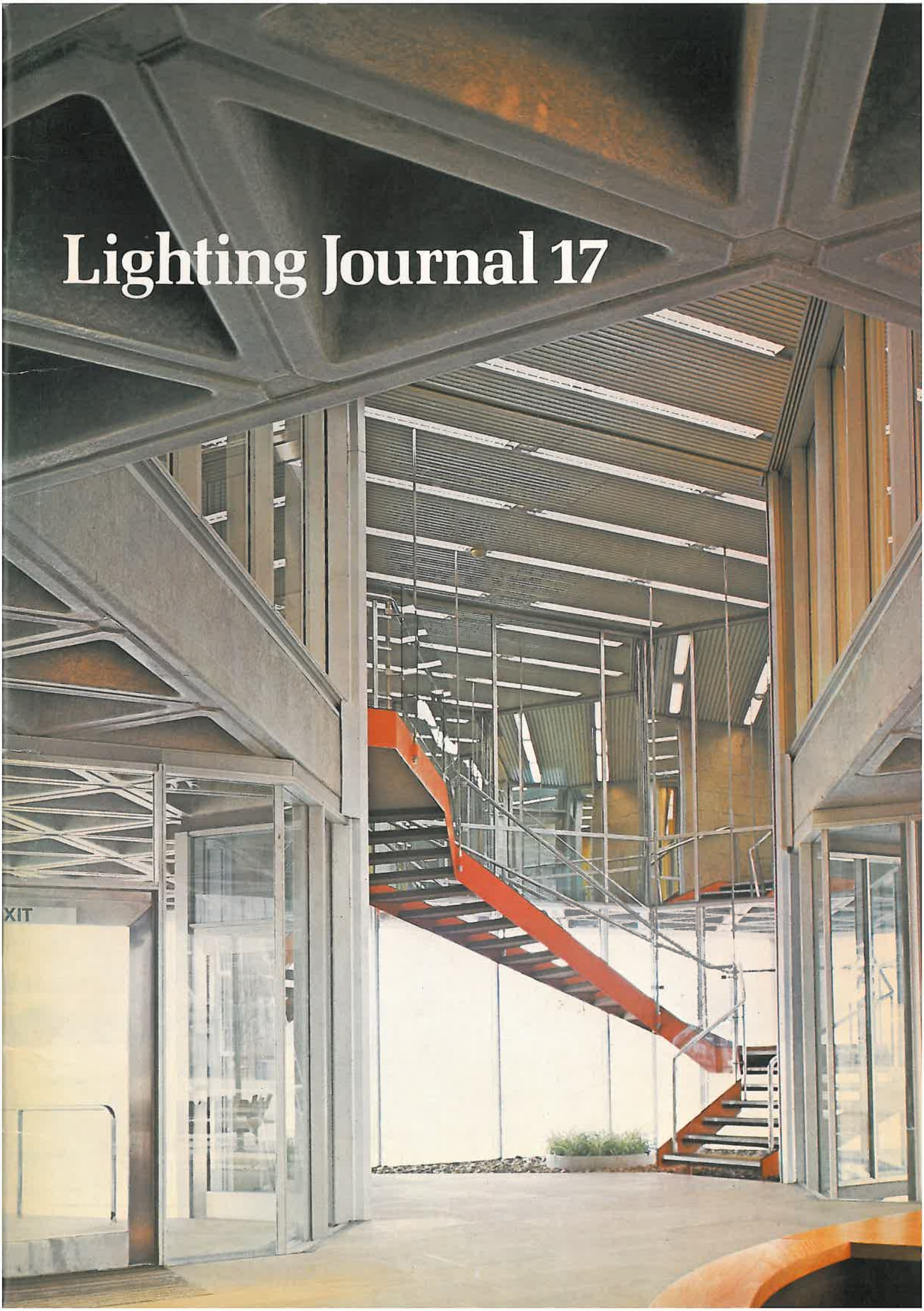
# Lighting Journal 17



# Lighting Journal 17

Spring 1977



We make no excuse for devoting an usually large amount of space in this issue to the lighting of Lichfield and Coventry cathedrals. Lighting a medieval building of the calibre of Lichfield cathedral does not often come the way of any company, to do this at the same time as improving the lighting of another cathedral is, perhaps a unique event. Lichfield contains a great deal of very fine medieval work as well as being rich in Victoriana; the new lighting is both effective and considerably less obtrusive than that in some other recently lighted cathedrals.
The whole scheme has been realised using standard equipment, without recourse to 'specials'.
At Coventry, a remarkable saving in current consumption has been achieved with a marked increase in illumination, by modifying existing, very inefficient, luminaires to take an up-to-date light source: a totally different approach but no less successful.

Other no less important topics are dealt with in an article describing the design service provided by Thorn Lighting not only in the U.K. but all over the world, and articles on lamp technology showing how fundamental research leads to advances in efficacy, colour and life. In this respect it is interesting to note the valuable contribution made by Thorn to coal mining, both above and below ground, below in the provision of more efficient and easily installed cap-lamps, and on the surface in floodlighting coal and waste tips. Descriptions of some interesting installations at home and abroad have some emphasis on floodlighting, appropriate to this Jubilee year of the Queen's accession.

**Contents**



*Far left: Kolorarc metal halide lamps in Hipak luminaires provide an illuminance of over 400 lux in Templeton Grays' Carpet Factory in Glasgow, reducing the annual lighting bill by £11,000 and maintenance costs by £5,500. Our cover picture shows the foyer of the Scottish Widows Fund and Life Assurance Society of Edinburgh, a description of which appears on page 20.*

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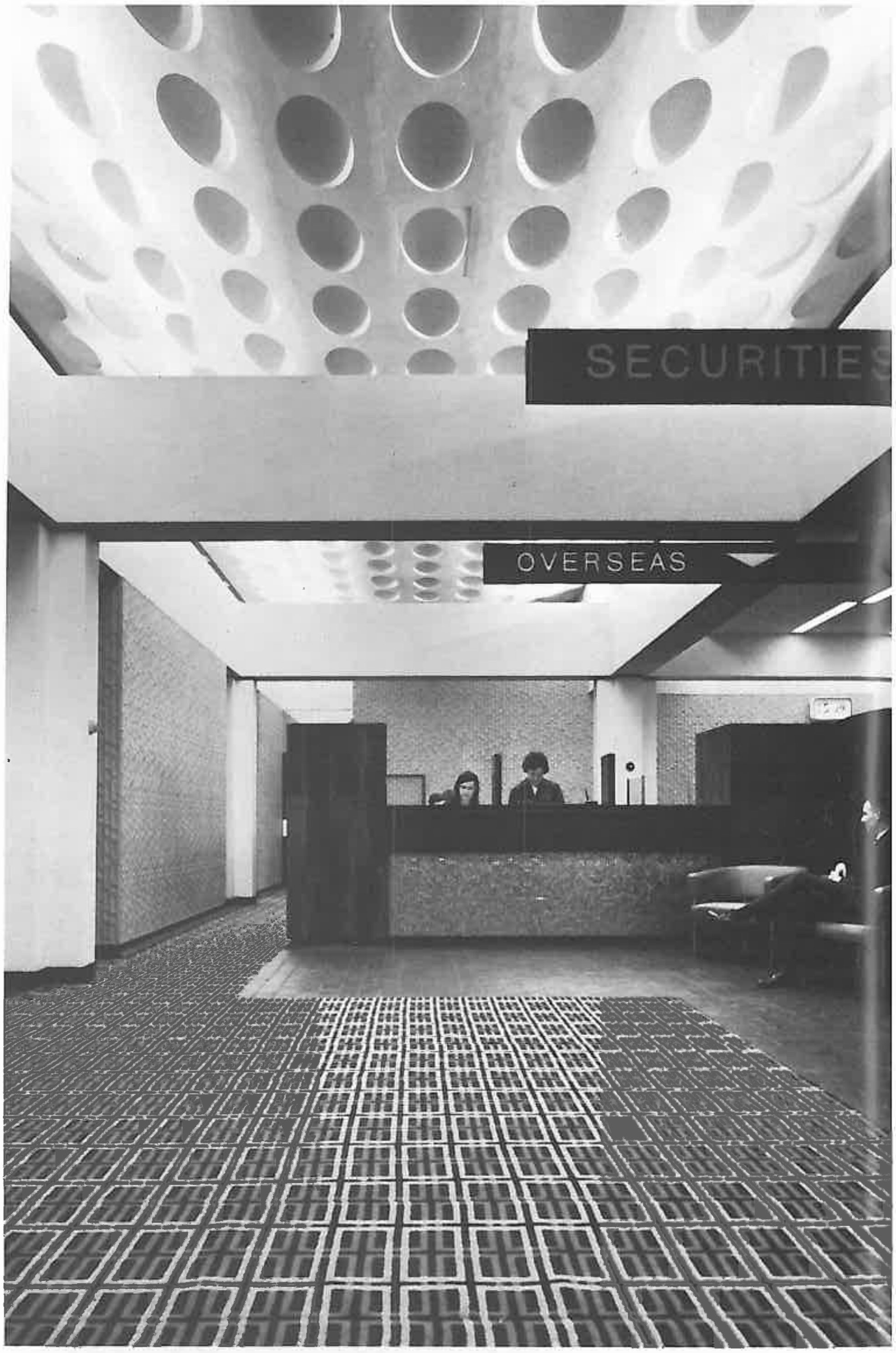
*An installation where the lighting designer worked closely with the architect to produce a planned visual effect.*




# At home and away

Lighting Technical Services in the United Kingdom and Overseas

W K Lumsden and W D Tyrrell

*Mr Lumsden and Mr Tyrrell are Chief Lighting Engineers for Thorn Lighting in the United Kingdom and the International Lighting Division respectively.*

For many years Thorn Lighting has provided a comprehensive lighting advisory service for customers both in the UK and overseas, using Thorn Lighting products. This service is generally provided by trained, experienced lighting engineers operating from a lighting engineering department (LED). Advice can be given in many different ways, from simple guidance on a choice of luminaires to the preparation of a fully detailed specification for a project using an integrated lighting and air-conditioning system.

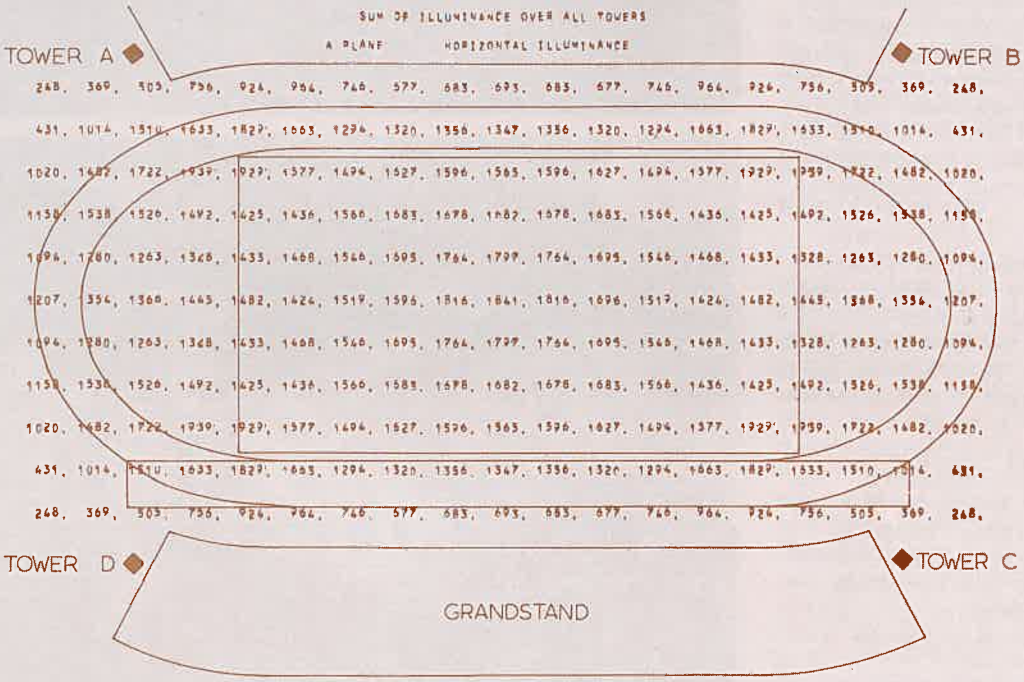
The Thorn Lighting designer has an important part to play in the development of a lighting specification. He is completely familiar with his company's products, he can indicate the best use for them and indeed, their suitability or otherwise for the project in hand. He has the benefit of ready access to the Company's laboratories and design department and not only understands his customers' problems but is in a better position than most to keep in touch with developments both in lamp and luminaire design and application research on a world-wide basis.

In the UK, any customer needing advice can either discuss his problem initially with his Thorn representative, or contact his local Thorn office. Either of these approaches would result in a visit from a technically trained salesman whose main function is to ensure that the needs of the customer are satisfied by the right levels of technical skills. He acts as a contact man in putting the customer in touch with the appropriate expert in the Company. Usually any necessary technical services will be provided by the Lighting Engineering Department which operates from each Thorn Lighting branch.

Overseas customers requiring advice can contact either the local Thorn agent or a Thorn subsidiary company who will forward the more complex lighting enquiries which are not easily serviced locally to the International Division Lighting Advisory Department (LAD), based at Romford in the UK. Enquiries for advice on overseas projects are usually received by the LAD either directly from specifiers in the UK or through International Division sales engineers.

Because of the short distance in the UK between any Thorn office and its customers, it is possible for the lighting engineer to work very closely with specifiers in designing lighting for any project. Overseas, however, direct contact with the customer by the lighting designer is normally impossible, so that all information must be relayed to the designer in the UK by the Thorn representative in the country concerned. Local variations to be taken into account include conditions for standards of safety as well as illumination requirements; suitability of luminaire design for use in areas of high temperature and humidity; differences in voltage and frequency; together with difficulty of interpretation because of language

*Left can be seen the stadium at Brunai as it now appears. A typical computer print-out for this stadium is shown at the head of the panel and the 'Run request sheet' issued for the same job at the bottom.*



PAGE 55 | THORN LIGHTING LTD | TODAY'S DATE 26/01/77
PROGRAM MN89 MARK 30 | FLOODLIGHTING SYSTEM | AT 21/05/25

LAP 5073 BRUNEI STADIUM 4 TOWER CSI INSTALLATION

SUM OF ILLUMINANCE OVER ALL TOWERS

A PLANE HORIZONTAL ILLUMINANCE



| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 248. | 369. | 505. | 756. | 924. | 964. | 746. | 577. | 683. | 693. | 683. | 677. | 746. | 964. | 924. | 756. | 505. | 369. | 248. |
| 431. | 1014. | 1510. | 1633. | 1829. | 1663. | 1294. | 1320. | 1356. | 1347. | 1356. | 1320. | 1294. | 1663. | 1829. | 1633. | 1510. | 1014. | 431. |
| 1020. | 1482. | 1722. | 1939. | 1929. | 1577. | 1494. | 1527. | 1596. | 1565. | 1596. | 1627. | 1494. | 1577. | 1929. | 1939. | 1722. | 1482. | 1020. |
| 1158. | 1538. | 1526. | 1492. | 1425. | 1436. | 1566. | 1683. | 1678. | 1682. | 1678. | 1683. | 1566. | 1436. | 1425. | 1492. | 1526. | 1538. | 1158. |
| 1094. | 1280. | 1263. | 1348. | 1433. | 1468. | 1546. | 1695. | 1764. | 1797. | 1764. | 1695. | 1546. | 1468. | 1433. | 1328. | 1263. | 1280. | 1094. |
| 1207. | 1354. | 1368. | 1445. | 1482. | 1424. | 1519. | 1596. | 1816. | 1841. | 1816. | 1696. | 1517. | 1424. | 1482. | 1445. | 1368. | 1354. | 1207. |
| 1094. | 1280. | 1263. | 1348. | 1433. | 1468. | 1546. | 1695. | 1764. | 1797. | 1764. | 1695. | 1546. | 1468. | 1433. | 1328. | 1263. | 1280. | 1094. |
| 1158. | 1538. | 1526. | 1492. | 1425. | 1436. | 1566. | 1583. | 1678. | 1682. | 1678. | 1683. | 1566. | 1436. | 1425. | 1492. | 1526. | 1538. | 1158. |
| 1020. | 1482. | 1722. | 1939. | 1929. | 1577. | 1494. | 1527. | 1596. | 1565. | 1596. | 1627. | 1494. | 1377. | 1929. | 1939. | 1722. | 1482. | 1020. |
| 431. | 1014. | 1510. | 1633. | 1829. | 1663. | 1294. | 1320. | 1356. | 1347. | 1356. | 1320. | 1294. | 1663. | 1829. | 1533. | 1510. | 1014. | 431. |
| 248. | 369. | 505. | 756. | 924. | 964. | 746. | 577. | 683. | 693. | 683. | 677. | 746. | 964. | 924. | 756. | 505. | 369. | 248. |

FOOTBALL PITCH ONLY
Ave Eh = 1603 Lux. Diversity - Max : Min = 1·35 : 1

WHOLE STADIA
Ave Eh = 1514 Lux. Diversity - Max : Min = 1·76 : 1

8/2/77 PROGRAM MN89 ILLUMINANCE FROM FLOODLIGHTING RUN REQUEST Sheet 1 JOB FOR W.D. Tyrell

DATE 18.1.77

CARD NO. 1. IF IN DOUBT CONSULT THE TECHNICAL SYSTEMS DEPARTMENT.

| layout | | | | | reduced grid | | | | | centre of symmetry | | atmospheric absorption constant (sigma) | | reserved | E-15 to E-77 | TV camera location (secondary) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | B | C | D | E | $S_x$ | $S_y$ | $N_x$ | $N_y$ | F | X | Y | | G | | | X | Y | Z |
| 1–2 | 3–4 | 5–6 | 7–8 | 9 | 10–12 | 13–15 | 16–18 | 19–21 | 22 | 23–27 | 28–31 | 32–43 | 44 | 45–62 | 63–65 | 66–70 | 71–75 | 76–80 |
| | | | | 1 | 5 | 3 | 11 | 7 | | 2862 | 1785 | | | | · | · | · | · |

notes on Card 1: A=maximum no of digits before decimal point on output. B= no of digits required after decimal point.
C,D control spacing between lines and figures- leave blank for standard spacing.
E= type of symmetry between towers - if no symmetry enter zero.
F-reserved. G=0 if sigma and tower measurments in consistent units, G=1 if sigma=/ft but other lengths in metres, G=2 if sigma=/m and other lengths in feet.

Full details are given in the user guide.

CARD NO. 2. Main page heading

| 1–80 |
|---|
| LAP 5073 BRUNEI STADIUM 4 TOWER CSI INSTALLATION |

CARD NO. 3. Specification of grid and other parameters.

| origin of grid | | | distance between points on each axis | | | no of points on each axis of grid | | | type of grid | number of grid points (total) | reserved | types of illuminance to be calculated option no. | | | lm/ft² to lux | TV camera location (principal) | | | common factor to all lamps. | sum of 4 planes | MN93 card? | reserved |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X | Y | Z | X | Y | Z | X | Y | Z | | | | 1 | 2 | 3 | | X | Y | Z | | | | |
| 1–5 | 6–10 | 11–15 | 16–20 | 21–25 | 26–30 | 31–33 | 34–36 | 37–39 | 40–42 | 43–45 | 46–48 | 49–51 | 52–54 | 55–57 | 58 | 59–63 | 64–68 | 69–73 | 74–77 | 78 | 79 | 80 |
| 0·0 | 0·0 | 0·0 | 31·8 | 35·7 | · | 19 | 11 | | | 209 | 1 | | 7 | | 1 | · | · | · | 0·65 | | | |

CARD NO. 3A Contour values to be plotted by MN93. This card is optional-(if present col 79 card 2=1)- cross off if not required.

| reserved | B | Contour values to be plotted up to 10 values (as specified by B in cols 8-9) |
|---|---|---|
| 1–7 | 8–9 | 10–80 |

Continue on sheet 2 if and only if type of grid = 1; otherwise continue on sheet 3

*Two office lighting installations showing different lighting treatments of vertical surfaces. In each case similar tasks are carried out in a comparable illuminance.*

problems and the distances involved.

The lighting designer is generally a man trained in engineering, who has considerable experience in the design and appraisal of lighting installations, and in addition has special knowledge of one or more aspects of lighting design. Lighting designers are people: some enjoy the detailed calculations and discipline necessary for designing complex floodlighting or street lighting projects, while others have a freer approach to life in general, and lighting in particular, and enjoy the challenge of designing a total visual environment.

**Creative Ability**

This requires artistic flair in the designer, more than the ability to carry out disciplined and orderly calculations. Neither requirement is predominant, both need a similar level of competence, even though some of the skills are very different.

When designing floodlighting for a football ground for example it is necessary for the designer to take into account many features that will be unique to each project. These include size of ground, possible tower/mast floodlight locations, illumination and glare control for black and white or colour television transmissions. The designer must use his skill and experience to produce a specification taking into account all of these factors. Having completed his calculations, he will prepare the data for a computer check, to confirm the accuracy of his calculations for illuminance diversity over a series of grid points on a horizontal and vertical plane.

