking is that it accommodates wiring for services such as clocks, loudspeakers, visual signals, etc.—effecting economies in conduiting and suspensions. The

cost of an installation using trunking is often considerably less than that of an installation of individual fittings. Work-benches and machinery can be re-deployed and the fluorescent fittings re-spaced to take care of the new layout. Trunking even facilitates the partitioning of a factory space, or the re-spacing of existing partitions, without the need for complicated alterations in the wiring layout. The lighting used for an assembly shop can be added to when the space becomes a machine shop or office, merely by adding more reflector assemblies.

In commercial lighting (and for our purpose the word 'commercial' embraces the office, the shop, the bank, and many public buildings) lighting systems also play an increasingly important part.



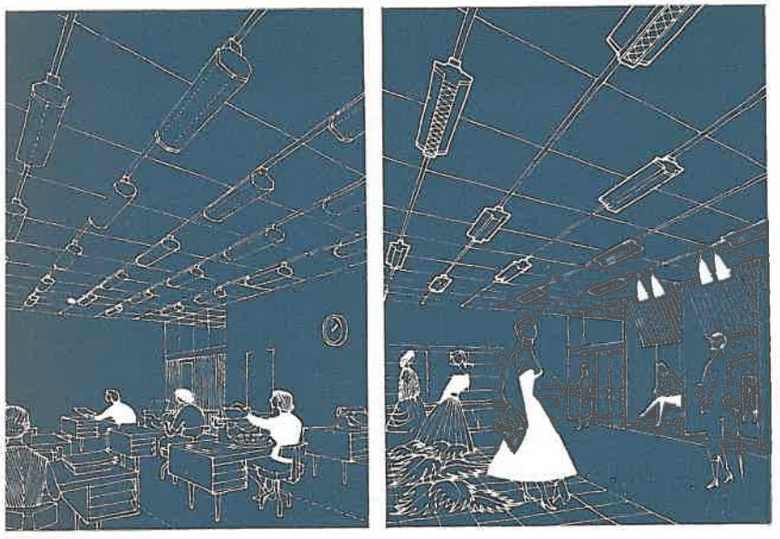


Mazda Invertrunking

The necessity for Mazda Invertrunking springs largely from the popularity of suspended acoustic ceilings using special ceiling tiles. Invertrunking, which is designed to meet the needs of commercial rather than industrial establishments, is another new, convenient and economical method of lighting which owes its origin to BTH lighting experience. An extruded aluminium section, with flanges to support ceiling panels, carries the wiring for lighting and other services. Access to the interior of this ducting is from below. Fittings of any type can be mounted along its length and their positions changed from below without interfering with the ceiling or other structural parts of the building. Invertrunking can be suspended or attached direct to the ceiling, with or without ceiling panels. When used fixed direct to the ceiling it may be faired off with plaster to form shallow coves with the lower surface almost flush with the ceiling. It is particularly suitable for use in speculative office blocks and similar buildings but has also been found to be an invaluable tool in display lighting of all kinds including shop, store and exhibition lighting where it can be used to provide a mechanical support for verticals.

Mazda Shallow Trunking

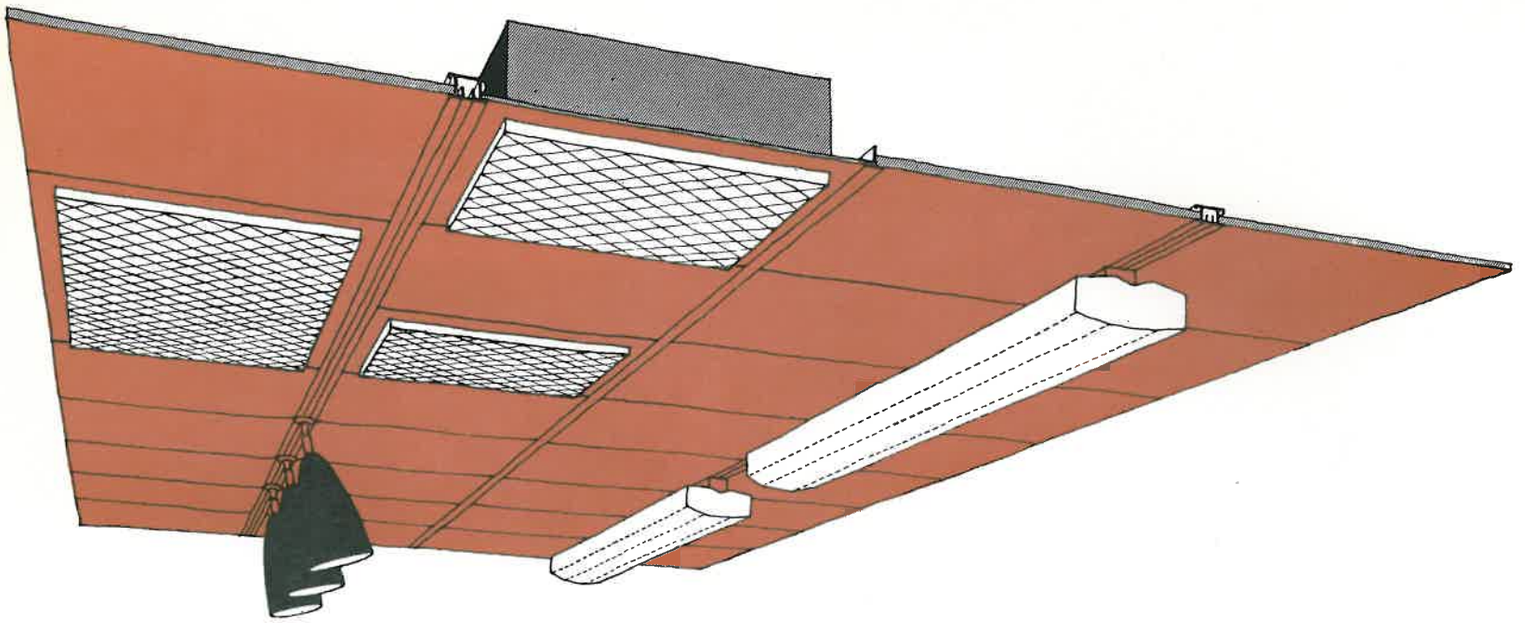
Developed by the Edison Swan Electric Co. Ltd. and similar in conception to Invertrunking, Shallow Trunking can be applied to virtually any type of industrial or commercial building. It was designed to meet the needs of industrial applications where accessibility to wiring was not available from above as in Mazda Universal Trunking. Commercially its main use is above luminous ceilings, in which case fluorescent lamps can be clipped straight on to the cover fillet, thus economizing on depth of void. Fluorescent, tungsten filament or other forms of lighting can be used with the standard carrier plate which is the basis of the system.