**Visual Impact**

The designer must be able to visualise the finished interior, and the impact it will have on the occupants. He must have sufficient knowledge and experience to take an architect's brief for visual effect and express this in lighting terms. For example, important factors would be the contrast in reflectance, illuminance and colour between the visually important room surfaces; the contrast in luminance between the luminaire and its background; the proportions of the luminaire relevant to the room proportions, and the colour of the light. All the lighting factors can be reduced by the application of skill and experience to the amount of flux required on different surfaces and the direction from which it should arrive. From this point many different methods of calculation can be used to arrive at a specification for the necessary luminaire distribution and lamp type to produce the desired visual effect. Occasionally, the lighting designer will use a standard computer programme to check his flux distribution calculations.

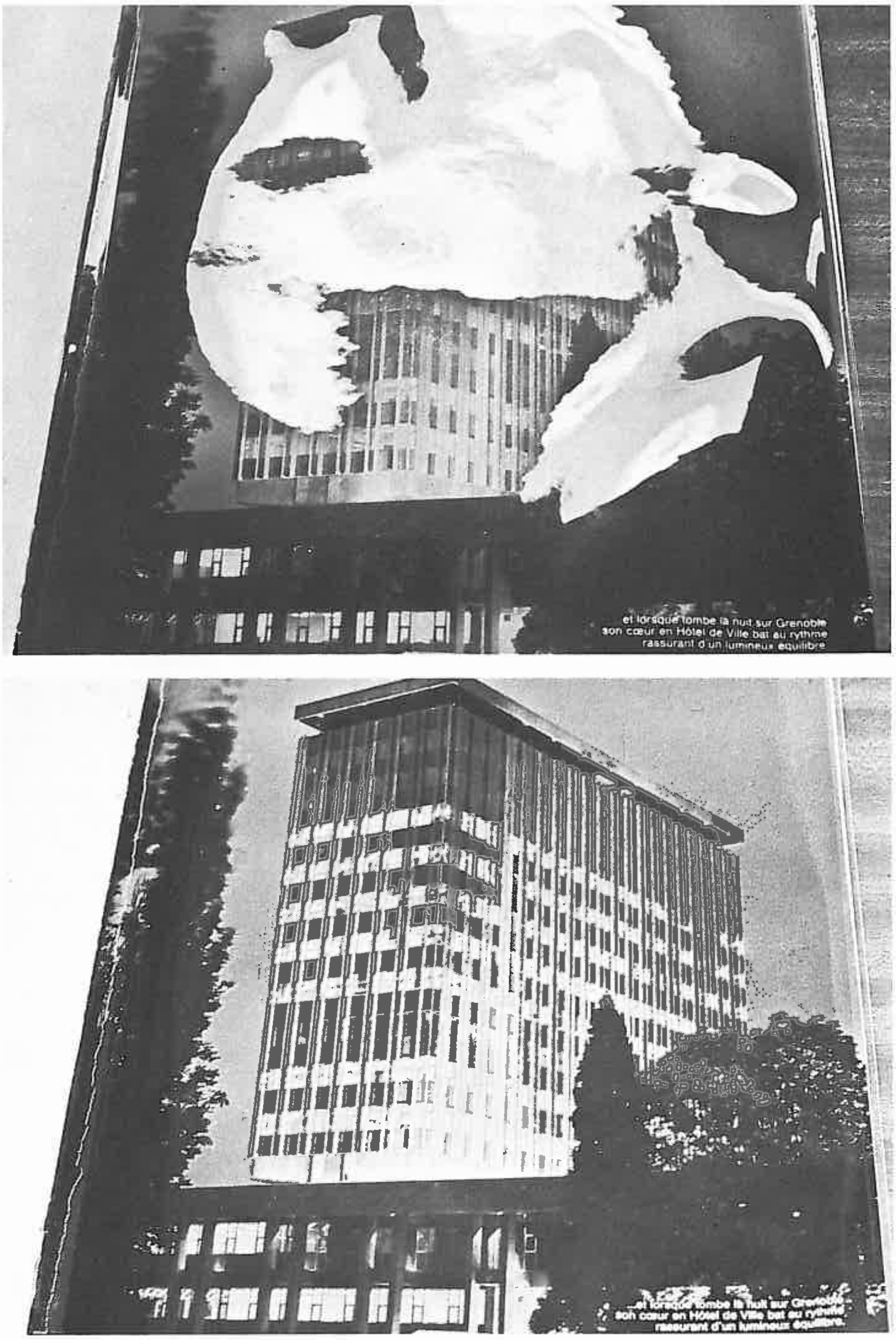
It occasionally happens that a lighting designer, who can be widely experienced in engineering designs for many different types of lighting installations, is called upon to design the lighting for an application completely new to him. When dealing with this type of enquiry, it is a sound method to go back to first principles and analyse the visual and functional requirements of the completed installation, then work back to arrive at a lighting specification. This process is based on the considerations given below.

The most obvious of several functions performed by lighting in any situation is to provide light for seeing to carry out a task. This may be as simple as seeing obstructions to walk through a circulation area, or it may entail seeing fine details on a work piece, or being able to carry out a precise drawing in a design office. In addition, however, the lighting designer's aim should always be to produce a pleasant environment, and this is a quite different concept from the need to provide light for functional seeing. The difference in reflectance and brightness has a profound effect on the worker's liking or dissatisfaction for his or her work and perhaps, indirectly, for their employers.

**Lighting for Seeing**

This is far more than a simple matter of designing for an average horizontal illuminance on any work task to meet the recommendations as set out in the British IES Code of Practice or for that matter, the American, Australian or any other European Code. All of these differ in terms of the actual value of illuminance to be provided, but the British Code is recognised and accepted world-wide.

The effect of a conventional design for a horizontal illuminance of 400 lux




*The effect of veiling glare. Reflections of a luminaire make it impossible to see the magazine cover, revealed when the glare source is removed.*

on the work surfaces in an office, where no regard has been paid to the direction of the light on the task and the direction of view of the observer, can be that the detail of the task is almost totally obscured by disabling reflections. A well designed lighting installation where thought has been given not only to the value of illuminance, but also the direction of light on the task, provides good seeing conditions for the worker.

**The Effect of Glare**

Direct and veiling glare can hinder vision and reduce the effect of higher illuminance. In a typical office where the lighting is provided by a regular array of luminaires it is perfectly possible for the effective illuminance in some working positions to be reduced to less than 25% of that of the average designed illuminance.

Full photometric data is needed to calculate accurately the illuminance and direct discomfort glare. Such data is produced by the Thorn Lighting Laboratories and published in the Thorn Photometric Data Books. In common with all general data, the interpretation of it needs the skill of an experienced lighting engineer. Direct glare can be assessed simply by the British Zonal System, but no similar simple method exists for predicting veiling glare and the lighting designer must use his skill and experience to minimise this. He will consider the relationship between luminaires and the working positions, and may specify the use of luminaires with batwing distributions or polarising panels, if this would help to improve visual conditions.

**Lighting for Effect**

There are so many variables in the visual environment that only the fully experienced lighting designer is in a position to make recommendations for light distribution and brightness patterns that will make an effective contribution to the desired effect. There is no validated code of practice that will give guidance to the lighting designer on values of illuminance or luminance (measured brightness) that will produce a required response.

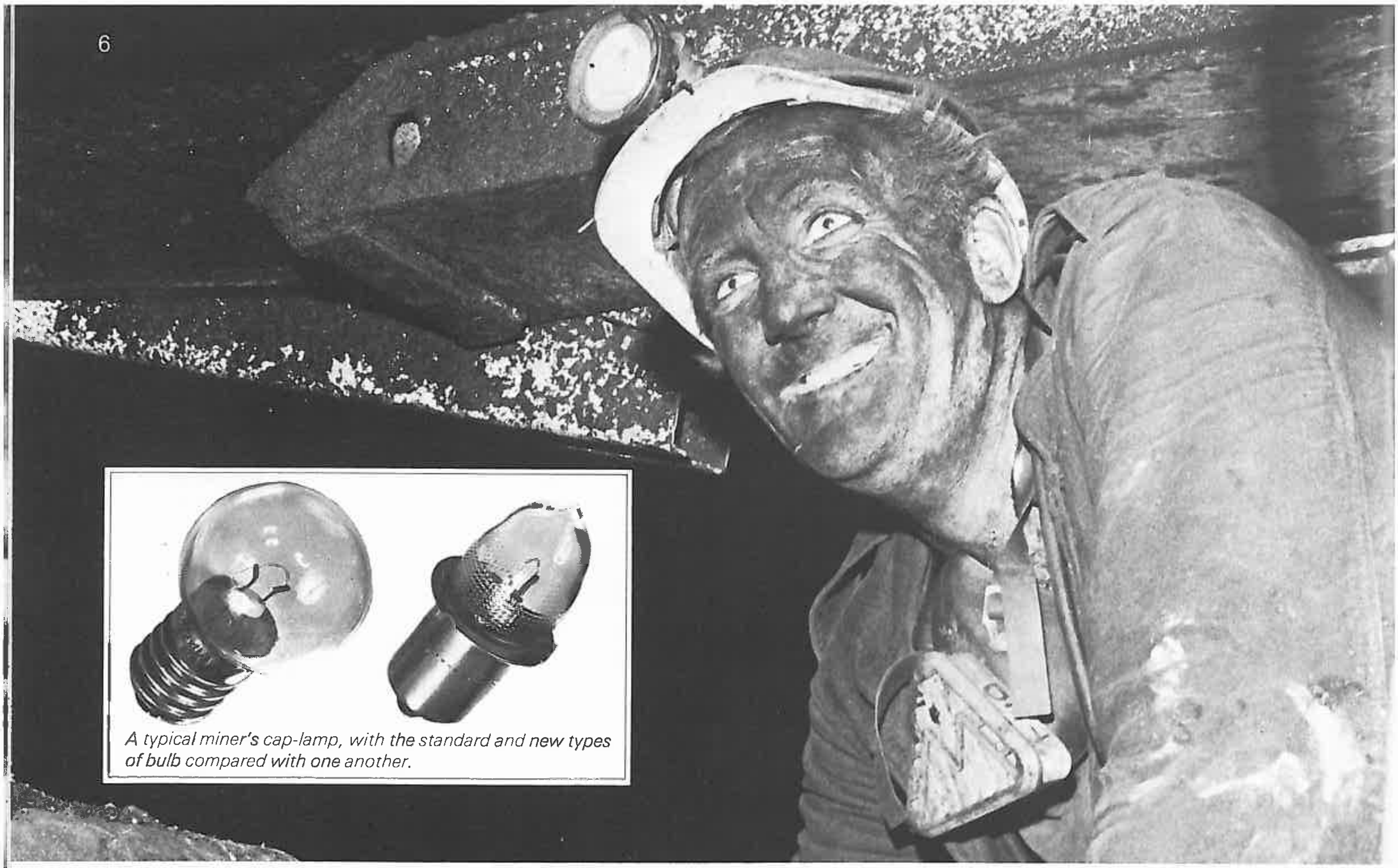
Aspects of the environment that determine the visual impression include the solid angles subtended by different room surfaces and the relative values of luminance that relate to their reflectance colour and texture. The lighting designer will usually have little influence on any of these except the choice of luminaire. Nevertheless, it is he who, more often than not, is deeply involved in trying to establish the lighting factors that will lead to the design of a satisfactory visual environment.

**Mutual Assistance**

There is, within Thorn Lighting Limited, a very free interchange of ideas between different departments and individuals. It is the company's general aim to ensure that all the skill and knowledge within the company is used on any project to produce the most technically effective and economic solution for the client. Even when overseas, the lighting designer has access to other lighting engineers, and through them to the lighting development groups existing within our research laboratories. It is perfectly possible for any individual lighting designer within the company to propose that fundamental research be undertaken to establish the most satisfactory lighting conditions, both from visual and psychological view points for any given project.

The lighting development groups can, and have in the past, erected mock-ups of real life situations to assess the effectiveness of the lighting engineer's designs. Recently, the laboratories have been involved in mock-ups which have established the degree of atmospheric absorption in floodlighting systems, the use of high-pressure sodium lamps in floodlight projectors in a steel mill (see Lighting Journal No 16) and the effectiveness of air extraction and diffusion luminaires or IED ceiling systems.

All of this work and the collaboration of the many experts within the company, ensures that the lighting specification whether presented to the customer in the UK, or overseas, can be relied upon to provide a sound engineering and aesthetic solution to the problem. It is the company's aim always to give the best possible technical advice to the customer, having regard to all research and field work carried out nationally and internationally and this is freely available to customers through our technical sales services.



A typical miner's cap-lamp, with the standard and new types of bulb compared with one another.

# Improvements to miners' cap lamps

D Brown

*The work recently done by the author of this article is typical of the constant revision of lamp types occurring in Thorn's Lamp Engineering Department. Very many variations and improvements of design of standard lamps, especially miniature types such as motor-car headlamps and projector lamps have been made since the introduction of the tungsten halogen principle. In this case the reason for making the change was the far greater accuracy in manufacture achieved since the lamps were first introduced. Individually designed lamps are occasionally required for specialised purposes such as this and Thorn's are at the forefront in such developments.*

*Mr Brown is an engineer in the lamp engineering department of Thorn Lighting at Leicester, specialising in miniature lamps.*

In a modern miners' cap lamp the main bulb is located in a specular reflector, with an auxiliary lamp beside it and this assembly is positioned in a housing by a protective glass cover which is held on to it by a bezel with a rubber sealing ring to form a hermetic seal. The lamp is powered from a rechargeable battery pack usually carried on the user's belt. The spherical 18 mm diameter bulbs used in these lamps are krypton filled to give increased light-output and are fitted with M.E.S. (E 10/13) caps.

The British Standard requirement for the M.E.S. capped miners lamp allows a tolerance on the coil position along the axis of the cap of ± 1.5 mm from the objective dimension of the geometric centre of the coil to the end of the solder contact. There is also an axiality tolerance of 1 mm from the axis of the cap.

Before mechanisation in the mines, cap lamps used a diffuse reflector to give an even beam distribution with a relatively low peak intensity, a suitable light distribution for the working conditions at that time; but with increased mechanisation the miners operated further away from the actual coal face in a dustier atmosphere and required higher intensities from the lamp. To achieve an improvement of the beam intensity the diffuse reflector was replaced with a specular reflector, but the M.E.S. capped bulb was retained although in order to obtain the optimum performance from the unit, the position of the light source would have to be controlled far more accurately than before.

**Focussing**

It is normal practice when assembling the cap unit or replacing lamps to focus the lamp manually by screwing the bulb in and out of the reflector in order to obtain the correct setting. The setting is maintained by a friction spring across the moulded thread in the reflector which also serves as the electrical contact to the cap shell. The replacement of lamps in service is usually performed in the lamp houses at the mines and this can be time consuming due to the necessity for manual focussing. It has to be carried out from the front of the housing and the operator's hand obscures the beam, so that he may have to make a number of tests before he achieves a good focus. There is also the danger of scratching the reflector as the lamp is turned. Moreover, by virtue of the design of the existing unit, the focussing cannot correct for any lamps having coils off the true axis. Tests have shown that lamps on the extremes of the allowable axial tolerances can reduce the peak intensity by up to 50%.

In view of all these difficulties it became clear that an alternative system should be adopted. Thorn Lighting lamp engineers, working in close co-operation with Oldham and Sons Ltd, the manufacturers of the cap lamps, put new proposals forward for an improved design, suggesting that consideration be given to a prefocus lamp which could be assembled from the rear of the unit. This would eliminate the need for manual focussing and reduce the possibility of damaging the reflector surface.

The prefocus flash lamp using an 11 mm diameter bulb and P 13.5s cap was taken as the basis of the new design. Its manufacturing tolerances of ± 0.3 on light centre length and ± 0.3 mm on axiality are very much less than those of the conventional krypton miners lamp. Flash lamps are usually vacuum lamps operating at much lower wattages than those required for the cap lamp application and the internal volume of the bulb is only about 1/3 that of the 18 mm bulb. Tests were carried out to see if it was feasible to make a 4V 1.0 A krypton rating to this design of prefocus lamp, and it was established that by adopting very careful controls during the manufacturing process it was possible to produce lamps which would comply with the same operating standards as those applied to the conventional lamp. An added benefit of using the 11 mm bulb was that this design can incorporate a stippled or granulated area below the filament which evens out the usually patchy distribution of light outside the main beam area without reducing the peak beam intensity. The manufacturer redesigned the reflector to accept this new bulb so that the prefocussed lamp and reflector would be directly interchangeable with the existing unit.

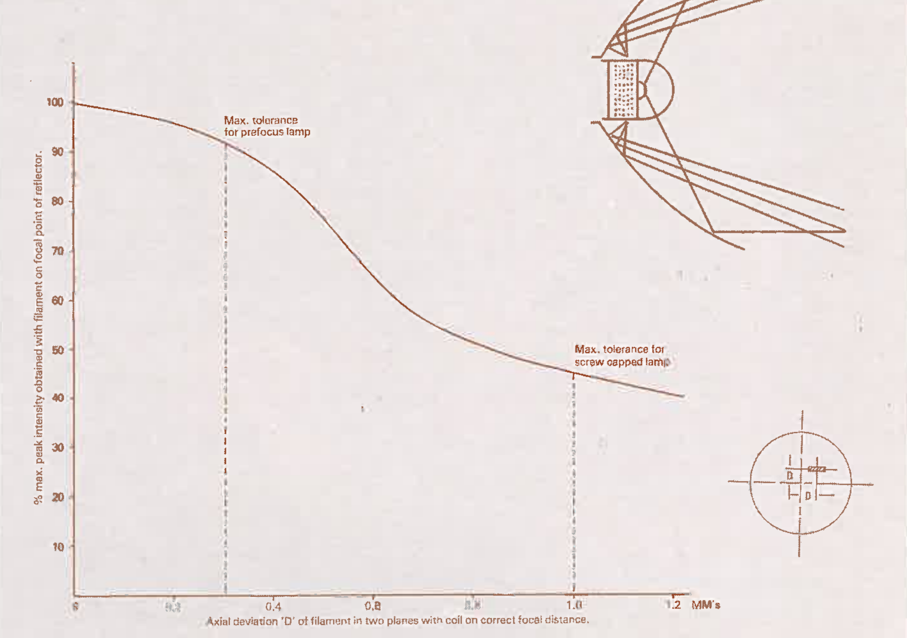
**Locating the Lamp**

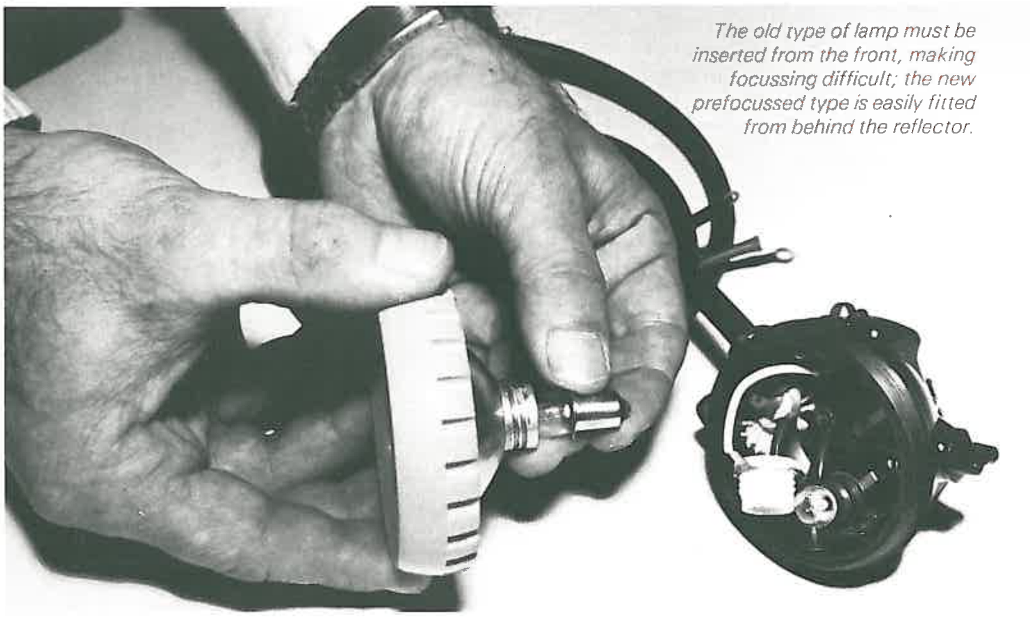
The prefocus lamp is inserted into the back of the reflector and is located on a seating plane which in turn is referenced to the focal point of the reflector. Lateral movement of the lamp is also restricted in the fitting to maintain the filament of the lamp on the axis of the reflector. Measurements of peak intensities when the filament position is on the extremes of the light centre length and axiality tolerances have shown the peak readings to be within 10% of the values of the same coil on the obejctive position.

This cuts out the time taken in focussing the lamp and eliminates the danger of scratching the reflector. The accuracy of the focus can be checked immediately the bulb is in position in the reflector.