Mazda 'Family' System of Fluorescent Fittings

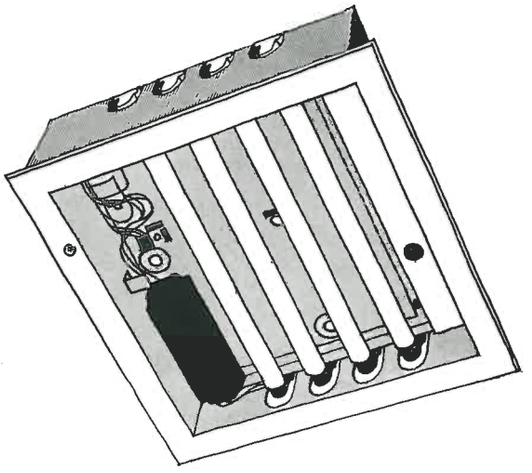
In 1954 the Mark IV range of Mazda fluorescent fittings was introduced based on two standard channel power packs, a one-lamp and a two-lamp, to which can now be attached the A.E.I. Lamp and Lighting Company's complete range of reflectors and diffusers including industrial overlamp reflector fittings. A simplification was introduced in 1956 when a common size of reflector and diffuser was adopted for use with one and two-lamp power packs. Interchangeability of diffusers and reflectors has greatly simplified maintenance work and storekeeping in factories as lighting fittings throughout offices and workshops may all be based on the Mazda one and two-lamp power packs.

The transition from a diffused lighting scheme designed for an office to a more decorative showroom scheme using louvered diffusers can be made with little more effort than is involved in placing the diffusers in position.



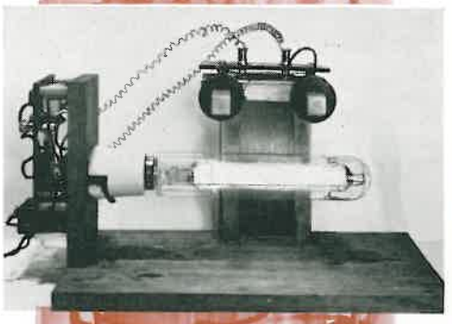
The 'Modular' System of Integrated Lighting

The word 'Module', familiar to the architect, has recently become prominent in lighting. The application of panels of lighting as 'modules' of the ceiling structure has enabled the designer and lighting engineer to make illumination an integral part of decorative treatment. 'Module' fittings, which are recessed containers for lamps and any necessary associated equipment, are fully interchangeable with standard ceiling panels. They are normally used to provide fluorescent lighting and should the need arise can be completely re-arranged to suit the changing use of the space which they light. They can be used to form an attractive component in the design of an interior, particularly in combination with 'emphasis' lighting from spot-lamps and other sources. Architects and designers have been quick to appreciate their possibilities.



Background: An early high-pressure mercury vapour lamp. A special glass had to be developed to withstand the mercury pressures and the red-heat of heavy arc currents. Below: Its first application to floodlighting; the Royal Bath Hotel, 1933.

LANDMARKS IN



An experimental magnetic arc control system, enabling mercury lamps to be burned horizontally.

RESEARCH IN the BTH Laboratories, particularly with regard to lamps and their applications, is closely related to the needs of everyday life. It is here that many contributions have been made to the development of modern lighting, and to the practical application of almost every other type of electrical device for industry and the home, over the past 25 years.

Look at some of the landmarks which make up the background to the A.E.I. Lamp and Lighting Company.

Discharge Lamps

In the late 1920's research workers in the BTH Company were investigating the possibility of using hot cathode electric discharges as light sources. They realized the advantages which could be made by the development of practical light sources freed from the limitations to efficiency and life of filament evaporation. Experimental evidence suggested that improvements in luminous efficiency of some three times were possible.

Mercury vapour lamps were found to offer great possibilities as efficient and practical light sources. One of the earliest applications was for the floodlighting of the Royal Bath Hotel.

RESEARCH

In the thirties, cheaper electric light for streetlighting stimulated intensive research into the most efficient light distribution systems to take advantage of these lamps. Experiments were carried out on roadways at night, to find just how the mounting height of the lamp and its light distribution affected the ease with which pedestrians wearing different types of clothing could be seen. It was proved that for optimum light control the axis of the arc should be horizontal.

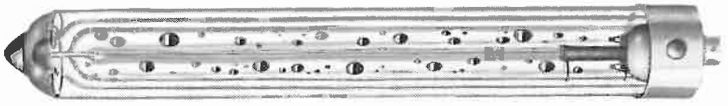
A magnetic arc control system was devised to maintain the arc in the centre of the tube. This enabled the first installations to be made of horizontal burning mercury lamps giving improved light distribution and much reduced glare.

Investigation into sodium vapour lamps were giving rise to equally important applications. In these lamps the vapour pressure must be controlled so that the maximum amount of electrical energy is converted into the now well known, almost monochromatic, yellow resonance radiation. Early experimental lamps had integral vacuum jackets while later models had separate flasks for economy. The biggest problem with sodium lamps was the reduction of the effect of chemical attack, the discoloration of the glass. The glass technologists introduced an alumino-borophosphate sheathing glass which virtually eliminated this discoloration, and led the way to the very efficient sodium lamps of today.

Progress in lamp development became rapid. New equipment enabled scientists to check the life behaviour, light efficiency and colour of the light sources. Currents as small as one millionth part of one millionth of an ampere were measured accurately.

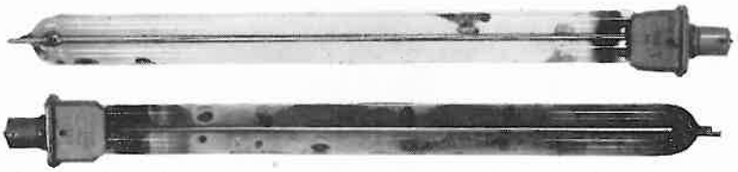
Radiation measurements showed research men the amount of energy

An early streetlighting installation using horizontally burning mercury lamps in experimental Mazda fittings.



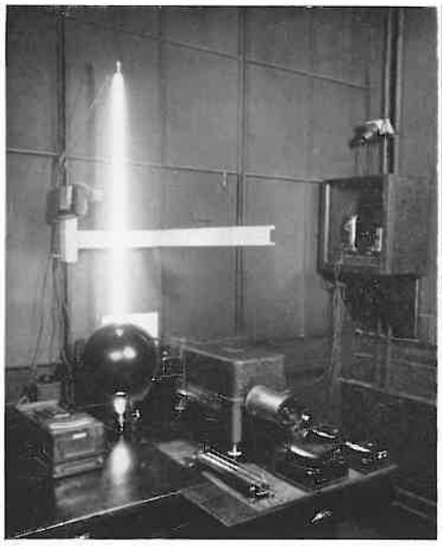
A modern sodium lamp with a metal cap protecting the seal-off pip and an inner wall support in the vacuum space carrying a barium-aluminium getter.

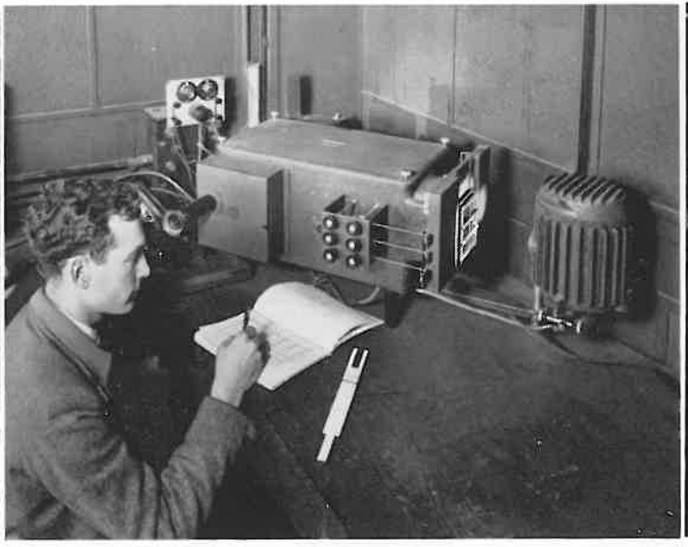
An early sodium lamp with integral vacuum jacket.