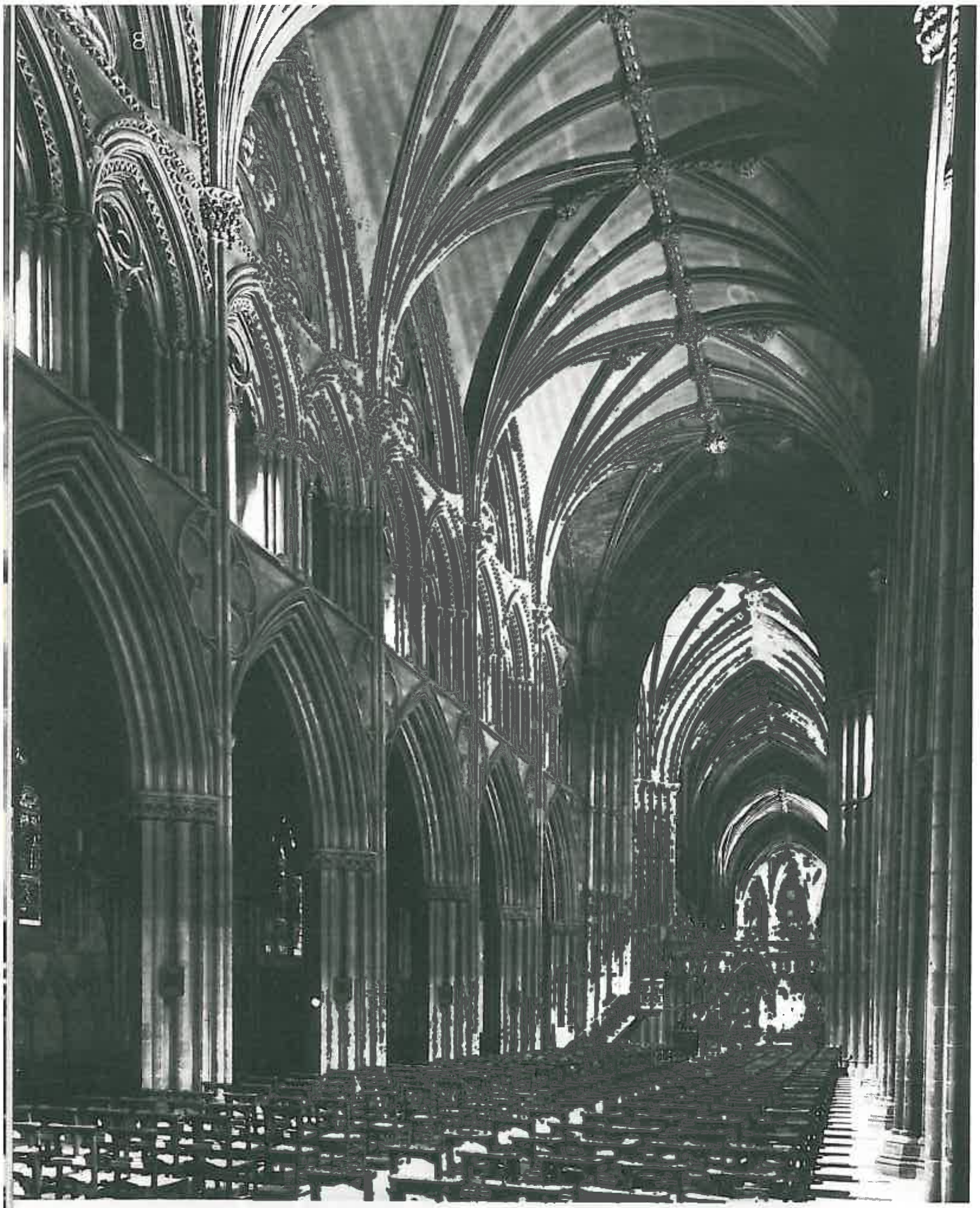
Before the use of any new lamp types for this application, its design and performance have to be independently checked by the Safety in Mines Research Establishment. These checks have shown that the prefocus lamp complies with the requirements and approval has been given for the use of this lamp in the British Mining Industry. The British Standard 535: 1973 which specifies light sources for miners portable lamps has been amended to include it. It is envisaged that there will be a progressive change-over to the use of the prefocus lamp due to the simplicity of assembly without the need to focus the lamp manually in the reflector and to the more consistent beam performance of the whole unit.

*Diagrams showing the relationship between peak beam intensity and the axial deviation of a filament, and the effect of granulation on the bulb.*



*The old type of lamp must be inserted from the front, making focussing difficult; the new prefocussed type is easily fitted from behind the reflector.*



The Nave of Lichfield Cathedral, looking East. The smaller picture shows its appearance looking West, before relighting. Opposite can be seen the Choir, lit for a winter evensong, with the vaulting only lighted in the Nave.

# A tale of two cities

Peter Bleasby

*Mr Bleasby is Zone Chief Lighting Engineer responsible for the technical aspects of lighting design in Zone 2.*

It is one of the oddities of English usage that any town that has a cathedral in it is given the courtesy title of "city", although in some cases, as for example Wells and Ely, it is no more than a market town. All other cities are created by the grant of a Royal Charter, but not all of them also contain a cathedral. In collaboration with the cathedral architect, Thorn Lighting has recently had the rare privilege of relighting two famous cathedrals, Coventry and Lichfield. Although both places are cities by Royal Charter the contrast between their cathedrals could hardly be greater, but Coventry and Lichfield, like Bath and Wells, was formerly one diocese with two cathedral cities, so it is perhaps appropriate that both cathedrals should have been relighted simultaneously. Coventry cathedral is an exercise in modern art and architecture, while Lichfield is one of the smaller, though very fine, medieval English cathedrals.

## Lichfield Cathedral

Lichfield Cathedral stands today substantially as it was when completed some 500 years ago, but it has undergone extensive restoration mainly due to damage during the Civil War. Although small by comparison with other gothic cathedrals, it is just over 400ft long with an almost uninterupted vista along the whole length. It is also the only English cathedral to have three spires, which dominate Lichfield from whichever direction it is approached.

The cathedral is cruciform, but due to the use of a natural sand-stone foundation at the east end, the axis of the choir and Lady chapel is out of alignment with the nave. The nave consists of 8 bays with open and accessible triforium arches in all but the westernmost bay, and is separated from the choir by a wrought iron screen designed by George Gilbert Scott and recently restored and re-gilded. The Choir has 8 bays and its vault continues without a break into the apsidal Lady Chapel whose windows contain some magnificent 16th century Flemish stained glass. The clerestory windows in the choir extend to the main arcade with a walkway at triforium level which also continues around each transept.

The roof vault in the choir, crossing and transepts is of grey sandstone. The nave roof vault, also of sandstone, was replaced with a plaster vault during the 18th century when the weight of the stone started to force the nave walls apart. Throughout the roof there is a most interesting variety of deeply carved bosses.

### Existing Installation

The cathedral was completely rewired in mineral insulated cable during the 1950's, and the basic lighting fittings installed as a temporary measure were still there in 1976 proving that there is nothing quite so permanent as the temporary measure. In the nave and transepts 200 watt pendant bell shaped reflector fittings were supplemented by a large number of louvred 100watt reflector lamps in the triforium. These were directed at the roof but did not give enough light to overcome the overall "tunnel" effect. Pendant wrought iron chandeliers, consisting of 3 double conical cylinders each housing a 100watt GLS lamp below and a 60watt GLS lamp above were used in the choir. Much of the light output was trapped and the upper lamps severely

overheated, with consequent short life. The altar, reredos, choir screen and other features were lit with reflector lamps, sometimes sited so far from the object they were lighting that their effect was lost.

The immediate problem was to provide more light for a similar energy consumption in the choir, which is used for weekday services. Lighting of the remainder of the cathedral would follow as finances permitted.

**Basic Considerations**

There are two basic methods of lighting a traditional church or cathedral. The most common is the pendant chandelier of a contemporary or "period" design. This method has three main disadvantages. Firstly the design is likely to be at odds with the architectural style, secondly it is likely to interfere with the clean lines of the structure, and thirdly a chandelier is an almost wholly diffusing source, depending on areas of high reflectance to re-direct its light downwards. Such surfaces are seldom available in gothic cathedrals and the result is high energy consumption with little light on the places where it is needed.

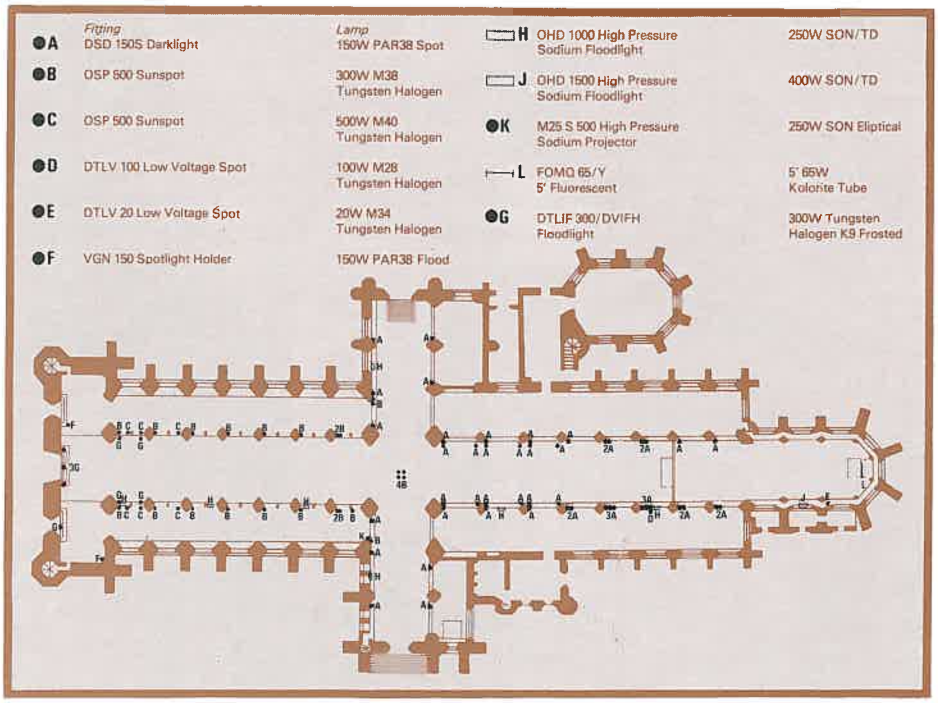
The second method is to conceal modern high efficiency equipment within the structure, to model and highlight the important areas rather in the manner of theatre lighting. This is usually more successful, but needs considerable care. Too often open reflectors and unshielded reflector or PAR lamps reveal their location by splashing uncontrolled spill light on adjacent stonework.

Having suffered from the first method, the Dean and Chapter readily agreed to consider the second. Accordingly, a small pilot scheme was installed and appraised. As a result of this, the lighting of the choir proceeded immediately, and finances were found for the relighting of the remainder of the cathedral to follow on without a break. The time span between the trial installation and the final alignment of the permanent installation was only 4 months, a remarkable turn of speed. This was made possible by using standard Thorn equipment throughout, although sometimes in an unconventional manner.

**The Lighting Design**

No useable drawings of the building were available, and time did not allow for a survey to be carried out or for plans to be drawn up. Rough sketches were prepared, and from these the position of each fitting was marked on the stone structure. Although the building seems symetrical, it is by no means regular, and it was not safe to assume that a position marked for new lighting equipment in one bay would be the same as in the next, let alone the bay opposite. During this process many traces of earlier lighting schemes were discovered and some new positions coincided with graffiti that was centuries old. Was "R Phillips 1839" perhaps a purveyor of purest wax candles, or an adjuster of gas jets, and if not what was he or she doing in the triforium?

Throughout the design, use was made of standard high efficiency equipment and lamps with a life not less than 2000 hours, installed in accessible locations for ease of cleaning and re-lamping. The design was also planned to utilise the existing electrical installation with the minimum of modification, and thanks to the painstaking ingenuity of the electrical contractor, this was achieved without sacrificing a logical switching arrangement.




**Lighting the Choir**

The basic luminaire is the DSD 150 Adjustable Darklight using a 150watt PAR 38 spotlamp. The black specular reflector gives a higher output, less inter-reflected light and less spill light than the more usual grooved black baffle downlight. The luminaires are concealed by the reveals of the choir windows, are accessible from the clerestory walk, and are directed to light the opposite side of the choir. A predominance of luminaires on the south side ensures a 'flow' of light from south to north. There is a greater concentration of luminaires in the sanctuary bays to emphasise the altar, but the crossed beams technique avoids highlighting Gilbert Scott's over ornate reredos. A DSLV 100 low-voltage tungsten halogen 100watt narrow-beam spotlight on the south side lights the altar cross and effectively separates it from this rather complicated background. Previously, it had been almost invisible.

Additional 'Darklights' are installed on the front of the walkway parapet of the first three bays and are directed almost vertically downward on to the choir stalls giving an illuminance of 150 lux on the music; four times the original for a slightly decreased load. The location of these 'Darklights' adjacent to some canopied 19th century statues gives them a character that they lack in daylight.

**The Nave**

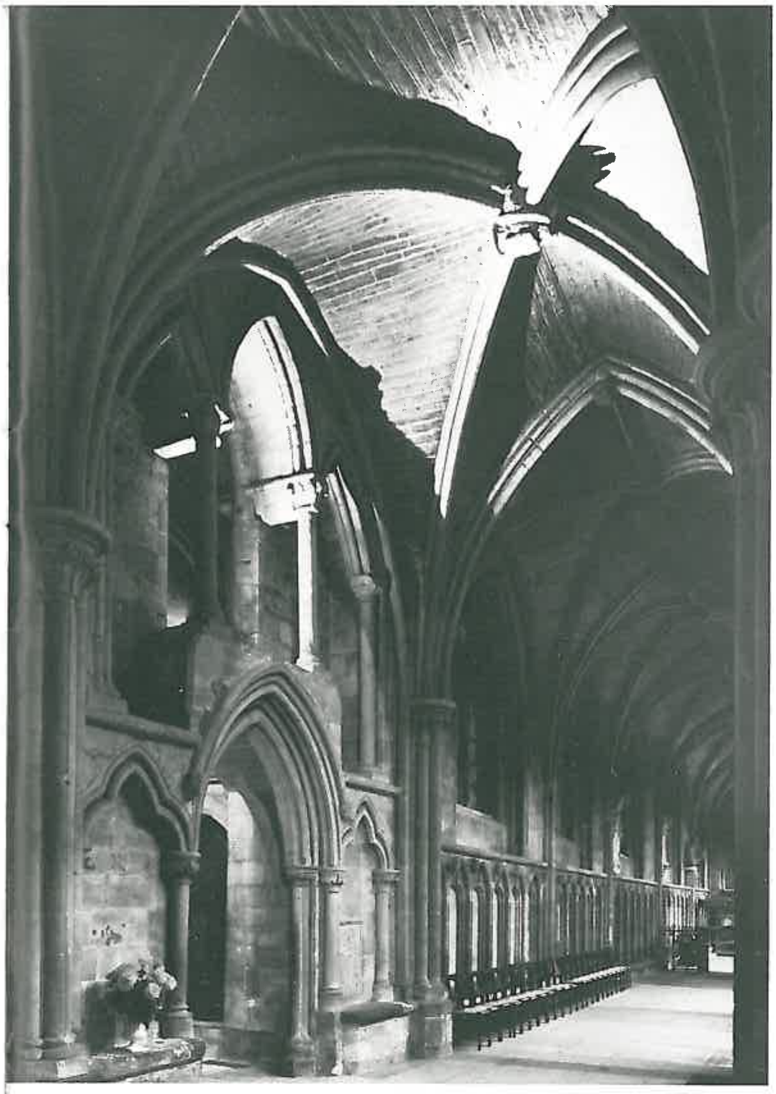
The transepts are lit in a similar way to the choir, but in the nave larger but fewer luminaires are concealed behind the triforium arches.

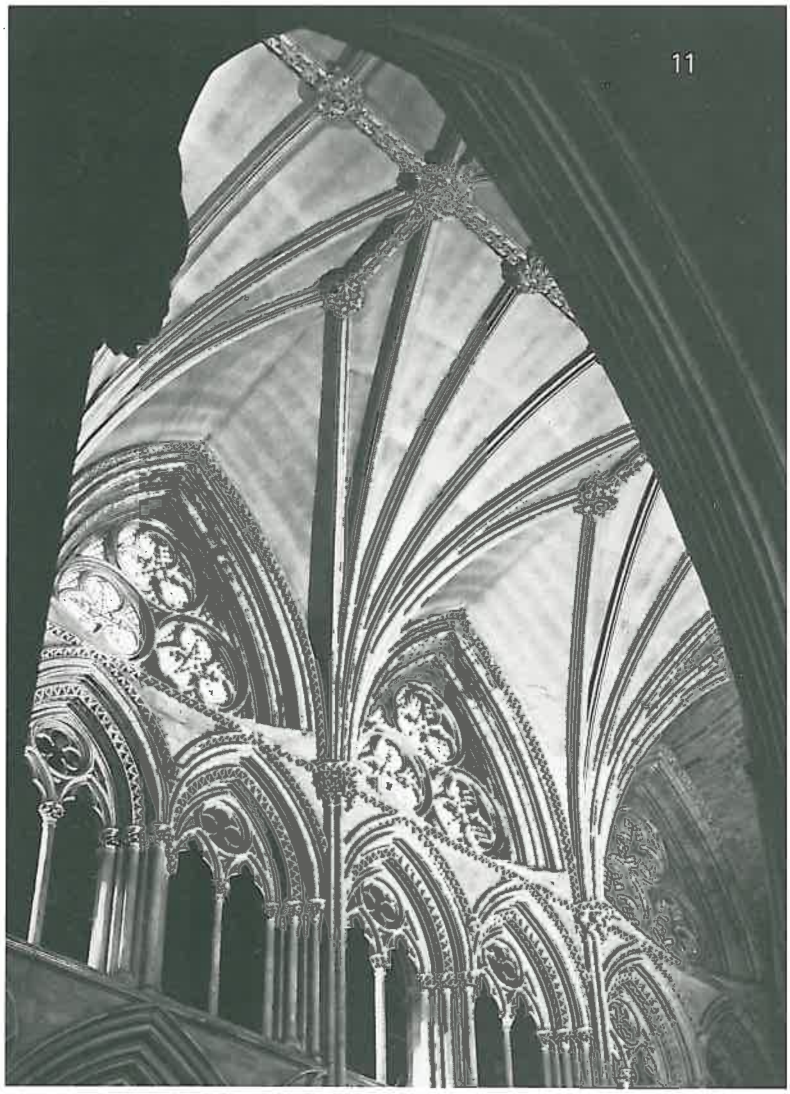
OSP 500 Sunspot with 300watt tungsten halogen lamps, located on the west side of alternate arches are aimed across and slightly forwards to the seating on the opposite side of the nave. The illuminance has been raised to an average of 100 lux, three times the original for a similar electrical load, and the concealment of the equipment from distant viewpoints at the west or east ends is excellent with very little spill light.

For lighting the occasional concerts held at the west end of the cathedral, additional 500watt Sunspots are installed behind the triforium arches, supplemented by 300watt tungsten halogen interior floodlights fitted with masking hoods installed on the face of the stonework of the west wall and sprayed to match it.

**Lighting the Vaults**

To emphasise the continuity of the vault, it was decided to eliminate the





colour difference between the stone and plaster. Consequently, discharge lamps were proposed and both mercury and high pressure sodium sources were appraised; the latter was preferred for its warm appearance, and for the modelling achieved on the roof. This is done by 250watt SON-TD Sonline lamps in OHD 1000 Haline floodlights with hood attachments positioned on the south side at triforium level, and this unidirectional flow coupled with the small source size gives excellent modelling and concentrates the light above the choir and the altar. Not only does it result in a warm attractive appearance to the whole cathedral, but it also provides sufficient background light for wintertime visitors at a running load of about 3kW. As an unexpected bonus, it provides interior floodlighting which can be clearly seen from outside through the clerestory windows.

**Choir Screen, Pulpit and other Special Features**

The crossing is lit by four Sunspots installed in the central wooden boss in the roof, a position previously and ineffectively occupied by 300watt industrial reflectors. Two of these Sunspots light the floor below, and two narrow-beam types with clear lenses are focussed on the choir screen. This near vertical glancing angle has enabled the screen either to be lit independently without creating shadows behind it, or to be left in silhouette against the choir. An additional altar is regularly placed in the crossing, and both front and side lighting for this is provided by additional Sunspots concealed in the nave and transepts, while the pulpit has its own individually controlled Sunspot positioned high in the triforium opposite.