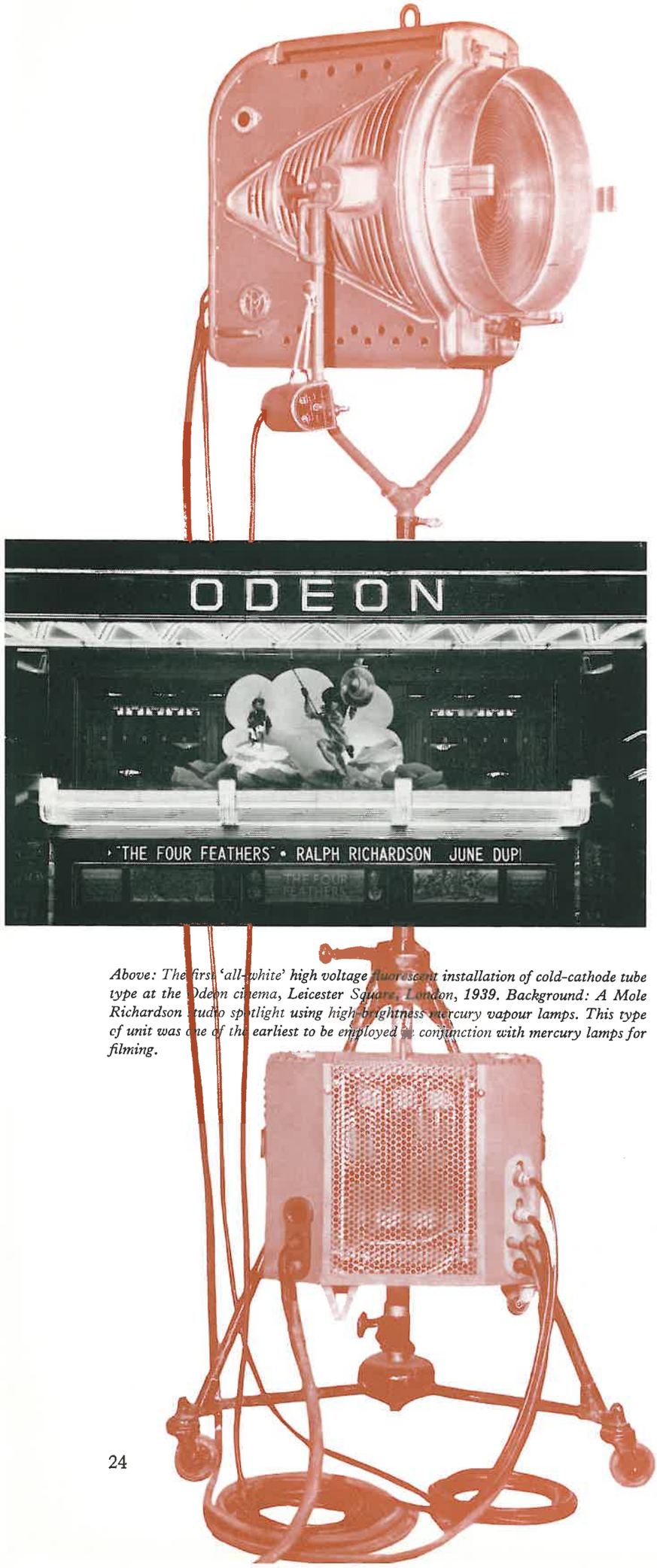


Compare the modern sodium lamp with chemically resistant sheathing glass with an older lamp. Both have been used for the same length of time.

Below (left): Equipment capable of measuring one millionth part of a millionth of an ampere gives complete radiation data on discharge lamps. (centre); Checking colour characteristics of electro-discharge lamps. (right): Colour measurement of fluorescent lamps in the BTH laboratories.







Above: The first 'all-white' high voltage fluorescent installation of cold-cathode tube type at the Odeon cinema, Leicester Square, London, 1939. Background: A Mole Richardson studio spotlight using high-brightness mercury vapour lamps. This type of unit was one of the earliest to be employed in conjunction with mercury lamps for filming.

in the ultra-violet region from the mercury vapour discharge. The long wavelength U.V. was used by enclosing the high pressure mercury vapour lamp in a 'Woods' glass outer bulb. This became a powerful and convenient source of U.V. for safely exciting fluorescence. *There followed, in the late thirties, one of the most important advances in the history of electric lighting—the fluorescent lamp.*

Fluorescent Lamps

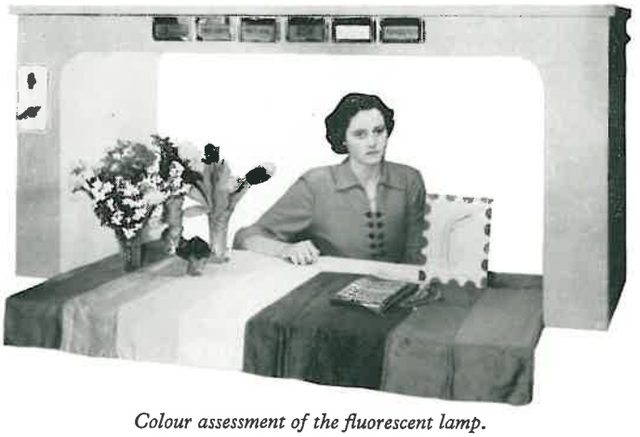
By devising a low pressure mercury vapour discharge so that approximately 50 per cent of the input power was radiated as short U.V. resonance radiation, it was possible to produce fluorescent lamps with colour characteristics quite distinct from those normally associated with electric discharges. Phosphors could be mixed to give light in a wide variety of colours and with differing colour rendering properties. Studies of colour measurement and colour assessment helped to establish a great degree of standardization among lamps with a necessarily wide range of colour rendering properties.

Field experiments and laboratory assessment trials showed the new lamp to have great potentiality for many applications. The first 'all-white' high voltage cold cathode fluorescent tube installation was made in the Odeon Leicester Square early in 1939. The Masonic Hall, Birmingham, became in September 1939 the first building to be completely equipped with such lighting. In 1940 the familiar 5 ft. 80-watt high loading lamp was first introduced for the lighting of wartime factories. Since then this lamp has become the most economical and widely used lamp for lighting industrial and commercial premises. Continued research has helped to reduce the price to one-third of that in 1940 and at the same time to raise its efficiency from 24 to 56 lumens per watt. Factories, offices, cinemas, shops and streets have shared the advantages of a light source which provides economical illumination of a quality never before obtainable by artificial means.

Germicidal Lamps

Another outcome of studying the transmission of light in the U.V. region was the development of soft glasses capable of transmitting the 2536 Å resonance radiation normally used to excite the light from fluorescent lamps.

Methods of measuring intensities of radiation of $\frac{1}{10}$ of 1 millionth of a watt per square cm. enabled short-wavelength light to be used safely for air sterilization. Water and some other liquids could be sterilized as



Colour assessment of the fluorescent lamp.

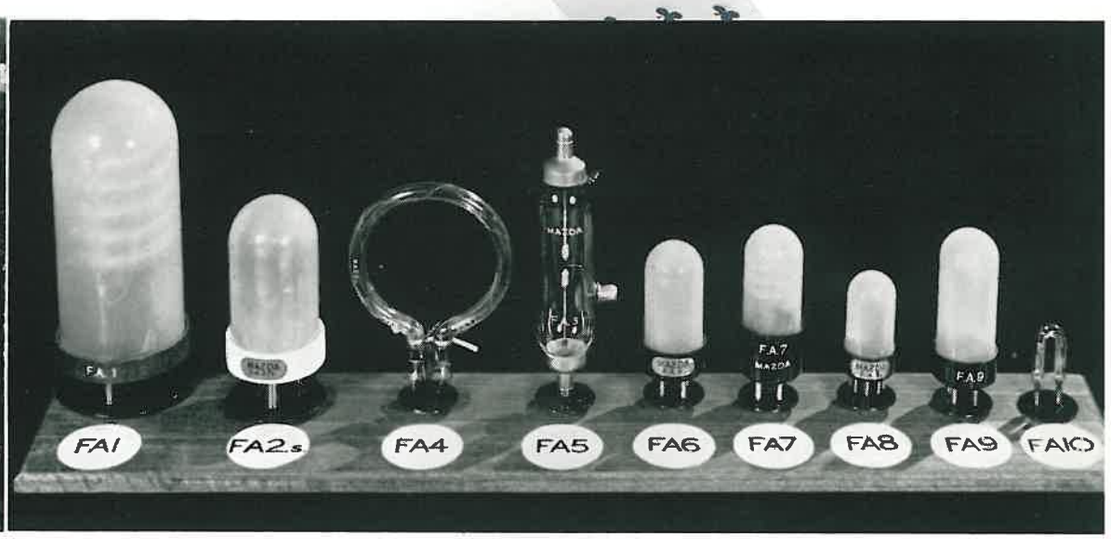
could certain solids. Thermoduric bacteria in sugar could also be eliminated in this way.

Lamps for specialized uses progressed along with the general purpose light sources.

High Brightness Lamps

As the pressure in gas or vapour filled devices is increased the light source is condensed and these enclosed arcs compete with projector lamps and even open arcs for optical projection. BTH research showed that by the addition of cadmium, high power mercury vapour lamps would provide a good colour light source with twelve per cent of red light with high efficiency. The colour properties of these power lamps proved good enough for making colour films.

High pressure rare gas sources, although less efficient, have colour qualities which are attractive for colour photography and specialized projection. They have many uses in medical, industrial and scientific research.