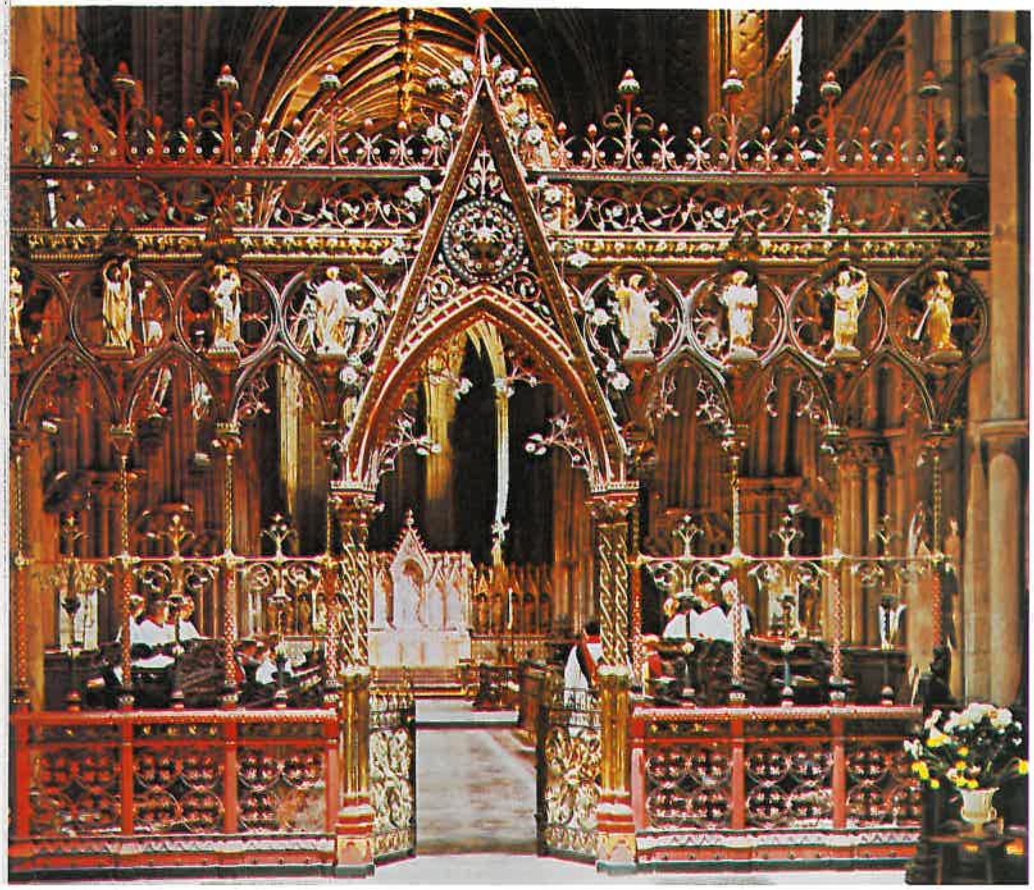
The carved and gilded wooden tryptich in the Lady chapel has recently been cleaned and restored. The blue 'sky' background behind the figures has been emphasised by placing a 5ft Clipper angle reflector luminaire with a Kolor-rite tube behind the altar to light upwards into it. It is supplemented by a DSLV 20 low-voltage 20watt tungsten halogen spot mounted in one of the south window reveals, to gently emphasise the centre panel.

Behind the bishop's throne an inverted WH 60 domestic downlight effectively relieves the gloom of the dark heavy canopy above it and various tungsten halogen and PAR lamps light the bookstall, and other monuments and features in the choir aisles.

As funds become available, it is hoped to re-light the chapels and also the nave and choir aisles, which rely at present on spill light from the main lighting.

An external floodlighting scheme has been prepared and is now going ahead. We hope to describe and illustrate this in our next issue.

Top left. *The entry to the Chapter House in the North choir aisle. Indirect lighting emphasizes the structure of the vault.*
Top right. *Details of the nave vault, clerestory and triforium are clearly seen without undue emphasis being placed upon them.*
Below. *A closer view of two Sunspots in the North triforium of the nave, lighting the seating area; a Sonline fitting can be seen across the nave.*



Left. *The vaulting above the presbytery at Lichfield was deliberately left unlighted to avoid a monotonous effect from the nave: the altar cross is picked out by a low voltage spotlight in the South clerestory walk.*
Below. *The rich detail of the Victorian choir screen is emphasized by strong down lighting from the roof of the crossing.*

## Coventry Cathedral

The new Cathedral was consecrated in 1962. It is oriented north and south and stands to the north of the ruins of the church destroyed in World War II. Internally the building continues without a break from the magnificent engraved glass "west" screen to the famous Sutherland tapestry which replaces the traditional "east" window. In 1962 this main space was lighted by 64 downlights recessed in groups of four in the slatted timber ceiling, fixed either side of an access catwalk at an approximate height of 28m.

Each of the four downlights in each group projected its light into the diagonally opposite quarter of the floor and consisted of a 440mm diameter spun aluminium parabolic reflector, surmounting a 550mm deep tapered black cowl resting in a 270mm diameter bezel in the ceiling. Thus the light source was concealed from almost every angle of view, but at the expense of efficiency. 500watt B2 projector lamps were installed over the choir, and 300watt GLS lamps over the nave, achieving an illuminance of 30 lux in the centre of the nave, falling off rapidly towards the side seats.

Extensive modifications to the reflectors of the downlights took place almost immediately, enabling a 1000watt GLS lamp to be used, giving more light, and with a longer life than B2 projector lamps. The original illuminance was approximately trebled but the load was increased to 64 kilowatts. This was a viable solution while energy remained cheap, but as costs began to soar the financial burden became intolerable and some of the downlights were disconnected. Consequently, the lighting was rather patchy.

### Thorn Is Called In

In the autumn of 1975, Thorn Lighting was asked to advise on a more economical lighting scheme particularly in the choir area which is most frequently used for weekday services. Several alternatives were suggested, but it was clear that no additional equipment could be tolerated at a lower level than the ceiling. The solution therefore was to

*Looking down the Nave of Coventry Cathedral from just inside the Altar rail. The new MBI lamps produce 350 Lux in this area; three times that from the original installation and consume a quarter of the current.*

improve the efficiency of the downlighting installation but because there was insufficient capital available to replace it, the existing equipment would have to be modified. The project was given additional impetus by the supply authorities' introduction of seasonal demand charges. For a 64kW load, these varied approximately between £30 per month in the summer, and £200 per month in December, January and February, so that still heavier maximum demand charges would be incurred.

**A New Light Source**

Clearly the main improvement in efficiency had to come from using a different light-source within the downlights. Since these had been designed for a point source, a clear discharge lamp with a small arc tube and acceptable colour appeared to be the solution. Two lamps were suitable, the SON/T clear high pressure sodium lamp, and the clear MBI metal halide lamp. The 400watt high pressure sodium lamp produces 42,000 lumens compared with 24,000 lumens from the MBI lamp, but since the choice would hinge partly on their colour appearance and colour rendering properties, a trial installation of both types was arranged in the cathedral. This consisted of one group of four 1000watt GLS downlights, one group of two converted for 400watt SON/T lamps and one group of two converted for 400watt MBI lamps. Each group was well separated so that there was no spill from one light source into the area covered by another.

The high pressure sodium lamps gave a rich warm appearance with almost an embarrassment of light. The linear arc tube parallel to the axis of the symetrical reflector produced a large 'hot spot' which was made to coincide with the seating area. This spot was in the order of 300 lux, with 200 lux in the centre aisle and 70 lux at the side seats, for only 20% of the existing lamp wattage.

The MBI lamps gave a distinctly cool appearance to the cathedral furnishings but the illuminance was higher than might be expected because the short arc tube was a more compact source. The illuminance in the centre aisle was 200 lux, and at the side seats 60 lux, again for only 20% of the tungsten lamp wattage.

A colour rendition test was then carried out using a selection of the cathedral vestments. Under the high pressure sodium lamp some distinctly different pastel colours in the vestments were almost indistinguishable, but the MBI lamps gave a generally excellent colour rendering and consequently this lamp was selected.

**Photometric Tests**

The choice was confirmed by photometric tests. It was found that the light output ratio of a downlight with a 1000watt GLS lamp and reflector was 20%. Substituting the 400watt MBI lamp and the original B2 projector lamp reflector increased this to 38%. The useful output per luminaire had therefore increased from 3460 to 9120 lumens, so that fewer luminaires would be needed. It was agreed that 32 luminaires should be converted to MBI and accordingly a cost comparison between this and the existing installation was prepared based on 1000 hours use per annum. This shows savings of 75% per annum, and the increased lamp life contributes to a saving in maintenance costs.

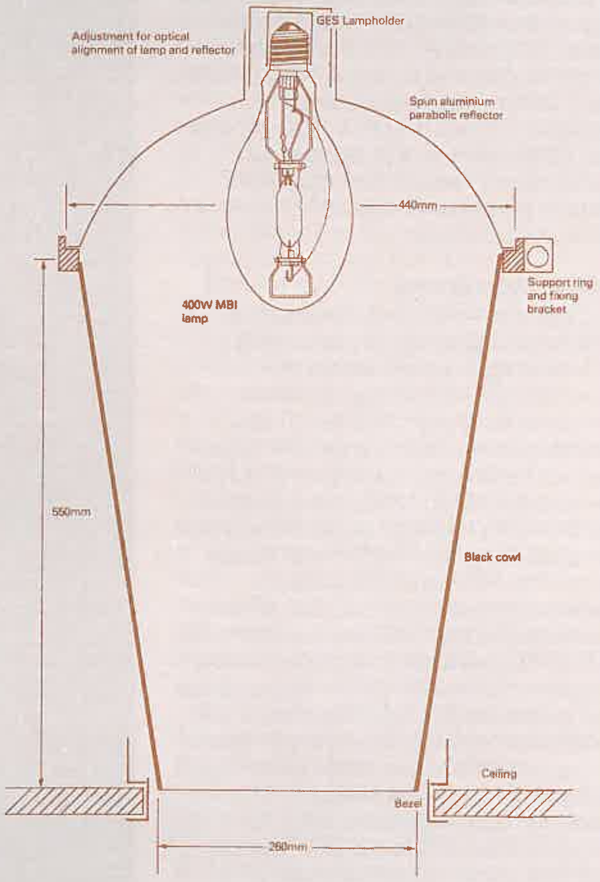
The initial illuminance compared with the 64kW tungsten installation is almost trebled, being 350 lux in the centre of the Nave and 500 lux in the chancel. It is difficult to be precise about the payback period for the capital cost of the conversion to MBI, since with a seasonal demand tariff, it depends on whether the summer or winter months are selected but it either case it is less than one year.

The new installation is now in service. Two of each group of four downlights have been modified for 400watt MBI lamps, and the beams are crossed to light the opposite side of the cathedral. The other pair of each group is unlit. The cool appearance is to some extent offset by tungsten lighting in the perimeter areas and over the choir stalls. This tungsten lighting also offers protection against the restrike time of the MBI lamps in the event of a momentary interruption of the supply. There is a most dramatic "sunrise" lasting about 3 minutes as the MBI lamps run up; no doubt this will be put to good use before long.

**Acknowledgements**

The Consultant Architect for both Coventry and Lichfield Cathedrals is Mr Charles Brown, FRIBA. The installation at Coventry was supervised by the Cathedral Clerk of the Works, Mr J West, and the Electrical Contractor at Lichfield was T A Griffin.

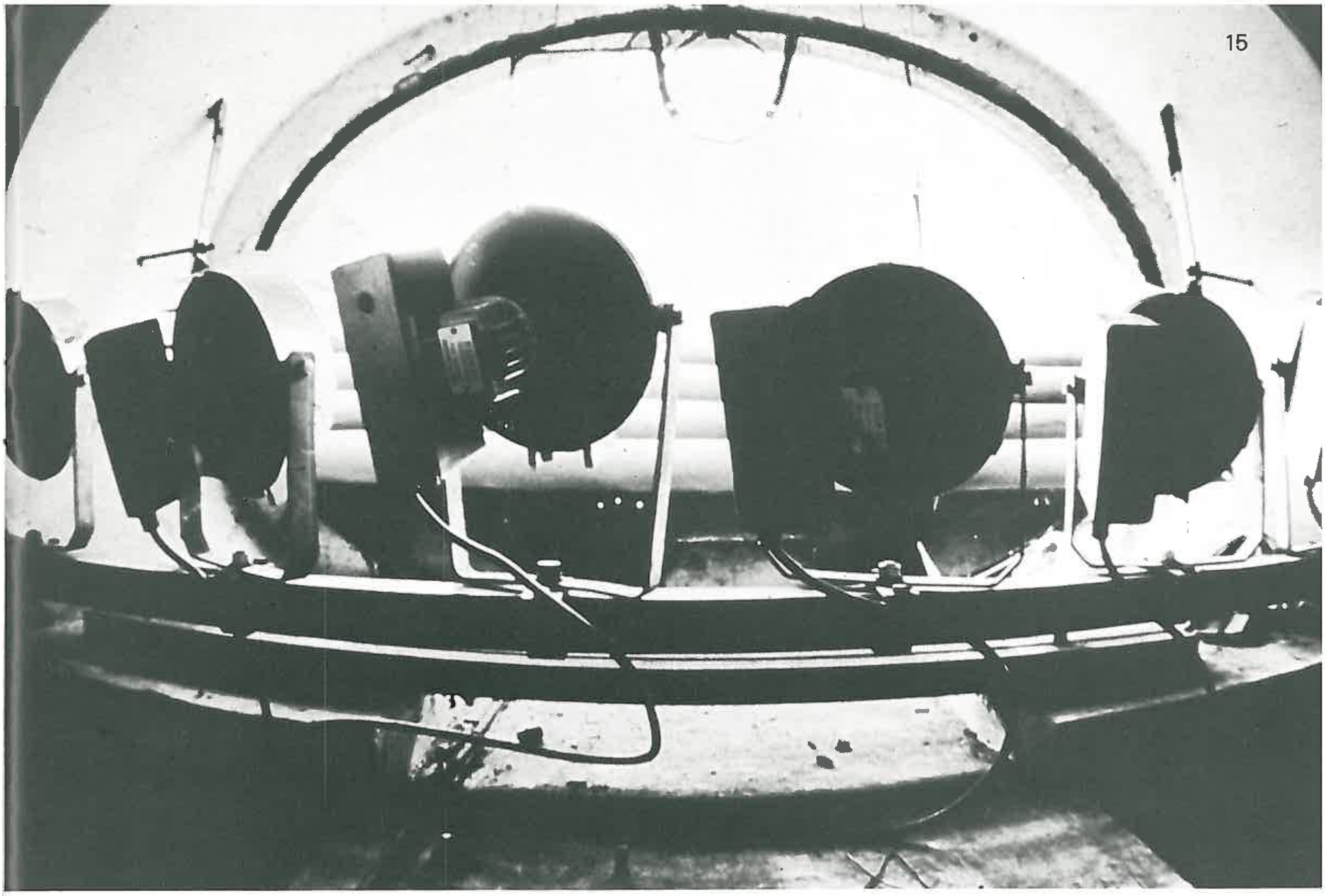
*A detail showing the original and modified lighting fitting taken from the walkway above the suspended ceiling, and a section of one of the luminaires.*




**Cost comparison based on 1000 hours burning per annum**

| | *Existing GLS Installation* | *Metal Halide Installation* |
|---|---|---|
| Lamps | 64 × 1000 watts | 32 × 400 watts |
| Load | 64kW | 16KVA (13kW) |
| Lamp Life | 1000 hours | 7500 hours |
| | £ | £ |
| Lamp cost per 1000 hours | 120 | 64 |
| Max. demand charges equivalent to £13.62 per KVA per annum | 872 | 218 |
| Unit charges 1.35p per kWh | 864 | 176 |
| Annual running cost | 1856 | 458 |
| Percentage | 100% | 25% |

(Excluding fuel adjustment and rounded to nearest whole numbers)



*Thorn CSI lamps in OM 1000 housing are grouped in the lunettes below the Cathedral dome to light the distant Festung. Below is a section showing the remarkable 'throw' and the concentration of the beam to avoid glare to patrons of the restaurant on the hill.*

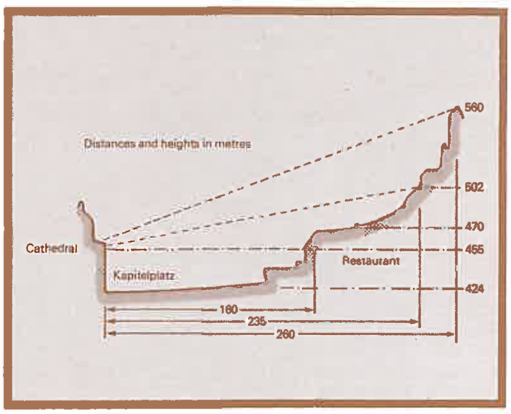
# Relighting the Festung at Salzburg

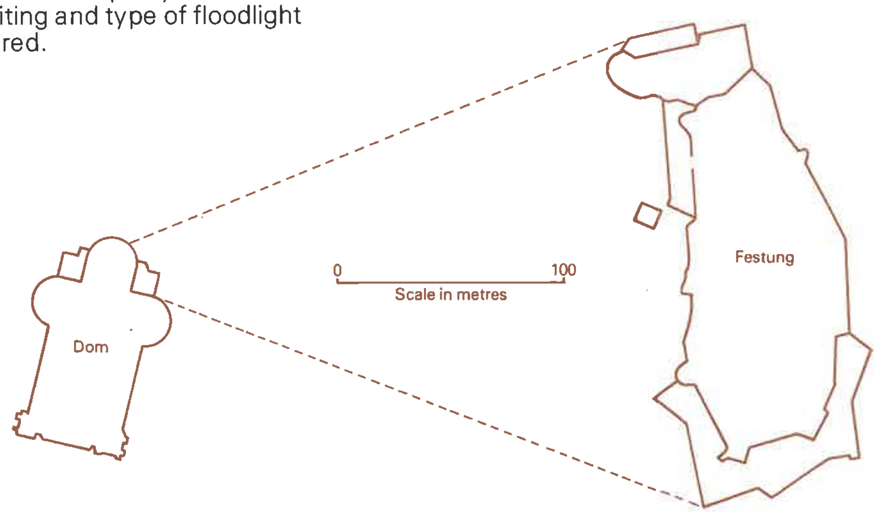
F Brigg

When, in 1974, an extensive floodlighting scheme was installed in the famous city of Salzburg, the lighting of the Festung, the ancient fortress on the hill overlooking the town, was clearly of great importance, for it provided a backdrop against which appeared the towers and domes of the city below.

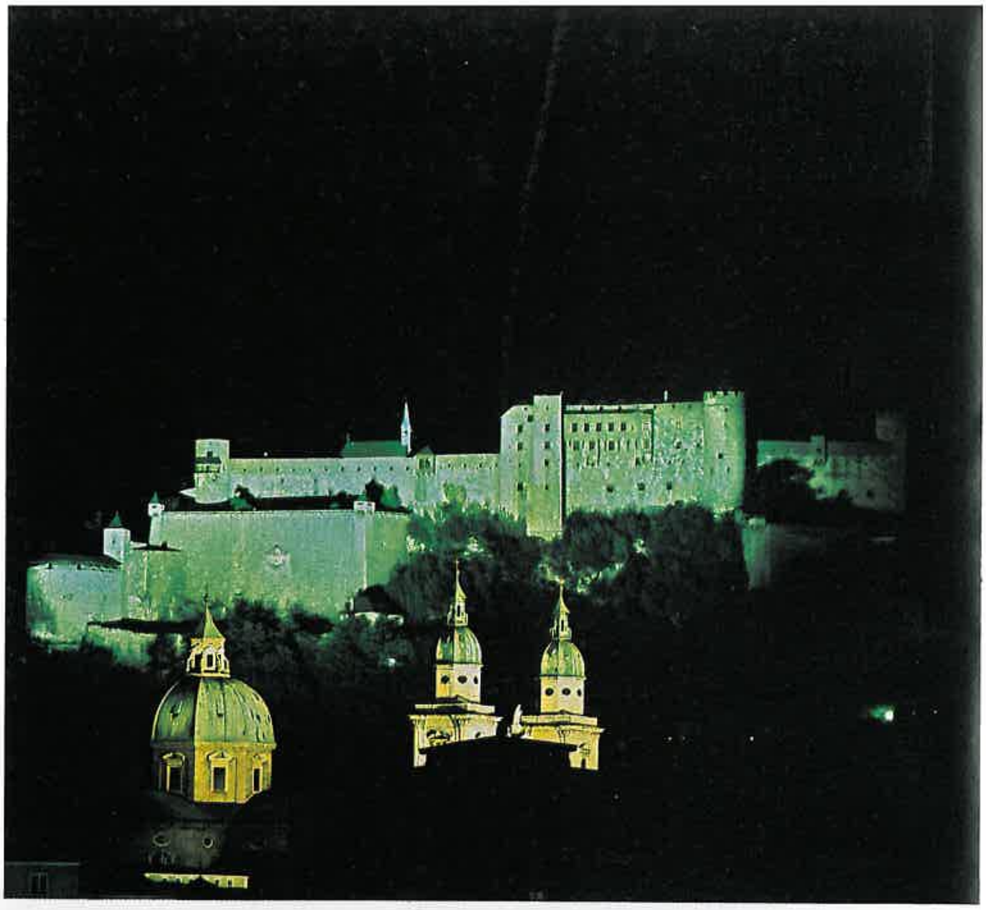
The possibility of lighting the walls of the fortress by projectors mounted close to them was ruled out by the precipitous nature of the hillside and by the fact that no electrical supply was possible without damage to the medieval walls. The main front of the building, facing the town, was finally lighted by long-range narrow-beam projectors mounted just below the principal cupola of the Cathedral, over 260m away.

Unfortunately the beam of these projectors was not very accurately controlled and the customers of a famous restaurant halfway up the Festungberg were dazzled by the spill-light from them. As the principal attraction of the restaurant was the excellent view of the floodlit city to be obtained from its terrace, the proprietors were justifiably annoyed and the muncipality had to reconsider the siting and type of floodlight required.



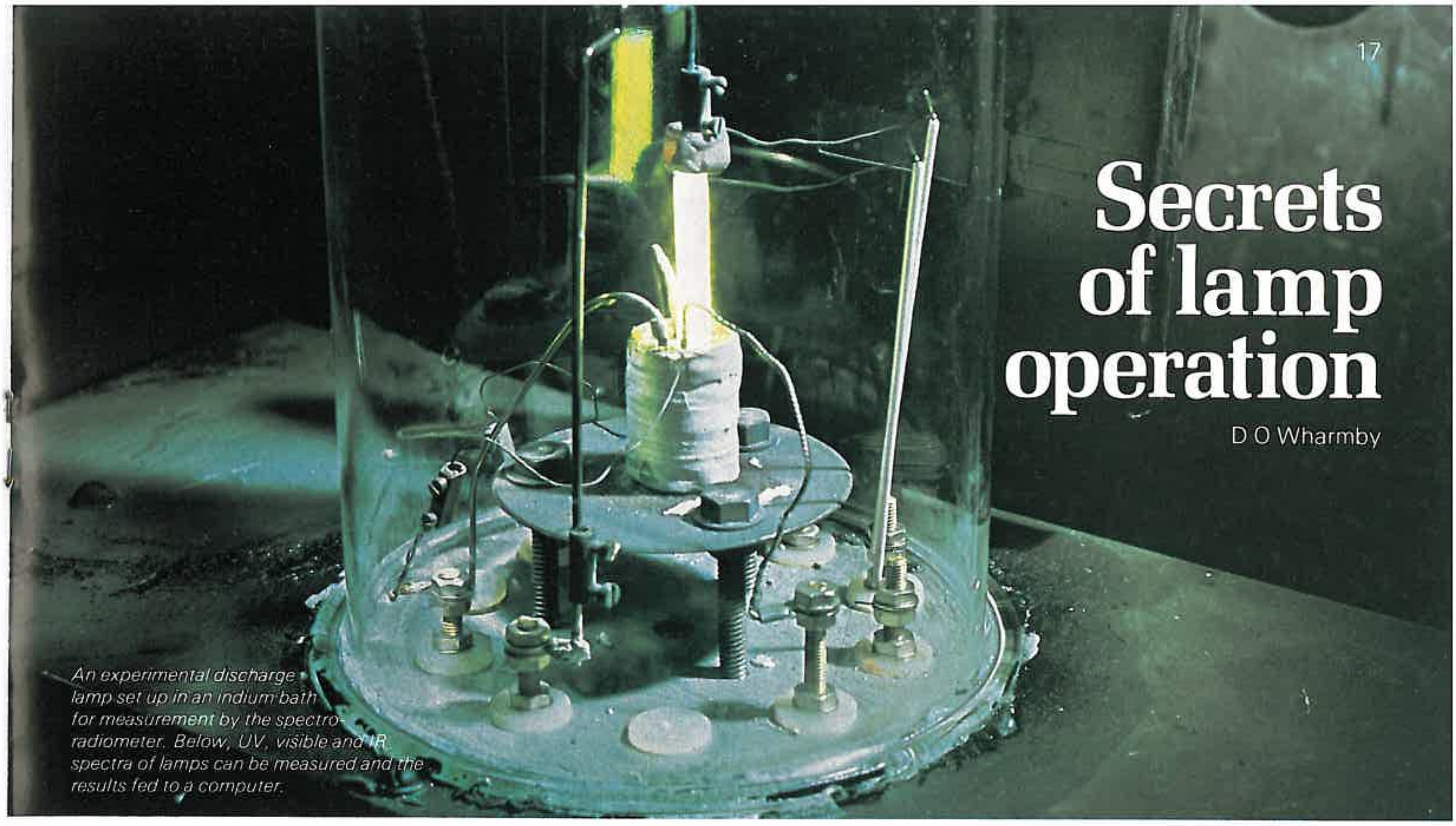



*Two views of the Festung rising above the towers and spires of the city. No lighting equipment could be mounted on the slopes of the mountain on which it is built.*



The problem was solved by the use of 8 Thorn CSI 1000W sealed-beam lamps in OM1000C housings. These mounted inside the lunettes below the cupola concentrated their light on the walls of the Festung with remarkably little spill. The restauranteur's customers were again able to enjoy the view from the terrace, the Festung itself was shown to even better advantage, and the electrical load was actually reduced.

The installation was planned and executed under the supervision of the City Engineer Herr Ing Behensky, acting in close collaboration with Herr F Brigg, the managing director of Thorn (Austria) Ltd.



# Secrets of lamp operation

D O Wharmby

*An experimental discharge lamp set up in an indium bath for measurement by the spectroradiometer. Below, UV, visible and IR spectra of lamps can be measured and the results fed to a computer.*

*In this article, the first of a series, Dr Wharmby describes some of the equipment used to discover exactly what is happening in the discharge tube of a metal halide or a high-pressure sodium lamp. Much of the complicated equipment described is designed and made in the Lamp Research Laboratories themselves.*

*Dr Wharmby is Head of Discharge Lamp Research at Thorn Lighting's Research and Engineering Laboratories, Leicester.*

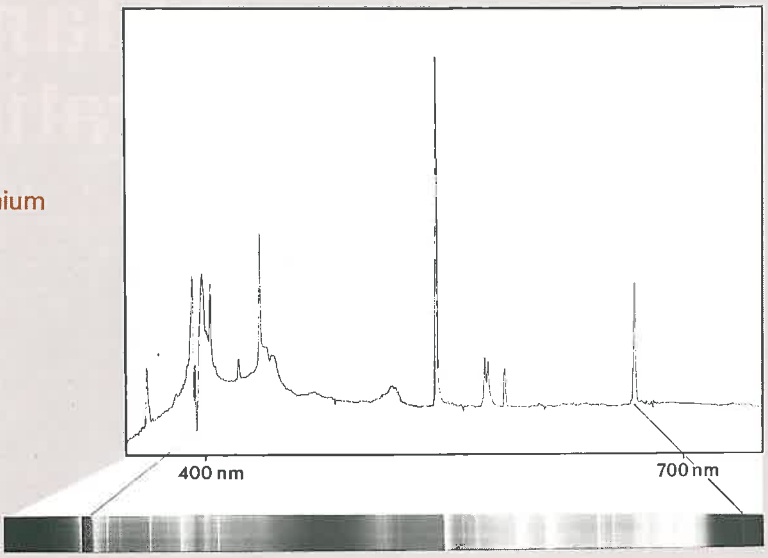
High-pressure discharge lamps have long been important sources of light. Today they are at the forefront of the intensive developments in light sources. Examples of comparatively recent developments are the SON (high-pressure sodium) lamps used principally for street lighting and MBIF (a high-pressure discharge in the vapours of sodium and scandium iodides) used for interior and exterior lighting. Active research and development continues on newer types of high-pressure discharge with the aim of improving efficacy and colour rendering still further.

All high-pressure discharge lamps have certain features in common. The operating pressure is usually in the range 1-10 atmospheres and the wall of the cylindrical alumina or silica discharge tube is at 800 to 1200° C. Moving towards the centre of the tube from the wall, the temperature increases very steeply until at the centre the gas reaches temperatures between 4000 and 6000° C. This hot gas is highly luminous and produces the light which we want.

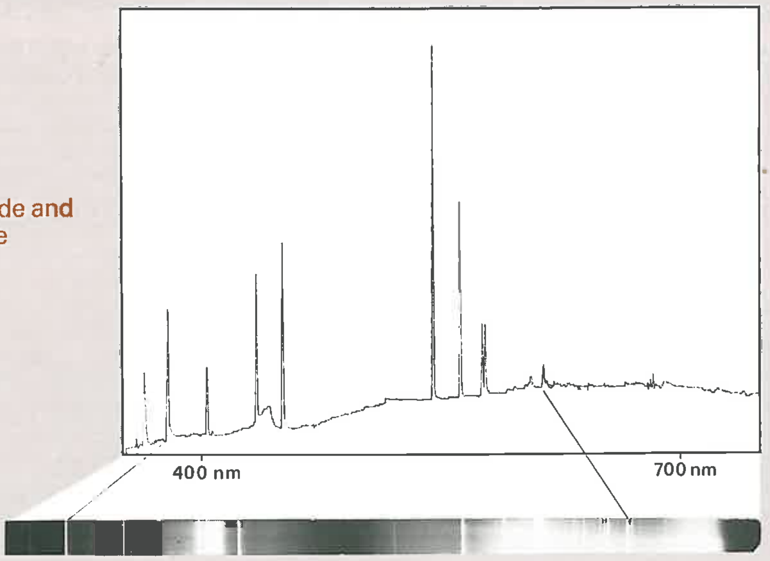
Research and development on high-pressure discharges means discovering ways to increase the amount of light and to improve its quality. The starting point is to measure and understand the properties of the hot luminous gas in the centre of the discharge. Just as

## METAL HALIDE LAMPS

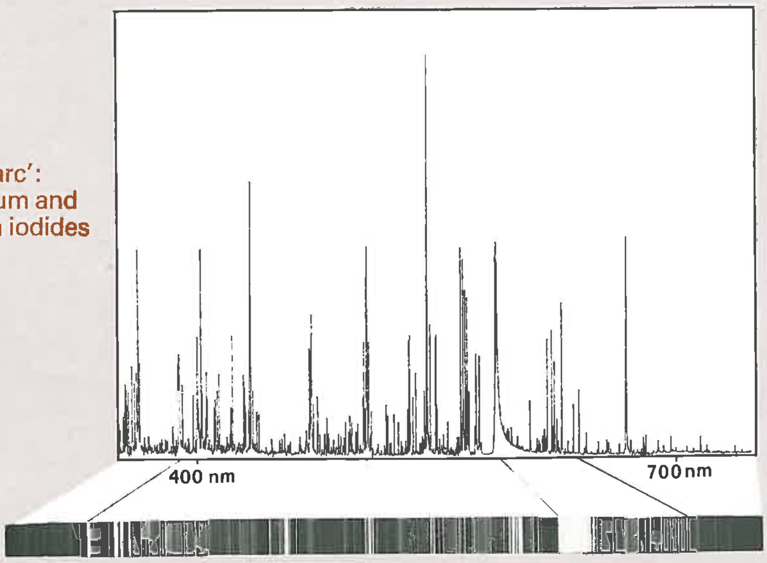
Aluminium iodide




Tin iodide and bromide




'Metalarc': scandium and sodium iodides




*Spectra of Thorn Kolorarc lamps recorded in graphical form by the spectroradiometer, with their spectrograph recording below them. The upper two are continuous and the lower a line spectrum.*

an astronomer learns about the conditions inside a star by observing the radiation from its surface, so we can diagnose the conditions inside a high-pressure discharge by measuring the light which comes out.

Unlike the astronomer we are hardly ever short of light and we can always do what he can do only part of the time. We split the total radiation into its spectrum. At the expense of some effort, this can tell us a great many facts: what the gas temperatures are, what elements and molecules are present, how they are distributed in the discharge, the colour and colour rendering index, the amounts of UV, visible and IR radiation and many others.

The basis of most of our instruments is therefore some form of spectrometer — an instrument which splits up the light into its spectrum. Complete instruments designed to do exactly what we want are often not available commercially and so we usually build our own.

A spectroradiometer is an essential instrument for the research and development of any discharge lamp. Thorn Lighting have half-a-dozen such instruments of varying degrees of complexity. The spectroradiometer measures the quantity of radiation in narrow wavelength bands. It may cover the visible region or it may extend either side of this region into the UV and IR.

### A measuring technique

One spectroradiometer much used in research and development of new types of discharge lamp is illustrated. (p.17). The lamp being measured is in the darkroom behind the instrument — this is to protect us from the dangerous amounts of UV and ozone emitted by some lamps when measured under experimental condition. Using a small diffuser we reflect the light from the lamp through a hole in the wall into the monochromator in the centre of the picture. This splits the light into its component colours. Three different radiation detectors (on the right) measure the amounts of radiation at each wavelength in the UV, visible and IR regions. The resulting signals have to be corrected by calibrating the instrument with a standard lamp. For high accuracy we do this correction by computer, after recording the data on magnetic tape cassettes (on the left). The complicated electronics in this instrument were designed and built in our laboratory.

We use the computer to plot the spectrum of the lamp (see graph on p.19), and to calculate such quantities as chromaticity, colour rendering index, permissible exposure to UV sources and the distribution of power among broad spectral bands.

In addition to its use in investigating complete lamps, our spectroradiometer is also used for investigating lamps in a highly experimental stage. At the top of p.17 can be seen such a lamp set up in the darkroom ready for measurement by the spectroradiometer. Here the temperature of one end of the lamp is controlled by dipping it into a bath of molten indium at a fixed temperature. This controls one of the major variables in a high-pressure lamp — the pressure of the vapour above the chemicals inside the discharge tube. When developing new ratings of existing lamps, for example our 70W SON lamp, this technique permits optimization using a relatively small number of experimental lamps. When developing new types altogether, for example metal halide lamps containing complex halide molecules such as NaA1C1 , spectroradiometer measurements made with the lamp in an indium bath play an important part in making sensible comparisons between the vast number of possible metal halide doses.

**Information from spectra**

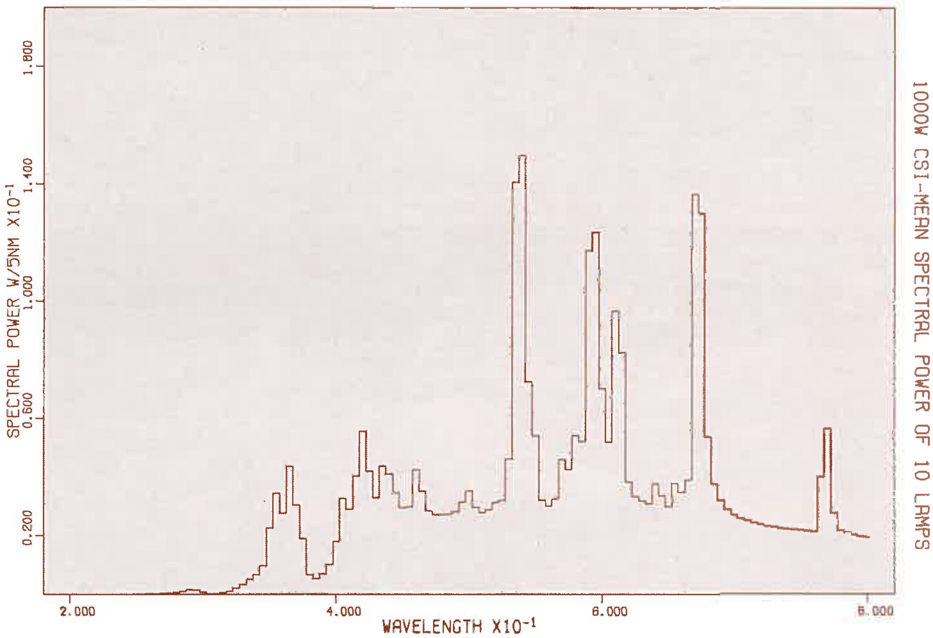
The spectra of some metal halide lamps consist of many fine spectral lines close together. This may be because the radiation comes from atoms with complicated atomic structure or from molecules. In both cases the first task is to identify the source of the radiation. For this purpose we record the spectrum on a photographic plate using a spectrograph. The graphs on p.18 show the result of measuring lamps using the spectrograph and the spectroradiometer. The much greater detail which can be obtained from the former is a great aid to identifying the source of the radiation and the major metal impurities. An extension of this technique permits the identification of certain gaseous impurities (nitrogen, hydrogen etc.) which may get in by accident.

For more detailed information about the conditions of temperature, pressure and chemical composition inside the discharge we go to another spectrometer. Instead of measuring the radiation from the whole lamp as we do with the spectroradiometer, we measure the radiation from discrete areas of the surface of the discharge. The illustration shows the equipment used. Light from the lamp (centre) is imaged by a lens on to the spectrometre (top right). The base on which the lamp is mounted is driven by a motor so that the image of the lamp moves across the spectrometer entrance slit. The resulting information comes out on the chart recorder. After a lot of calculation this information gives the temperature of the luminous gas and details of the chemical composition of the gas in the discharge tube.

This sort of measurement is of key importance at both ends of the research and development chain. For example, it can help us to understand the vaporization of complex halides in new types of halide lamp, or it can help in the control of colour spread in lamps already in production.

I have described three of the methods which we use to diagnose the properties of high-pressure discharge lamps. The spectroradiometer is used to find out how the radiation is distributed in the spectrum, the spectrograph is used to identify the atoms and molecules emitting the light. The third spectrometer, tells us where the light comes from in the discharge, and what the physical and chemical conditions are in the hot gas. The use of these instruments to give measurements which make sense requires a high degree of technical skill and a deep understanding of how radiation is emitted from discharges.

*A spectrometer for measuring the temperature and chemical composition of the luminous gas in a high-pressure lamp is shown below: above it is the UV, visible and near IR spectrum of a Thorn compact-source lamp measured on the spectro radiometer and plotted by computer.*




# Some solutions to structural and ceiling problems

**Two solutions to structural problems**

In Trumans new offices in Brick Lane, London, *left* special luminaires based on the Thorn 2ft Format fitting, are recessed in the structural ceiling coffers. Each luminaire houses four 2ft 20W white tubes over an aluminium louver and incorporates an acoustic panel and a temperature sensor for fire detection. The architects were Ove Arup and Partners, and Electrical Contractors Duncan Watson.

Below is one of the very large open plan offices of the Scottish Widows Fund and Life Assurance Society at Edinburgh. The hexagonal construction of the structural frame of the building, clearly shown in our cover picture, necessitated the design of special luminaires. More than 7 000 Natural tubes in single — tube louvered luminaires, adapted for air handling, provide an illuminance of 700 to 800 lux in office areas such as this. Gear trays and louver assemblies can be located anywhere on the extruded aluminium trunking, supported by brackets on the structural members of the building.

Architects were Sir Basil Spence, Glower and Ferguson, structural engineers Ove Arup and Partners, electrical contractor, Balfour Kilpatrick.

**Two Programme 2 Installations**

The two installations illustrated opposite differ widely both in size and technical content. The central area of the ceiling of the Directors Dining Room on the 5th floor of Compair's offices at Slough consists of sixteen 1200 mm modules containing moulded coffers, each housing a New Format luminaire with an air-handling optical controller. This is the sort of small job for which standard Programme 2 components can be used to give a luxurious finish at a reasonable cost.

In contrast to this modest scheme the refurbished office block of Brittania Investments Ltd, Oyez House in Fetter Lane, had well over 3000 square meters of floor space to be lighted. When Programme 2 was specified it soon became apparent that it would have to be modified to fit the 1000 mm module decided upon

by the architects, but the size of the job justified the extra work and cost involved.

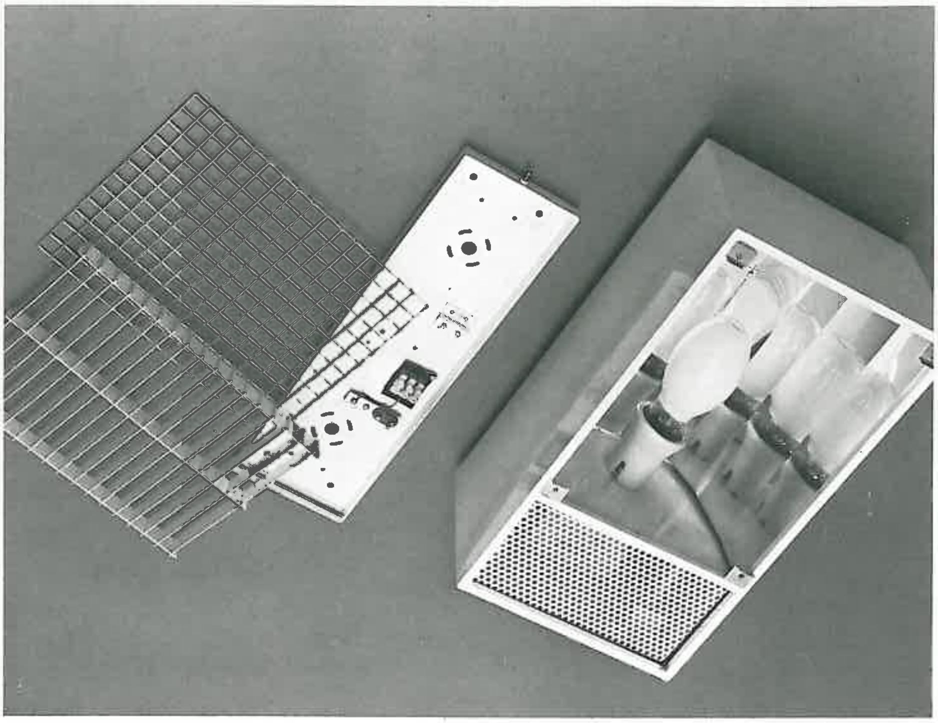
Special ceiling infills and other components were designed so that the Carlyle Moduline Air Diffusers could be incorporated in the grid. These Moduline units assembled in long lines replaced a number of Programme 2 main tees. The production of a Carlyle Moduline extrusion compatible with the Programme 2 grid is now under consideration. Another complication was that the orientation of the Programme 2 main grid changed direction when adjacent to the windows.