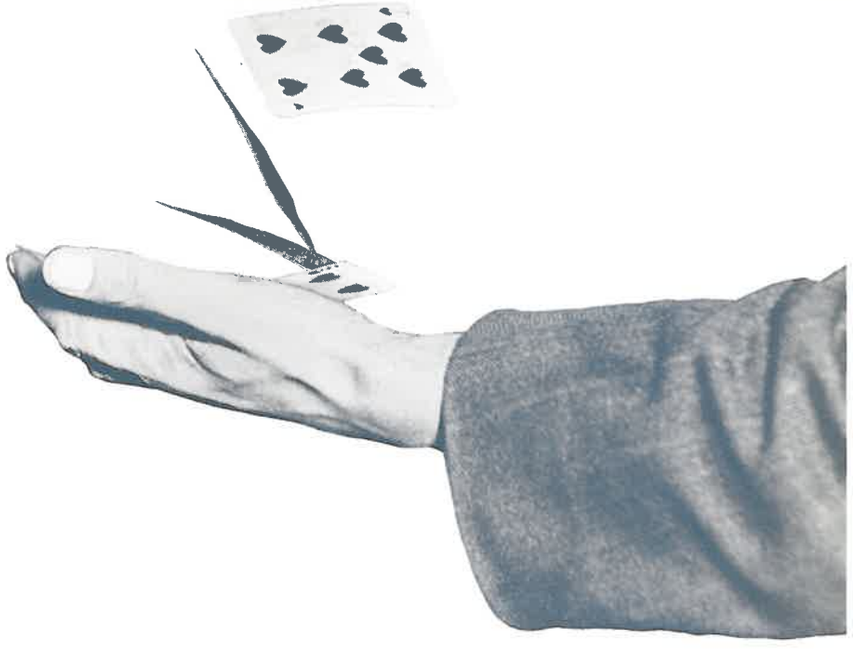


Above (left): Testing a lamp subsequently used for photographing the retina of the human eye. It is a low power lamp which can be focused on the retina and pulsed to a very short brilliant flash for the photograph. (right): Mazda electronic flash tubes. Background: Rare-gas flash tubes enable the photographer to capture movements which are invisible to the human eye.

Flashing Lights

Electric discharges, if fed with pulsating electric power, give at intervals light flashes which closely approach the time of the energy pulse. Extremely high flash powers lasting for several seconds enable very intense light to be maintained for high speed photography or for signalling purposes. Xenon lamps have proved particularly valuable because of the constancy of their good colour quality with variation of current. Special lamps can operate at a low power for focusing on to the retina of the eye, and a $\frac{1}{20}$th of a second pulse of 10 kW's has enabled colour photographs to be taken of it so that the cure of certain eye diseases can be followed accurately.

Still shorter pulses can be synchronized with recurring movements. Special mercury vapour lamps were made for studying the cavitation of ships' propellors and for fuel injection investigations. They enabled the Medical Research Council to photograph the progress of a 'sneeze'. Many of the applications in this field of lighting are now served by a range of rare-gas flash tubes. Photographs taken by the light of single



An experimental installation of Mazda 2½-kW mercury discharge lamps used in combination with tungsten lighting during 'field' trials in an engineering workshop. This research led to the development of the Mazda 1-kW MA/H lamp *(see page 17).*

pulses from these lamps capture high speed movements which are too fast to be appreciated by the human eye.

With these new light sources, new problems were solved—old ones simplified.

Research and Field Trials

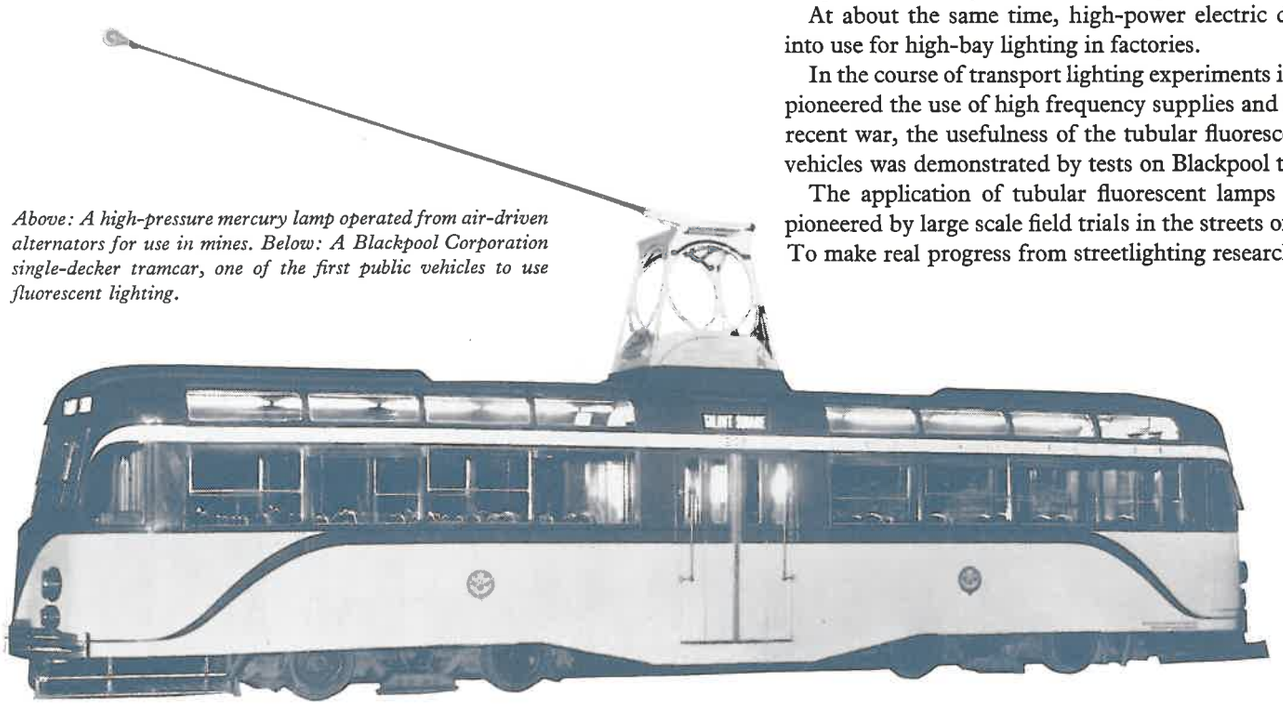
In hazardous mining operations where electric cables could not be installed, more light was needed. High pressure mercury vapour lamps were operated from air-driven alternators. Later, tubular fluorescent lamps were developed for use below ground.