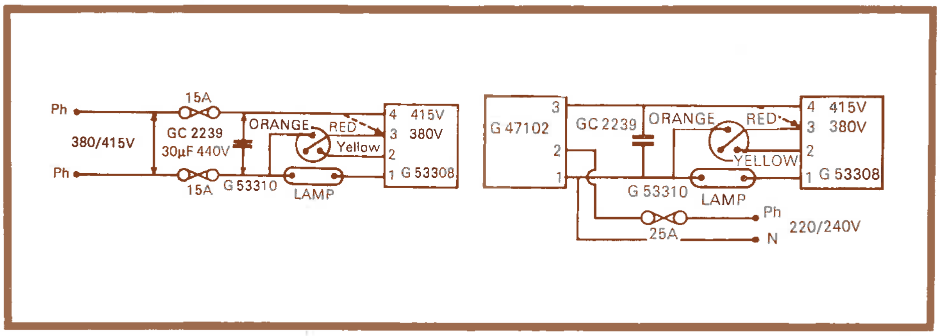
Exhaust air was handled over 1000 standard New Format luminaires housing twin U-tubes above moulded opal controllers.

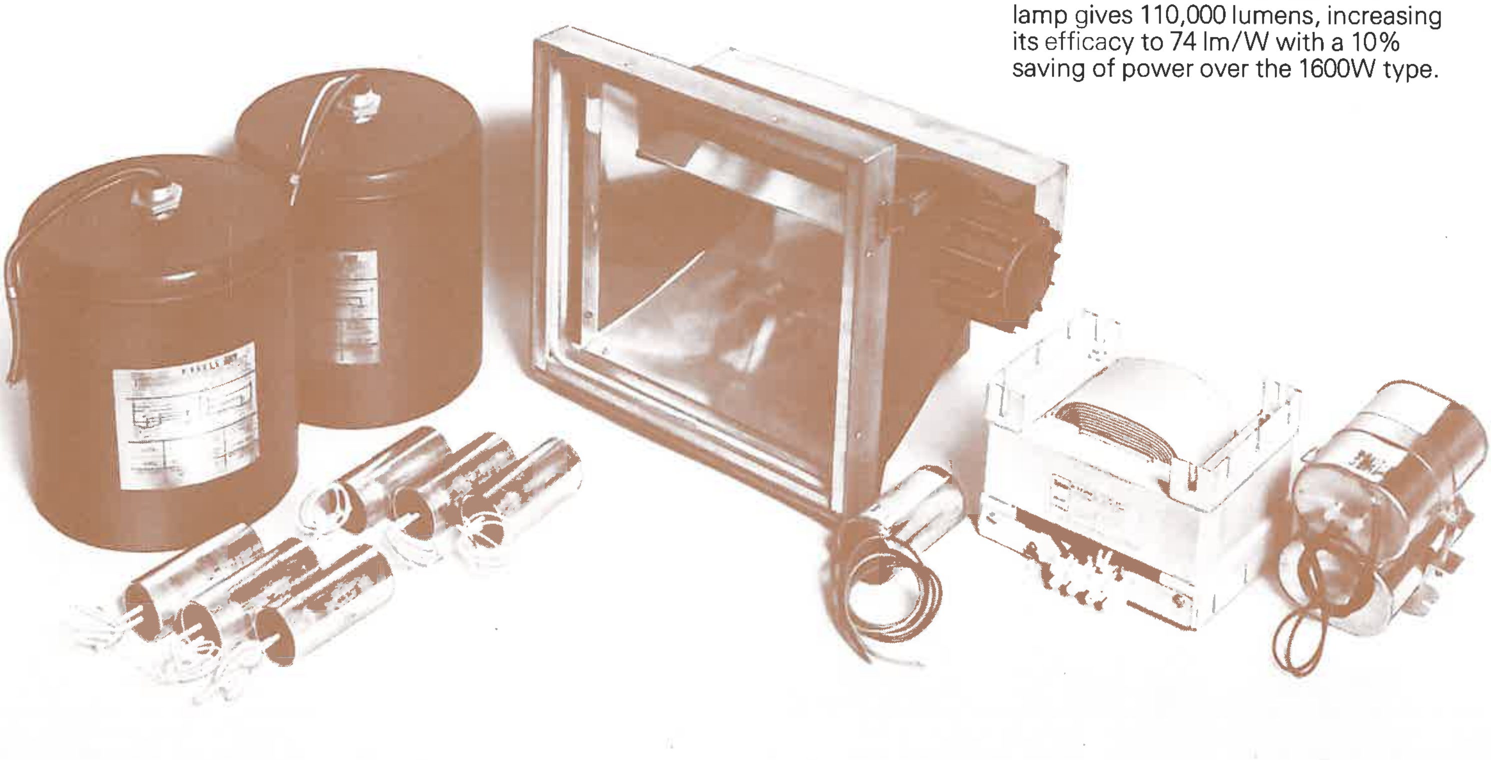
In spite of having to produce 17 different grid components instead of the eight or nine needed in the standard system, the job was completed within ten months of the first delivery in January 1976.

The architects were: Hume Chadwick & Partners, consultants Lawrence Oliver & Partners, electrical engineers William Steward & Co. Ltd., and ceiling contractors A G Stringer.

# Small is beautiful





**The "Lo-pak" surface mounted luminaire**

This new luminaire is designed to accommodate the three types of 250W high pressure discharge lamps, merely by using the appropriate control gear. By mounting the lamp horizontally and enclosing the gear at one end of the fitting, the overall depth is kept down to 224mm, making it suitable for ceilings as low as three metres. The luminaire is easy to install and takes up much less space on the ceiling than a fluorescent luminaire giving equivalent light output: for example one Kolorarc lamp can replace four 6ft 75W "Natural" tubes, giving the same illuminance with 50% saving in power. A white painted metal louver is supplied for commercial situations and a steel wire guard for industrial applications where there is danger of mechanical damage to the lamp.

The mounting plate is first fixed to the ceiling and the main body offered up to it and hooked in position while the electrical connections are made, saving time and effort in installation.

**Gear for the 1500W MBIL Lamp**

A considerable technical advance has been made in the development of the control-gear for the new 1500W linear metal halide lamp, which is designed to replace the 1600W type in the ON 1600 floodlight.

The 1600W lamp requires two large cylindrical chokes and six capacitors, with a total weight of around 46 kg: the new lamp uses a choke and ignitor with two capacitors when operated between phases as in the diagram on the left; if wired between phase and neutral a transformer is added. The total weight is reduced to 13.8 kg and both initial and wiring costs are reduced. The 1500W MBIL lamp gives 110,000 lumens, increasing its efficacy to 74 lm/W with a 10% saving of power over the 1600W type.

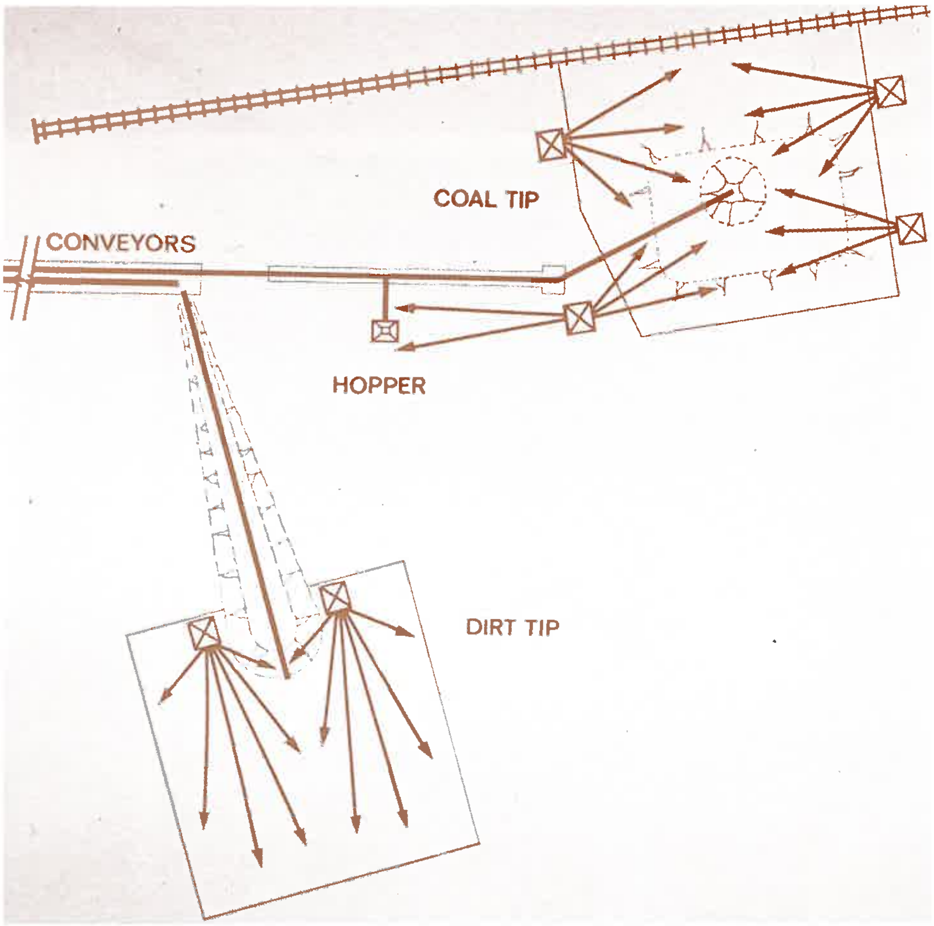
# NATIONAL COAL BOARD
## Betteshanger Colliery

Paul Barton

*Mr Barton who planned the installation is now a sales engineer in Thorn's International Lighting Division.*

# Black power

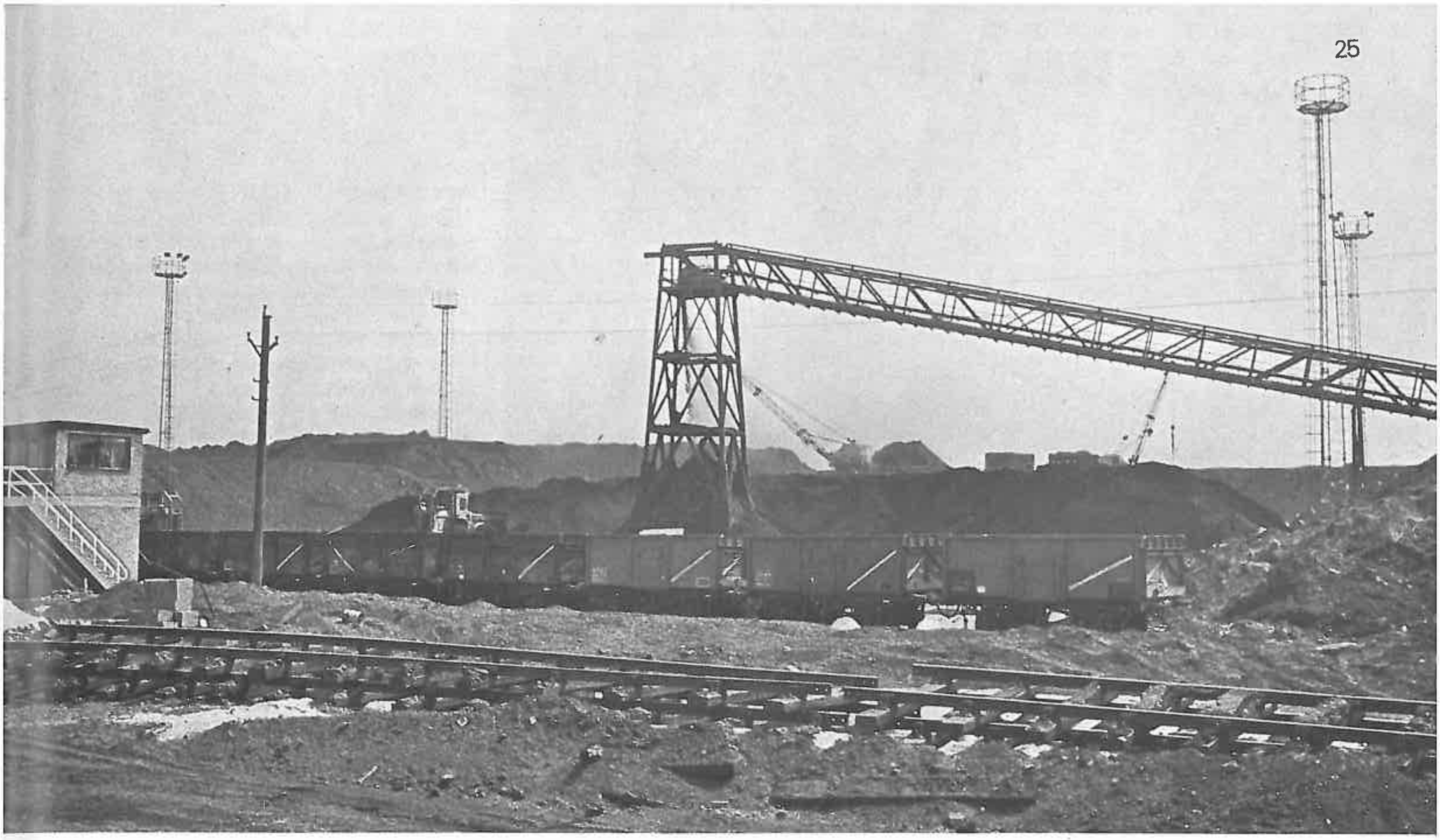
*The plan below shows the arrangements of the coal-tip and refuse tip, the conveyor belts which feed them and the positions of the lighting towers. The railway siding can be seen at the top of the plan.*




Betteshanger Colliery, near Deal on the East Kent Coast, was one of the earlier of the Kentish pits and a few years ago it seemed likely that it would be closed down, but it was decided instead to modernise its machinery and thus make it a viable proposition.

The Kentish coalfield came into being early in the present century and great care was taken to avoid the creation of the great slag-heaps which are so prominent a feature of older coal-mining areas. Betteshanger was no exception and both the coal and the waste had to be disposed of as unobtrusively as possible. Initially they were sorted by hand at the pithead and then loaded on to trucks which carried them down a light railway to two tips, sited in a disused chalk quarry, from which they were loaded on to railway wagons or lorries for disposal. Today the sorting is done automatically, though still at the pit-head and two conveyor belts occupy the cutting formerly used by the light railway. At this tip, the conveyors separate, one carrying the waste southward and the other continuing on the same line to deliver the coal to a hopper and a loading area served by a railway siding and with access for lorries.

*The misty conditions which frequently occur so close to the coast necessitate very powerful floodlighting equipment; the pictures show how effective this is. The small picture shows the waste tip under construction, before the cladding of the conveyor belt.*



The whole of this process is automatic and the size of the tips is monitored by closed-circuit television cameras mounted at 12 m above the ground on the sides of the two terminal conveyors, and reporting to the pit head. Since the area is used both night and day, a floodlighting scheme is necessary, and this had to be designed to provide enough light (approximately 150 lux) for the television cameras to operate successfully.

It might at first appear that to light the virtually non-reflective surface of a coal-tip presented an almost insuperable problem, but in fact, it was the size and shape of the heap that was to be discerned, and not the surface detail, so that the lighting equipment had to provide predominantly vertical illumination. Careful siting of floodlight projectors (as shown on the plan) mounted on 17.5 m towers produced the desired effect, but a number of other factors affected their positioning.

**Coal Tip and Dirt Tip**

As will be seen from the plan, the coal tip, which is the larger of the two, is lit from two sides, the positioning of the towers being largely determined by the proximity of the railway siding. It was realised that a very tightly controlled beam with a sharp cut-off above the horizontal was necessary to avoid lens flare, and the Thorn ON 1600 floodlight housing 1600W linear metal halide lamps was selected. These lamps, with an efficacy of 72 lm/W would give the required illuminance, concentrating the light on the steeply sloped sides of the tips so that their shape could easily be seen on the television screens and reducing glare from the two towers facing the cameras to the minimum. The dirt tip is always kept smaller than the coal tip, so that only two towers were required and their siting was rather less critical.

An absorption factor of 15% was assumed to take into account the atmospheric losses caused by air-borne dust and the sea mists which are common in this area. Some of the photographs illustrate these conditions. A total of fourteen floodlights mounted on four towers were required to light the coal-tip. Each tower also carried a 1 kW tungsten halogen lamp in a Haline floodlight to provide standby lighting, which although producing very much lower illuminance than the main lighting is adequate for emergency operation. Extra lighting from 400W metal halide lamps in semi cut-off street lighting lanterns is situated between the coal-tip and railway sidings to provide adequate light in this area. The total loading of the scheme is only 62 kW.

The scheme was designed by Thorn Lighting engineers in close collaboration with the consultant engineers, Messrs. Leonard & Partners and has now been operating satisfactorily for about a year.

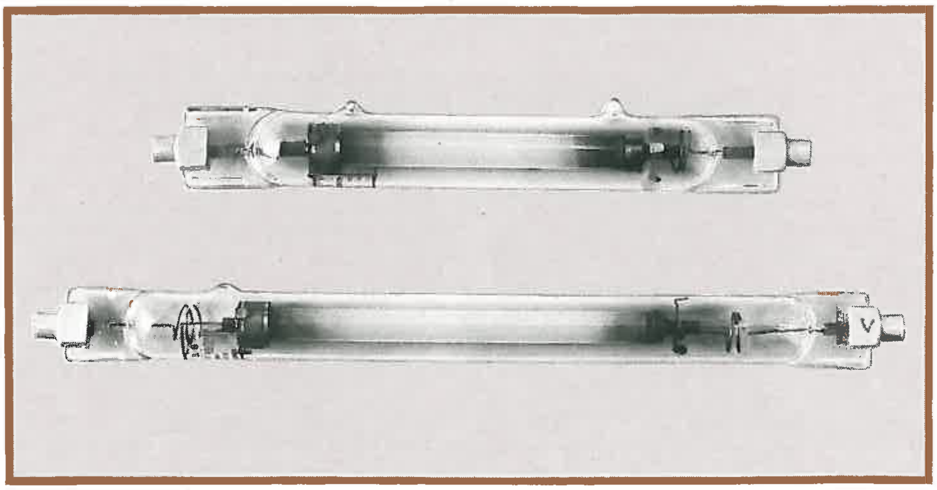
Top *A view of the erection of the floodlighting towers, while, below, is a detail of the conveyor belt on the site of the old light railway, before it was enclosed.*

# SONline; the lamp for area floodlighting

B J Cannell

*Dr Cannell is Leading Engineer responsible for Sodium Lamp Development and Engineering at Thorn Lighting's Research and Engineering laboratories at Leicester.*

*Linear sodium lamps are used both for industrial and decorative floodlighting. Above can be seen the "Gothic Warehouse" at Ironbridge, Salop, lighted by two 400W floods in Haline projectors mounted on the parapet. The windows contain three PAR 38 lamps mounted on track. Below can be seen the new 250W SONline lamp compared with the 400W lamp.*



## Introduction

Due to its high efficacy when compared to the mercury discharge lamp and its better colour rendering properties when compared to the low pressure sodium lamp, the high pressure sodium lamp has had a considerable impact on lighting practice over the last few years. Although it was limited at first to replacing the 400W mercury lamps in street lighting lanterns and industrial high-bay fittings, following the introduction of the 250W lamp, its use was extended first to area floodlighting and then to many other applications, ranging from lighting offices and public buildings to swimming baths and gymnasia and even churches. Now, the introduction of the 400W and 250W double-ended SONline lamps, specifically designed for floodlighting, has opened new possibilities in this very important field.

## Lamp Design

The 250 and 400W lamps are shown below. Each consists essentially of a conventional alumina arc tube sealed inside a quartz jacket, the space between the two being filled in this case with an inert gas and not enclosing a vacuum as in the case of most SON lamps. The introduction of this inert gas into the lamp "outer" increases lamp life and improves lumen maintenance as it lowers the alumina arc tube temperature in its central region and reduces staining of the quartz bulb.

Because the narrow quartz-glass sleeve does not give the same protection as the large outer bulb, the lamp must be operated in an enclosed floodlight and this has led to a considerable advance in design technique. The lamp is run at its rated watts in a housing specially designed to give optimum performance by making use of the radiant heat from the reflector to raise the lamp volt-drop. This effect has been allowed for in the design of the lamp, which consequently will not operate at the correct value in free air. The new lamps can be used in the standard 'Haline' floodlights designed for tungsten halogen lamps as their overall lengths are precisely the same as the 1000W and 1500W double ended tungsten halogen lamps. The length and cap are internationally standardised so that the lamp can be used in any suitably designed tungsten halogen luminaire.

## Colour

Like that of the conventional KolorSON lamps, the light from the SONline is of a pleasing golden white colour which resembles that of a black body at 2100 K. This colour has been recommended by the Department of the Environment to be used for public lighting in conservation areas. The effect on human skin is quite pleasant and although reds and blues are not given their full values, colours are readily distinguishable and most people find the "warm" appearance of the light attractive. Where accurate colour rendering is the main criterion, rather than high light output, metal halide lamps or fluorescent tubes provide a satisfactory alternative.

**Starting and Operating Characteristics**

External starting using a high voltage pulse applied by an ignitor which ceases to function once the arc has struck simplifies lamp construction, ensures immediate striking and is very reliable. If necessary the control gear box can be mounted up to 30m from the lamp housing. The lamp takes 4 to 5 minutes to run up to full brightness and will normally restrike within 1 minute of extinction rapidly regaining full light output. This is a very important factor and is a considerable improvement on the restriking times of mercury discharge lamps. Lamp starting is not affected by ambient temperatures down to -40° C.

The lamp operates in the horizontal + 20° position but tests to date suggest that it will ultimately be universal burning. Lighting design lumens are the same as for the 250W and 400W SON/T, i.e. 25,000 and 46,000 respectively.

**Life and Maintenance**

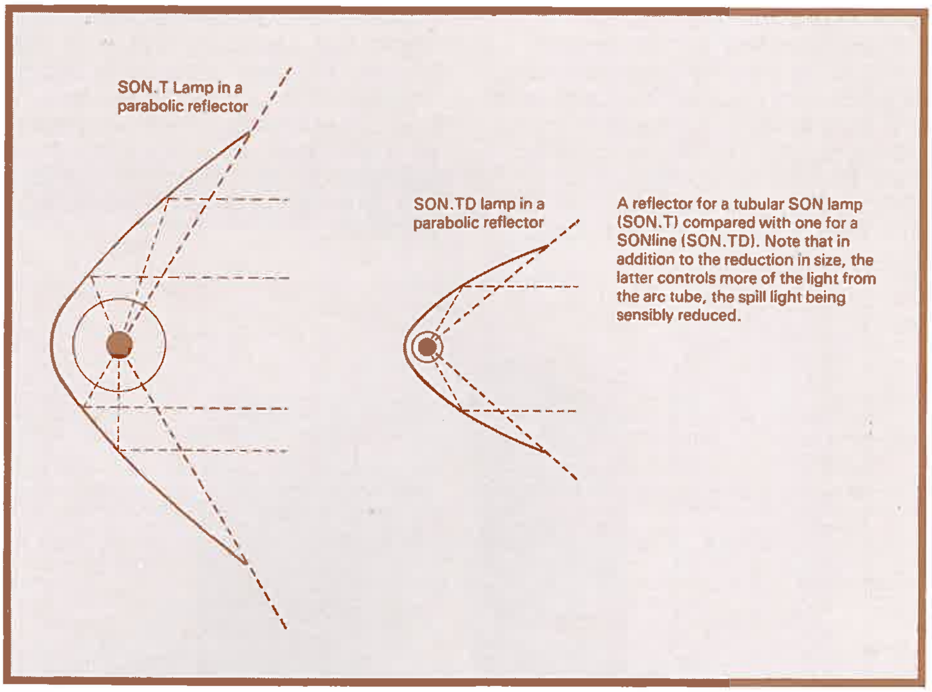
The life performance of SONline lamps is similar to that of the conventional high-pressure sodium lamp in both reliability and maintenance, that is 90% survival and lumen maintenance at 6000 hrs, under normal operating conditions. In an installation at Thrybergh Steel Works, Rotherham, operating 24 hours a day, over 90% of the lamps have survived for 10,000 hours.

This excellent performance is the result of attention to three major factors:

1. The reduction of the alumina arc tube temperature by the use of an argon inert gas filling between the arc tube and the outer quartz jacket instead of vacuum.

2. The use of non-evaporable getters instead of the conventional barium flash getters. eliminates a rather complex and subtle process involving the release of photo-electrons from the barium by ultra-violet light from the arc tube. This would lead to the electroyltic diffusion of sodium ions through the alumina and subsequent failure of the arc tube.

3. Further reduction of the arc tube temperature by the use of larger diameter tubes than used for standard 250/400W SON lamps.




*The smaller the outer bulb the nearer the light-source can be brought to the reflecting surface and the smaller can be the reflector. Savings in weight and windage can obviously be made, and the Light Output Ratio of the reflector improved.*

**Applications**

The major application of SONline lamps is in floodlighting and area floodlighting. The lighting of an area normally necessitates the use of luminaires having wide horizontal spreads and very controlled vertical beams, to avoid glare to onlookers or loss of light into the sky. Since the reflected light should be so controlled that there is an effectively even illuminance from the luminaire to the most distant point being lit, close control of the beam can only be achieved by concentrating the light-source at the focus of the parabolic reflector of the floodlamp. Most conventional floodlights achieve this by using a very large reflector, but this creates windage problems. The advent of the linear tungsten halogen lamp sparked off considerable advance in the design of floodlights, allowing a far more compact design, less than a quarter the size of a conventional floodlight of the same wattage. The new linear high pressure sodium lamp has similar dimensional characteristics, allowing very close control of the beam in the transverse axis and a wide spread of light in the horizontal plane, a suitable arrangement for an area floodlight. The long narrow arc tube can be mounted much closer to the reflector than if it were enclosed in a wide cylindrical bulb. In addition, the light output of the 400W is 39% higher than that of a 1500W linear halogen lamp and it has three times the life.

Two types of luminaire specially designed for use with linear lamps are available in the Thorn range. The first is the 'Haline' range of luminaires, originally designed for tungsten halogen lamps and available in specular or matt reflector finishes. The one piece reflector body is extruded in aluminium to form an asymmetric facetted reflector of parabolic cross section. This construction gives rigidity and accuracy of profile leading to a consistency of optical performance. The specular unit is designed to give an asymmetric light distribution which will give effectively even illumination for the majority of area lighting applications. In areas requiring a wider distribution the diffuse reflector luminaire can be used.

**Stadium Floodlights**

The second luminaire which uses the 400W lamp is the ON 1600 stadium floodlight. This unit is designed to give an asymmetric distribution together with a very sharp cut-off above the peak. This characteristic makes this unit suitable for applications where the strict control of glare is an essential requirement and it has been used in this type of floodlight for long distance floodlighting of industrial plant.

**Lamp Economics**

If at first glance the economics of the SONline lamp when compared to its equivalent tungsten halogen do not look very attractive due to the higher initial cost of lamp and control gear, the increased light-output of the 400W (39%), and the 250W (19%) should be borne in mind. In running costs the new lamps have a distinct advantage, especially where the cost of current is high, as it is in the United Kingdom. This can readily be seen from the accompanying pillar-graphs, all of which are based on a lamp operating for 4000 hours per annum and electricity charges of 2.5p per kW hour.

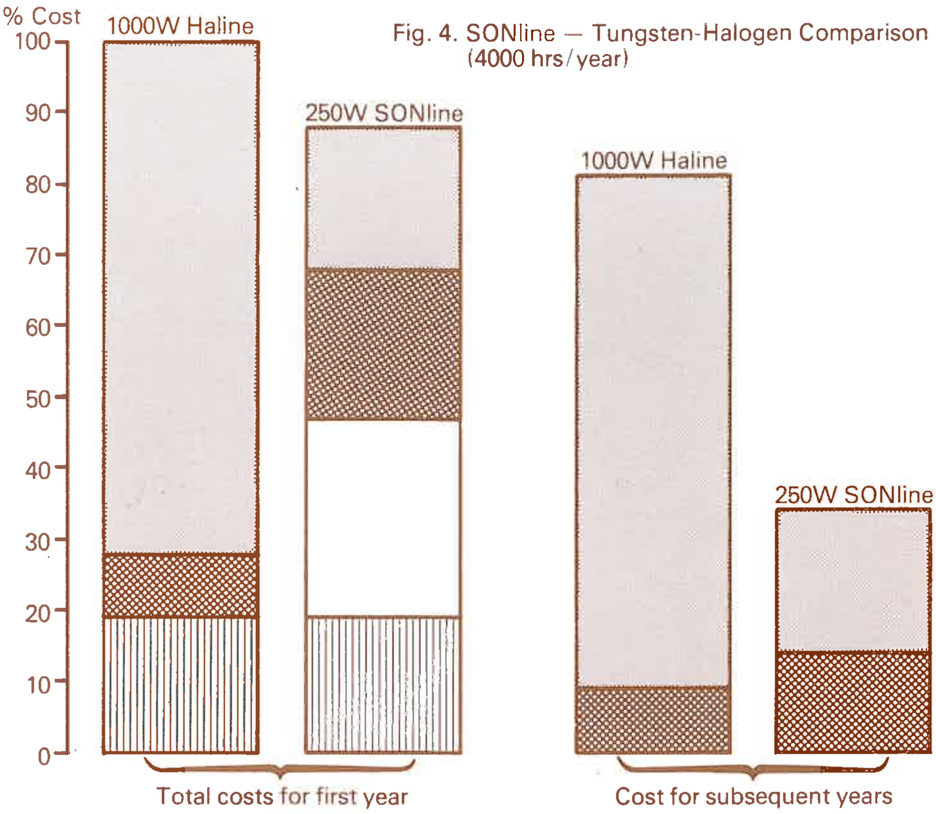



Fig. 4. SONline — Tungsten-Halogen Comparison (4000 hrs/year)

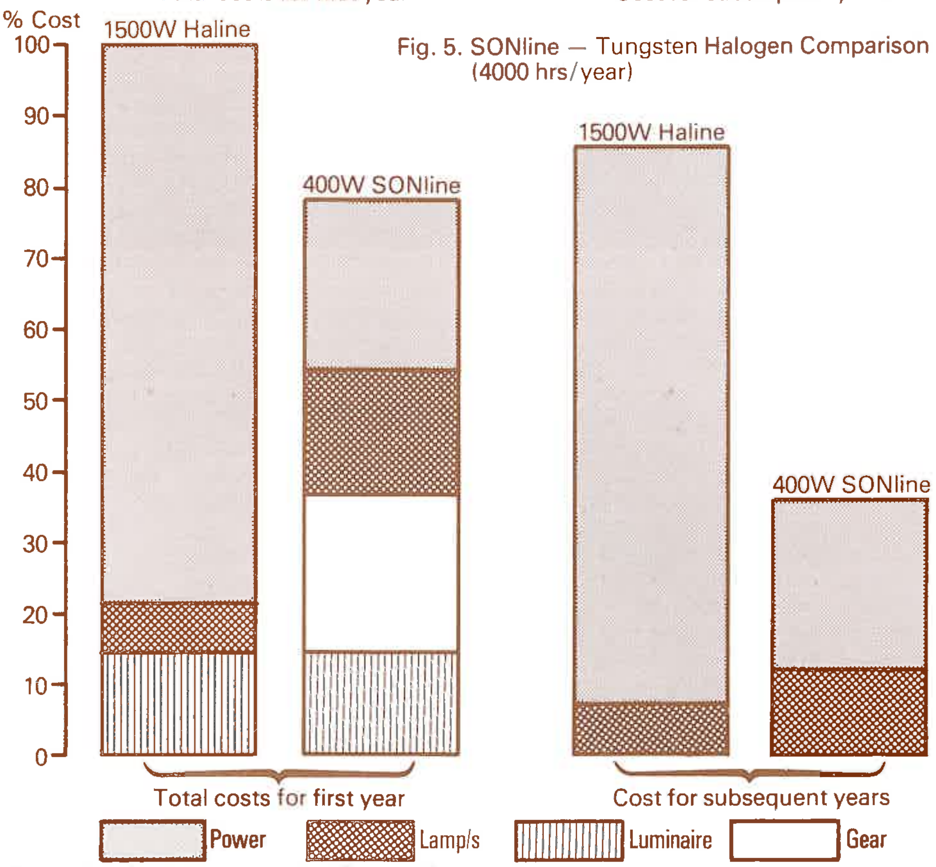



Fig. 5. SONline — Tungsten Halogen Comparison (4000 hrs/year)

*Economics of tungsten halogen and linear sodium lamps compared.*

It will be seen that if the total cost of a 1000W tungsten halogen lamp in a 'Haline' floodlight plus the cost of current and one lamp replacement for a single year is taken as 100%, the power consumed accounts for 72% of the total expenditure; the two lamps costing about 10% and the floodlight the remaining 18%.

This is compared in the second column with a similar floodlight using a 250W SONline lamp and control gear. The cost of the floodlight remains the same, but that of lamp and control gear is about 49% of the original total and the cost of current only 20% of it, so that the total cost of this arrangement is 88% of the original.

**Running Costs**

Annual running costs for subsequent years are still more favourable. If that of the tungsten halogen lamp is taken as about 81% of the first year's figure, that of the SONline, because of the reduced current consumption, is only in the order of 35%.

A similar case can be made for the 400W SONline compared with a 1500W tungsten halogen lamp. The power consumed by the latter in the first year is about 78% of the original total, but that taken by the SONline is not more than 25% and the annual figures after the first year are comparable with those already quoted. It will be seen too that further savings will also be obtained due to less maintenance as these new lamps have a rated life of 6000 hours and this will mean fewer lamp changes. Therefore it can be said quite conclusively that both lamps will easily pay for themselves in the first year with substantial savings in subsequent years.

In conclusion it can be seen that in an era where power consumption on a world-wide basis is becoming more critical we have a new lamp design, the SONline, which will have the following gains over their equivalent tungsten halogen lamps.

| | **250W** | **400W** |
|---|---|---|
| 1. More light | + 19% | +39% |
| 2. Savings in power consumption | 71% | 70% |
| 3. Increase in lamp life | x 3 | x 3 |

It appears that in any situation where colour is relatively unimportant, or where an instantaneous flood of light is not required, the SONline lamp is likely to be first choice for area floodlighting.

# Dans cette édition.

**EN GRANDE-BRETAGNE ET À L'ÉTRANGER** ¼
*W K Lumsden et W D Tyrrell*
La société Thorn Lighting met à la disposition de ses clients étrangers et britanniques un service d'études des plus complets. Il se peut cependant, qu'en raison d'une administration à distance et d'un manque de contact direct avec le client, le Service Conseil de International Lighting (LAD) — bien que de structure semblable à celle du Service Technique de Lighting (LED) ait à faire face à un établissement des dossiers incomplet ainsi qu'à des difficultés de langues, sans oublier les obstacles que présentent la variation des voltages, fréquences, et les normes de sécurité et d'éclairage propres à chaque pays.
LED et LAD sont composés d'effectifs parfaitement entraînés, c'est-à-dire d'ingénieurs en éclairage qualifiés, dont certains sont des experts dans un domaine particulier de l'éclairage. Ils bénéficient du soutien des ressources techniques de la société, et ont libre accès aux ordinateurs ainsi qu'aux laboratoires de recherche.
Il est impérieux que dans un champ de travail déterminé, la tâche visuelle soit supportée par une qualité et une quantité appropriées de lumière; ce qui ne veut pas dire que l'éclairage environnant soit de moindre importance. Il faut en fait assurer un parfait équilibre entre la luminosité de la surface de travail et la surface environnante et éviter toute brillance directe ou réfléchie, phénomène que seul peut réaliser un ingénieur qualifié, en possession de tous les faits nécessaires et de toutes les données photométriques relatives aux luminaires publiées dans les Livres de Références Photométriques de Thorn.

**AMÉLIORATIONS DES LAMPES À AURÉOLE DES MINEURS** 6
*D Brown*
Les premières lampes à auréole de mineurs avaient été conçues pour projeter une lumière diffuse sur le front de taille du charbon, mais l'ère de la mécanisation a obligé les mineurs à se tenir à des distances plus éloignées de la surface de travail et dans des conditions atmosphériques beaucoup plus poussiéreuses. On substitua alors ces premières lampes par un réflecteur spéculaire afin d'obtenir un faisceau plus concentré, mais la position des filaments dans l'ampoule remplie de Krypton de 18mm de diamètre demeura la même. La focalisation manuelle précise s'avéra difficile et doublement problématique du fait qu'elle devait se faire à partir de l'avant du réflecteur. En fait, elle n'était effective que dans l'axe linéaire et un filament à la limite de la tolérance axiale de 1mm pouvait réduire l'intensité de pointe de 50%.
Les ingénieurs d'éclairage de Thorn collaborèrent étroitement avec les fabricants de lampes à auréole pour en améliorer l'exécution, en basant la nouvelle conception sur une lampe flash précentrée de 11mm de diamètre. Les résultats se traduisirent par la mise au point d'une lampe remplie de krypton de 1,0 amp 4V, de tolérances plus serrées que celles des lampes précédentes. Elle est dotée d'un culot à précentrage et s'insère par l'arrière du réflecteur, se positionnant automatiquement sur son foyer. Cette nouvelle exécution a été éprouvée et pleinement approuvée par la British Safety in Mines Research Establishment et la Norme britannique 535 1973, définissant les sources lumineuses pour les lampes portatives des mineurs, a été modifiée pour les inclure.
Grâce à sa compétence, l'ingénieur éclairagiste produira les configurations de luminosité désirées sur les surfaces délimitant le champ visuel. Il peut, aussi bien auprès de LED que de LAD, faire appel à l'expertise de ses collègues ainsi qu'à celle du laboratoire de recherches qui, le cas échéant, effectuera des essais dans les conditions d'utilisation. La société préconise la mise à disposition en faveur de ses clients d'excellents services conseil et technique.

**ILLUMINATION DES CATHÉDRALES DE CONVENTRY ET DE LIECHFIELD** 8
*P Bleasby*
Contrastant avec le bâtiment moderne de Conventry, Liechfield est la représentation type d'une cathédrale gothique anglaise datant du 13ème et 14ème siècles. Ses trois flèches élégantes s'élancent dans le ciel et sa Chapelle absidale de la Vierge repose sous une suite de la voûte du choeur principal.
L'on procéda à un recâblage total, il y a environ vingt ans, lors de l'installation de luminaires suspendus peu efficaces. Les nouvelles illuminations qui y ont été depuis lors apportées ont fait appel à des techniques d'éclairage dissimulé et par projection, en utilisant partout un équipement et des lampes des plus standards.
Le choeur et la Chapelle de la Vierge sont éclairés par des "luminaires sourds" réglables de 150W, cachés derrière les claires-voies, avec projection d'éclairage supplémentaire sur les stalles. Un spot, de faible tension, monté sur la rangée de claires-voies illumine la Croix de l'Autel.
Des lampes halogène au tungstène de 300W, tension secteur, qui se présentent dans des projecteurs "sunspot" ont été installées dans les triforia de la nef et dans les transepts, éclairant le nef à travers de l'église. Un éclairage spécial a été prévu dans l'extrémité ouest de la nef où ont lieu les concerts. L'autel de la nef, la chaire, le trône épiscopal et une imposant triptyque que l'on peut apercevoir dans la Chapelle de la Vierge bénéficient également d'un traitement specialisé.
Un éclairage indirect des voûtes principales est assuré par des lampes sodium "SONline" montées dans les projecteurs Haline qui sont installés dans le triforium sud de la nef et la rangée de claire-voies du choeur. Grâce à cet agencement, les sombres journées d'hiver se voient illuminées d'un doux éclairage. La puissance installée totale ne diffère pas du projet d'origine, mais l'on peut noter une plus grande luminosité et une absence appréciable de brillance.
Lors de la reconstruction en 1962 de la Cathédrale de Coventry, la nef et le choeur avaient été provisés de 64 lampes «projecteur» 500W dans reflecteurs paraboliques reposant sur des disposatifs noirs à conicité profonde, eux-mêmes montés en groupes de quatre dans le faux plafond. La courte longévité de ces lampes fit qu'elles furent sans tarder remplacées par des lampes de 1000W montées dans des réflecteurs modifiés qui augmentèrent la puissance installie à 64 kW.
Vers l'année 1975, les coûts sans cesse croissants du courant avaient rendu ce système peu économique et il fallut éteindre la moitié des lampes, donnant un éclairage très dispersé. C'est à Thorn que l'on s'adressa pour présenter un projet moins onéreux en faisant toutefois appel aux luminaires existants. Après quelques recherches Thorn mit sur pied un projet utilisant des lampes à l'halogénure métalliques de 400W montées dans 32 luminaires en association avec les premiers réflecteurs, réduisant ainsi la puissance installie de 12,8 kW et améliorant incontestablement l'éclairage de l'ensemble . . . un exploit admirable!

**RECHERCHE AU NIVEAU DU FONCTIONNEMENT DES LAMPES A DECHARGE A HAUTE PRESSION** 17
*D O Wharmby*
Les lampes à décharge à haute pression, qui occupent de nos jours le premier plan des développements, fonctionnent normalement dans la gamme de 1-10 atmosphères, avec une température de paroi de tube à décharge de 800°-1200°C. La lumière est produite par le gaz à une température atteignant jusqu'à 6000°C au centre de l'arc; — la mesure et la compréhension des propriétés de ce gaz lumineux chaud sont des éléments essentiels à la recherche.
Une analyse spectrale de la radiation en provenance de l'arc indiquera les températures du gaz, la nature et la distribution des atomes et des molécules dans l'arc, sa couleur et l'indice de reproduction des couleurs, les proportions de la radiation U.V. visible et de la radiation I.R., et autres.
Un spectroradiomètre, spécialement exécuté pour répondre à cette fonction, mesure la quantité de radiation émise en bandes de longueurs d'onde étroites. Il est possible de placer la lampe dans une chambre noire, prévue derrière l'appareil, afin de protéger le personnel opérant contre toute radiation dangereuse, en faisant appel à un ordinateur pour relever le spectre de lampe et calculer ses qualités. Les lampes provenant de la chaîne de production sont aussi mesurables que celles à l'état expérimental, un bain d'indium coulé servant à contrôler les pressions de la vapeur dans le dernier exemple. On utilise un spectrographe pour mesurer les spectres à lignes extrêmement fines et pouvoir ainsi déterminer si la radiation provient de structures atomiques compliquées ou de molécules. Le spectre est enregistré sur une plaque photographique qui est une aide précieuse à l'identification de la source rayonnante et à la détection des impuretés.
On a recours à un autre spectromètre pour déterminer l'origine de la lumière dans une décharge ainsi que les conditions physiques et chimiques dans le gaz chaud. Il est impérieux que les opérants possèdent une profonde compétence technique et une compréhension extrême des radiations provenant des décharges pour pouvoir manipuler et exploiter ces instruments.