At about the same time, high-power electric discharge lamps came into use for high-bay lighting in factories.

In the course of transport lighting experiments in 1938, BTH engineers pioneered the use of high frequency supplies and immediately after the recent war, the usefulness of the tubular fluorescent lamp in transport vehicles was demonstrated by tests on Blackpool tramcars.

The application of tubular fluorescent lamps to streetlighting was pioneered by large scale field trials in the streets of Rugby and London. To make real progress from streetlighting research it is essential to test

Above: A high-pressure mercury lamp operated from air-driven alternators for use in mines. Below: A Blackpool Corporation single-decker tramcar, one of the first public vehicles to use fluorescent lighting.



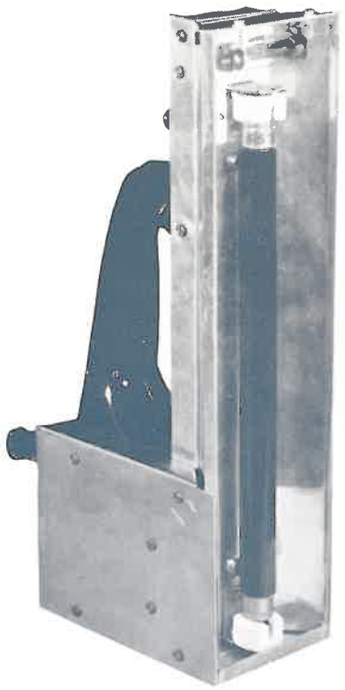
experimental lanterns in actual streetlighting installations and for many years Rugby Corporation have co-operated with the Research Laboratory in its programme for the field testing of streetlighting equipment.

Streetlighting in Scandinavia, Africa, Australia, South America and many other parts of the world uses lamps and lanterns which were originally tested in experimental form in the streets of Rugby.

Working late in the evening, when traffic is light, research teams use specially designed apparatus to assess accurately the qualities of new streetlighting equipment. One of the most important factors to be measured is road brightness, and this is often determined by representational photography—a method whereby photographs are taken under carefully controlled conditions and provide a record of the brightness at any point on the road.

A 4w. fluorescent lamp has been developed to produce ultra-violet 'black' light, to excite fluorescence in instrument dials in aircraft cockpits, and for tracing leaks in condenser tubes.

Germicidal lamp experiments, carried out in schools for the Medical Research Council, the use of U.V. radiation for photo chemical work, and the study of the effectiveness of radiation of all types for the control of plant growth, are some further examples of collaboration between BTH and other research bodies which have brought—and are continuing to bring—better living conditions to the community.



Ultra-violet 'black' light from this hand torch is used to excite fluorescence which traces leaks in condenser tubes.

In a well lighted street, road brightness can enable a driver to see objects in silhouette. Staff at the Research Laboratory at Rugby can accurately measure road brightness from a photographic negative of a streetlighting installation, using a special technique known as representational photography. Above right: A representational photograph of an installation of twin-lamp fluorescent facade lanterns at Regent Street East, Royal Leamington Spa.

Right: Germicidal lamps, developed by BTH research in collaboration with the Medical Research Council, were used experimentally to reduce airborne infection in schools.

1

STREETLIGHTING

Good streetlighting has become familiar and the three companies have together probably made the greatest contribution to this end in the world. The first real landmark was in 1927 when the BTH Company produced their first horizontal mercury discharge lantern.

War held up any progress in streetlighting until 1948 when BTH against the opinion of experts in this country and in the United States proceeded with the development of fluorescent streetlighting and showed that not only could the five-foot lamp be used for streetlighting but that it would provide good lighting with lower road lumens and electrical loading than other types of light source.

Fluorescent lighting has done more than any other method of illumination to simulate daylight out of doors and so to create safer conditions for driver and pedestrian at night.

The pioneering efforts of the three companies in other forms of streetlighting should not be overlooked, however. Mercury vapour and sodium vapour lighting, though both have inherent disadvantages in colour rendering compared with the fluorescent form, have brought powerful, economic illumination to thousands of roadways at home and abroad. And the filament lamp, though used less extensively than before, remains an important means of side-street lighting.

Many lament the disappearance of the old gas lantern with its often quaint charm and singular conformity to so many of its surroundings. But the 20th century, with its fast moving traffic, its crowds of darting, unpredictable pedestrians and (just as common) its unpredictable drivers, has no place for lanterns which glow with intense and glaring light, dissipating their illumination as much into the sky as onto the road. Only the

Bond Street, London

Kensington Road, Westminster

modern fitting with its efficient reflector, its minutely adjusted optical system and its reliable lamp, can adequately meet the needs of today's roadway.

It is fitting that one of the most recent and spectacular outdoor lighting schemes should have been carried out in Kensington Road and Knightsbridge by the Westminster City Council. For it was that council which sponsored the first Mazda fluorescent scheme in Bond Street. In the new installation, 80 Mazda 5 ft. lanterns each house four 80-watt lamps. They are mounted at 25 ft., either singly or in pairs, and give a lighting intensity of 11,000 lumens per 100 ft. of roadway. The British Standard Code of Practice lays down a normal maximum figure of 7000 lumens per 100 ft. for main roads.

1. *Introduced by BTH in 1954, this 'Sapphire' mercury streetlighting lantern is shown installed on a Mazda 'Trifoil' spun concrete column approved by the Council of Industrial Design. Compare it with the first BTH horizontal mercury lantern, the Mercra H 320 (4, bottom of page), introduced before the war for use with 250-watt and 400-watt lamps.*

2. *A Metropolitan-Vickers lantern introduced in 1955 for use with tungsten or mercury lamps, the 'Star-cone' was the*

Rio de Janeiro

2

Westminster Council Estate, Pimlico

Loop Road, Middlesbrough

3

4

first streetlighting lantern to incorporate 'Diakon', a new clear thermo-plastic material which is almost unbreakable.

3. *The first virtually all-'Perspex' lantern (Type SO 50) was introduced by the Metropolitan-Vickers Electrical Co. Ltd. in 1949. It is still supplied today with only minor modifications.*

4. *Mazda Mercra H 320, the first BTH horizontal mercury streetlighting lantern.*

An early BTH mercury discharge floodlighting installation using Type F 'Mercra' projectors at the Adelphi Hotel, Liverpool.

Lincoln Cathedral floodlighted by Edison Swan for the Festival of Britain.

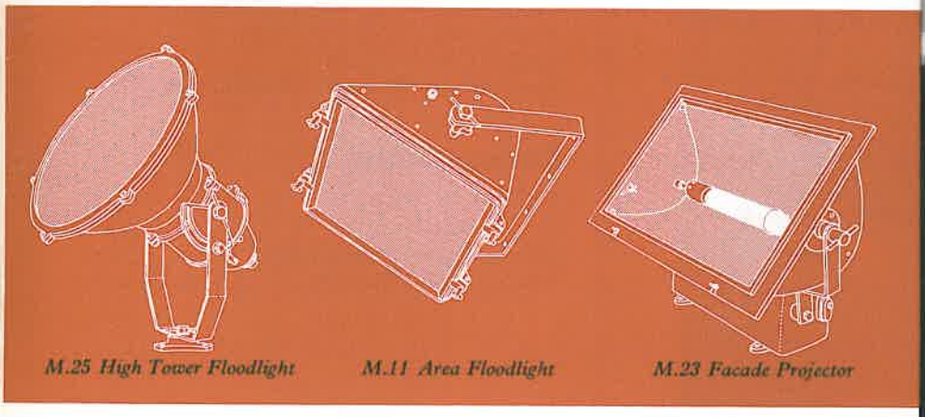
Metropolitan-Vickers floodlighting at the White City Stadium.

FLOODLIGHTING

EXACTLY 75 YEARS AGO, the great Paris exhibition afforded the first opportunity for a public display of electric lighting. The Palais de l'Industrie in the Champs Elysees glowed in the light of thousands of filament lamps. Visitors could hardly believe their eyes as they looked upon the world's first full-scale floodlighting. Sir Joseph Swan's invention created a spectacle which even the usually restrained correspondent of the *Times* described as 'Greater than anything that has ever been seen in the world'.

Within a year our own exhibition centre of the period, the Crystal Palace, presented an even more glittering spectacle. The world had seen for itself that the electric lamp was far, far more than a passing phase.

Yet even those demonstrations were to pale as the years went by. Powerful floodlight projectors took the place of bare light bulbs. The Silver Jubilee of King George V, the Coronation of the present Queen, great sporting events, public buildings of every kind — every place and occasion of note can be picked out of darkness at an instant's notice, or given dramatic emphasis by the skilful arranging of lights. Sports stadiums, circus arenas, outdoor theatres; all can entertain by night as well as by day with the aid of the electric lamp.



M.25 High Tower Floodlight *M.11 Area Floodlight* *M.23 Facade Projector*

Fulham Power Station—floodlighted by Metropolitan-Vickers

A.E.I. Lamp and Lighting Company Limited

Mazda *Lamps stay brighter longer*

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