**HOUILLÈRE BETTESHANGER — UN ÉCLAIRAGE HORS DU COMMUN** 23
*P Barton*
L'automatisation du procédé de synthèse du charbon et des terrils, dans l'une des plus grandes houillères de Kent, fait appel à un haut niveau d'éclairement afin que la croissance des terrils puisse être commandée par des télévisions en circuit clos.
Il a été procédé à l'installation de sept tours de 17,5m, portant chacune de 3 à 4 lampes (1600W) halogénure métalliques linéaires incorporées dans des projecteurs ON 1600 Thorn et une lampe halogène au tungstène de 1 kW contenue dans un projecteur Haline pour un éclairage de secours. Ce système fournit, pour une puissance installie totale de 62 kW, un éclairement lumineux moyen de 150 lux projeté sur les côtés des terrils.

**SONLINE — LA LAMPE DE PROJECTION PANORAMQIE** 26
*B J Cannell*
Le champ d'application des lampes à vapeur de sodium à haute pression — vouées à l'origine à l'éclairage des rues et des installations industrielles — s'est considérablement élargi, d'abord sous la forme d'éclairage par projection panoramique puis dans les endroits les plus divers: bureaux, bâtiments d'utilité publique, piscines et même églises. Les types d'ampoule cylindriques et elliptiques d'origine se voient adjoindre désormais une lampe tubulaire à deux sorties spécialement exécutée pour un éclairage par projecteurs.
Bien que du gaz inerte comble l'espace prévu entre la mince enveloppe extérieure à quartz et le tube à décharge, améliorant la longévité de la lampe et la maintenance du lumen, les lampes doivent fonctionner dans des supports enfermés en raison de leur petit diamètre. Leur longueur est identique à celle des lampes halogène au tungstène tubulaires de 1000W et 1500W, ce qui les rend utilisables dans les éclairages par projection 'Haline' concus pour ces dernières. L'aspect des couleurs et leurs propriétés de reproduction des couleurs sont comparables à ceux des autres lampes à vapeur de sodium à haute pression.
Un déclencheur d'impulsion haute tension extérieur assure un démarrage des plus fiables même dans des conditions de basse température. Les lampes mettent de 4 à 5 minutes pour atteindre leur pleine luminosité et se réallument généralement dans la minute suivant leur extinction. Un fonctionnement à l'horizontale est préconisé ainsi qu'une bonne maintenance du lumen et une longévité prolongée. La minceur de leur enveloppe permet aux petits réflecteurs d'être mieux utilisés qu'il n'était possible avec les lampes cylindriques; leur coût d'exploitation peut facilement se comparer à celui des lampes halogène au tungstène en raison de leur consommation réduite en courant, leur longévité prolongée et leur rendement lumineux amélioré.
Elles feront certainement l'objet des préférences dans des applications exigeant une projection lumineuse panoramique, spécialement dans les endroits où une bonne reproduction des couleurs ou une soudaine projection de lumière n'est pas requise.

# In diese Ausgabe.


Thorn Lighting unterhält einen umfassenden Beratungsservice für Kunden im Ausland und in Grossbritannien. Da über grosse Entfernungen arbeiten muss und selten Gelegenheit hat — so wie es in England möglich ist — direkten Kontakt mit Kunden aufzunehmen, kommt es gelegentlich vor, dass der "International Lighting Advisory Service" LAD (Internationaler Beratungsdienst für Beleuchtung), wenn auch in seiner Struktur ähnlich den "Lighting Engineering Departments" LED (Technische Beleuchtungsabteilungen) im Mutterland, unter unzureichenden Informationen leidet wie auch unter den Schwierigkeiten, die durch Sprachprobleme und die Vielzahl von Normen in anderen Ländern für Spannung, Frequenz, Sicherheit und Beleuchtung auftreten.

LED und LAD besitzen beide einen Stab von vorzüglich ausgebildeten Beleuchtungsingenieuren mit langjähriger Erfahrung, von denen viele anerkannte Autoritäten auf Spezialgebieten der Beleuchtungstechnik sind. Ihnen steht Unterstützung durch die technischen Hilfsquellen der Firma zur Verfügung, unter anderem auch Zugang zu den Computern und Forschungslaboratorien.

Bei der Beleuchtung einer Arbeitsstelle steht an erster Stelle die Forderung Licht in ausreichender Quantität und Qualität für gutes sehen zu erhalten; die Beleuchtung der Umgebung ist jedoch fast ebenso wichtig. Hierbei kommt es auf ein gutes Gleichgewicht zwischen Helligkeit für die Arbeit und deren Umgebung an wie auch darauf, eine Blendung durch direktes und reflektiertes Licht zu vermeiden. Dies kann nur durch einen ausgebildeten Ingenieur erzielt werden, der über alle Fahlen verfügt, einschliesslich der vollen photometrischen Daten für Leuchten, wie sie von Thorn in Handbüchern über photometrische Daten veröffentlicht wurden.

Gestützt auf seine Erfahrung, stellt der Beleuchtungstechniker die richtige Helligkeit auf den an des Sichtfeld angrenzenden Oberflächen her, er kann dabe das Know-how seiner Kollegen un LED und LAD nutzen wie auch das der Forschunglsabors, die gegebenenfalls in der Lage sind, spezielle Grossversuche durchenführen.

Die Firma bietet ihren Kunden in der ganzen Welt bestmöglichen Kindendienst und Beratung.


Ursprünglich wurden Bergarbeiterhelm-Lampen so ausgelegt, dass sie eine diffuse Beleuchtung vor Ort gaben. Als Resultat der fortschreitenden Mechanisierung stehen die Bergarbeiter jedoch in grösserem Abstande zur Kohle und arbeiten in einer wesentlich staubigeren Atmosphäre. Um ein Strahlenbündel mit kleinerem Öffnungswinkel zu erzeugen, hat man statt dessen Spiegelreflektoren verwendet; die Toleranzen für die Lage des Glühfadens in dem mit Krypton gefüllten Kolben von 18mm Durchmesser blieben jedoch die gleichen. Ein genaues Fokussieren von Hand ergab Schwierigkeiten, insbesondere deshalb, weil dieses von der Vorderseite des Reflektors ausgeführt werden musste. Es war nur auf einer geraden Achse wirksam, und bei der Grenze der Axialtoleranz von 1mm für den Glühfaden verminderte sich die Spitzenintensität um 50%.

Die Beleuchtungstechniker von Thorn haben in Zusammenarbeit mit den Herstellern der Helmlampen die Konstruktion dadurch verbessert, dass sie eine präfokussierte Blitzlampe von 11mm Durchmesser als Grundlage für die Neukonstruktion wählten. Es wurde eine mit Krypton gefüllte lampe fur 4V, 1A entwickelt, die viel engere Toleranzen als die ursprünglichen lampen besitzt. Sie ist mit einer präfokussierten Kappe ausgerüstet, wird in den Reflektor von der Rückseite eingeführt und automatisch im Brennpunkt angebracht. Die neue Konstruktion wurde von der "British Safety in Mines Research Establishment" (britischen Forschungsstelle für Grubensicherheit) überprüft und genehmigt; die britische Norm 535/1973, die Lichtquellen für tragbare Bergarbeiterlampen festlegt, wurde entsprechend abgeändert.


Im Gegensatz zu dem modernen Gebäude in Coventry ist die Kathedrale von Lichfield ein typisch englisches gotisches Bauwerk, das hauptsächlich aus dem 13. und 14. Jahrhundert stammt. Sie besitzt drei Türme und in der Apsis eine "Lady Chapel" (Marienkapelle) unterhalb der Fortsetzung der Hauptchorgallerie.

Vor ungefähr zwanzig Jahren wurde sie völlig neu verdrahtet, und es wurde eine Reihe von nicht sehr wirkwungsvollen Hängeleuchten installiert. Bei Ausführung der neuen Beleuchtungsanlage entschloss man sich, unter Verwendung von Standardlampen und -ausrüstungen an allen Stellen von der Technik der indirekten und Flutlichtbeleuchtung Gebrauch zu machen.

Chor und Lady Chapel wurden mit einstellbaren, hinter der Obergadenfensterleibung verdeckt angebrachten "indirekten Leuchten" von 150W beleuchtet, während eine besondere Beleuchtung für die Kirchenstühle vorgesehen wurde. Das Altarkreuz wurde durch eine Niederspannungs-Scheinwerferlampe, die am Obergadengang angebracht ist, hervorgehoben.

In den Triforien des Mittel- und Querschiffs wurden 300-W-Wolfram-Halogenlampen für Netzspannung in "sonnenartigen" Scheinwerfern angebracht, welche quer über die Kirche scheinen. An der westlichen Seite des Mittelschiffs wurde eine Spezialbeleuchtung für Konzertveranstaltungen vorgesehen.

Der Mittelschiffaltar am Kreuzgang, die Kanzel, der Bischofsthron und ein grosses Tryptichon in der Lady Chapel erhielten ebenfalls eine Sonderbehandlung.

Die indirekte Beleuchtung der Hauptgallerien durch SONline-Lampen mit Halogenprojektoren, welche am Südtriforium des Mittelschiffs und am Obergadengang angebracht sind, erzielt eine sanfte Allgemeinbeleuchtung an dunklen Wintertagen. Die Gesamtlast ist nicht grösser als die der ursprünglichen Anlage; es ist jedoch viel mehr Licht vorhanden, wobei Blendung weitgehend vermieden wurde.

Beim Neubau der Kathedrale in Coventry im Jahre 1962 wurden Mittelschiff und Chor durch 64 Abwärtsstrahler beleuchtet, die Projektorlampen mit konzentrierten Glühfäden in Parabolreflektoren beherbergen. Diese werden von schwarzen Hauben mit Tiefkonus getragen und sind in Vierergruppen in der Einschubdecke angebracht. Weil die Standzeit dieser Lampen gering war, wurden sie bald durch 1000-W-Lampen mit modifizierten Reflektoren ersetzt, wodurch sich die Last auf 64kW erhöhte.

1975 wurde diese Anlage auf Grund der Strompreiserhöhung unwirtschaftlich, und man schaltete die Hälfte der Lampen ab, wodurch sich eine sehr lückenhafte Beleuchtung ergab. Man wandte sich an Thorn wegen einer weniger kostspieligen Anlage, aber unter Verwendung der bestehenden Leuchten. Nach Ausführung einiger Versuche wurde eine Anlage installiert, welche 32 Metall-Halogenlampen von 400W in den ursprünglichen Leuchten verwendet, die paarweise mit ihren Originalreflektoren eingebaut wurden. Hierdurch erniedrigte sich die Last auf 12,8 kW, und es gab erheblich mehr Licht — das ist wirklich eine bemerkenswerte Leistung.


Die heute im Vordergrund der Entwicklung stehenden Hochdruck-Entladungslampen werden normaler weise im Bereich von 1-10 atü bei einer Temperatur der Entladungsrohrwand von 800 bis 1200°C betrieben. Licht wird aus dem Gas bei einer Temperatur von bis zu 6000°C in der Mitte des Lichtbogens erzeugt. Für die Forschung ist die Messung und ein Verständnis der Eigenschaften dieses heissen, leuchtenden Gases unumgänglich.

Aus der Spektralanalyse der Lichtbogenstrahlung erhält man die Gastemperatur, die Art und Verteilung der Atome und Moleküle im Lichtbogen, seine Farbe- und seinen Farbwiedergabe-Index, das Verhältnis von sichtbaren U.V.-Swalen Infrarotstrahlung etc.

Mit einem gewöhnlich besonders für die Aufgabe konstruierten Spektroradiometer misst man die Strahlenmenge in engen Wellenlängen-Bändern. Man kann die Lampe in einer Dunkelkammer hinter dem Instrument anbringen, um das Bedienungspersonal gegen schädliche Strahlung zu schützen, und benutzt einen Computer zur Auswertung des Lampenspektrums und Berechnung seiner Grössen. Man kann Lampen von der Fertigungsstrasse ebenso wie Lampen im Versuchszustand messen; im letzteren Falle verwendet man ein Bad mit geschmolzenem Indium zur Kontrolle des Dampfdrucks. Ein Spektrograph wird dazu verwendet, Spektren mit vielen Feinstrukturlinien zu messen, um festzustellen, ob die Strahlung von komplizierten Atomstrukturen oder Molekülen herrührt. Das Spektrum wird auf einer photographischen Platte aufgezeichnet; dies ist ein gutes Hilfsmittel für die Identifizierung der Strahlenquelle und damit für das Auffinden von Verunreinigungen.

Ein weiterer Spektrometertyp wird dazu verwendet, den Ursprung des Lichts in einer Entladung und die physikalischen und chemischen Zustände im heissen Gas festzustellen. Zum Betrieb dieser Instrumente braucht man erhebliche technische Fähigkeiten und ein grundlegendes Verständnis für die aus Entladungen stammende Strahlung.


Die Automatisierung des Aufschüttens von Kohle- und Schutthalden bei einer der bedeutendsten Kohlengruben der Grafschaft Kent stellte die Aufgabe, einen sehr hohen Flutlicht-Beleuchtungspegel zu erzeugen, damit das Anwachsen der Halden mit Hilfe von Betriebsfernsehen überwacht werden konnte.

Eine Anlage, bestehend aus sieben 17,50m hohen Türmen, von denen jeder drei bis sechs gerade 1600-W-Metall-Halogenlampen in Thorn-Projektorfassungen Typ ON 1600 und eine 1-kW-Wolfram-Halogenlampe in einer HalogenFlutlichtfassung für Notbeleuchtung trug, wurde installiert; bei einer Gesamtlast von 62kW ergab sich eine Durchschnittsbeleuchtungsstärke von 150 Lux auf der Oberfläche der Halden.


Die Verwendung von Natrium-Hochdrucklampen, die sich ursprünglich nur auf Strassenbeleuchtung und hoch montierte Industriebeleuchtung erstreckte, wurde weiterentwickelt, und zwar zuerst auf Grossflächen-Flutlichtbeleuchtung und später auf eine grosse Reihe von Anwendungsgebieten, angefangen mit Büros und öffentlichen Gebäuden bis zu Schwimmbädern und selbst Kirchen. Ein doppelseitiger, röhrenförmiger Leuchtkörper, der speziell für Flutlichtbeleuchtung entwickelt wurde, ist jetzt den ursprünglichen elliptischen und zylindrischen Leuchtkörpern hinzugefügt worden.

Wenn auch ein Gas den Raum zwischen dem schlanken äusseren Quarzgehäuse und dem Entladungsrohr ausfüllt, wodurch Standzeit und Lumen-Haushalt verbessert werden, müssen die Lampen doch wegen ihres verringerten Durchmessers in geschlossenen Leuchten verwendet werden. Ihre Länge ist die gleiche wie diejenige der röhrenformigen Wolfram-Halogenlampen mit 1000W und 1500W, so dass sie in den "Haline" Fluchtlichtlampen, die für die letzteren konstruiert wurden, verwendet werden können. Ihre Farbe und Farbwiedergabe sind ähnlich denen der anderen Natrium-Hochdrucklampen.

Um zuverlässiges Starten selbst bei niedrigen Temperaturen zu ermöglichen, wird ein aussen liegender Hochspannungsimpuls-Zünder verwendet. Es dauert 4-5 Minuten, bis die Lampen ihre volle Helligkeit erhalten. Wiederzündung ist normaler Weise innerhalb einer Minute vom Erlöschen möglich. Sie müssen in Horizontallage betrieben werden und besitzen guten Lumen-Haushalt mit hoher Lebensdauer. Dank ihren schlanken Gehäusen können kleinere Reflektoren verwendet werden, als es bei den früheren Zylindertypen möglich war. Ihre verringerte Stromaufnahme, längere Lebensdauer und verbesserte Licht Leistung sind der Grund dafür, dass ein Vergleich ihrer Betriebskosten mit denen der Wolfram-Halogenlampen zu ihren Gunsten ausfällt. Für Grossflächen-Flutlichtbeleuchtung, wo gute Farbwiedergabe oder eine plötzliche Lichtflut nicht benötigt werden, sind sie wohl vorzuziehen.

# En esta edición.

**EN EL PAÍS Y EN EL EXTRANJERO** 2
*W K Lumsden y W D Tyrrell*
Thorn Lighting mantiene un servicio de planificación completo tanto para sus clientes extranjeros como para aquellos en el R.U. Debido a que debe operar a grandes distancias, y raramente tiene contactos directos con sus clientes, a no ser en pocas ocasiones en la Gran Bretaña, el International Lighting Advisory Service (Servicio Consultor de Iluminación Internacional), LAD, a pesar de ser similar a los Departmentos de Ingeniería de Iluminación (LED) en el R.U. sufre ocasionalmente de especificaciones inadecuadas, como también de las dificultades generadas por los problemas linguísticos y los distintos voltajes y frecuencias, seguridad y normas de iluminación de los diferentes países.

LED y LAD tienen un personal totalmente entrenado de ingenieros luminotécnicos, muchos de los cuales son autoridades reconocidas en el campo especializado de la iluminación. Cuentan con el apoyo de los recursos técnicos de la Compañía, incluyendo el acceso a computadores y a los Laboratorios de Investigaciones.

Al iluminar una situación de trabajo, el suministro de la cantidad y la calidad correcta, de la iluminación del trabajo visual, es de gran importancia, pero la iluminación del medio ambiente tiene casi la misma importancia. Esto incluye un equilibrio correcto entre la luminosidad del trabajo y su ambiente, como también la evitación del brillo directo o reflejado, y esto solamente puede ser alcanzado por un ingeniero entrenado que se encuentre de pose de todos los datos, inclusive todas las informaciones fotométricas de los cuerpos luminosos, publicadas en los Libros de Informaciones Fotométricas de Thorn.

La habilidad del ingeniero luminotécnico producirá el model correcto de luminosidad sobre las superficies que amalgaman el campo visual, y en LED y LAD puede contar con la pericia de sus colegas y con los Laboratorios de Investigaciones los cuales, si fuere necesario, llevarán a cabo experimentos en escala total. La compañía suministra a sus clientes, donde quiera que se encuentren, los mejores servicios técnicos y consejos posibles.

**MEJORAMIENTOS DE LOS BOMBILLOS DE FAROS PARA MINEROS** 6
*D Brown*
Los bombillos faros para mineros originales fueron diseñadas para suministrar un luz difusa sobre el frente de arranque del carbón, pero la mecanización ha traído como resultado el hecho de que los mineros tienen que trabajar más alejados de la superficie de trabajo y en ambientes considerablemente más polvorientos. Fue substituido un reflector especular para proporcionar un haz más estrecho, pero la tolerancia de la posición del filamento en la lámpara rellena de criptón de 18mm de diámetro permaneció la misma. El enfoque manual exacto era difícil y el problema se complicaba todavía más, ya que esto tenía que hacerse por la parte frontal del reflector. La lámpara era solamente efectiva en el eje longitudinal, y un filamento en el límite de tolerancia axial de 1mm podía reducir la intensidad maxima en un 50%.

Los ingenieros de bombillos Thorn cooperaron con los fabricantes faro para mejorar el diseno, tomando el bombillo de lintesna de preenfoque de 11mm de diámetro como base de su diseno. Se ha desarrollado un bombillo relleno de criptón de V, 1,0 amp., la cual tiene tolerancias más estrechas que los bombillos anteriores. Tiene un casquillo de preenfoque, y se inserta a través de la parte trasera del reflector y se localiza automáticamente en su punto focal. El nuevo diseño ha sido verificado y aprobado por el Establecimiento de Investigaciones para la Seguridad de las Minas Británicas y las normas británicas BS. 535 1973, que especifican las fuentes de luz para las lámparas portátiles de los mineros han sido enmendadas para incluirla.

**ILUMINACIÓN DE LAS CATEDRALES DE COVENTRY Y LICHFIELD** 8
*P Bleasby*
En contraste con el moderno edificio en Coventry, Lichfield es una típica catedral gótica inglesa que data de los siglos 13 y 14. Tiene tres torres y una Capilla absidal de Nuestra Señora bajo una continuación de la bóveda del coro principal.

Fue completamente recableada hace cerca de veinte años cuando se instalaron algunos dispositivos luminosos colgados, elegantes besono eficiento. Al efectuar la reiluminación, se decidió la aplicación de técnicas de iluminación oculta y proyectada, usando solamente lámparas y equipo normales.

El coro y la Capilla de Nuestra Señora estan iluminados por dispositivos de "luz oscura" ajustables de 150 W, ocultos detrás del derrame de los ventanales de la celosía, con iluminación extra en los sitiales. Una lámpara de luz concentrada de bajo voltaje montada sobre la pasarela de la celosía, hace resaltar la cruz del altar.

Se instalaron proyectores "Sunspot" empleando lamparas de tungsteno halogeno de 300W en el triforio de la nave y los brazos del crucero que iluminan a través de la iglesia, y se suministra iluminación especial en el lado occidental de la nave para los conciertos. El altar de la nave, en el cruzero, el púlpito, el trono episcopal y un gran tríptico en la Capilla de Nuestra Señora también han recibido un tratamiento especial.

Las iluminación indirecta en las bóvedas principales por medio de lámparas SONline y proyectores Haline montados en el triforio sur de la nave y la pasarela de la celosía en el coro, suministran una iluminación general suave durante los obscuros días del invierno. La carga total no es superior al esquema original, pero se suministra mucha más luz con una notable ausencia de reflejo.

Cuando la Catedral de Coventry fue reconstruida en 1962, la nave y el coro fueron iluminados por 64 dispositivos por flujo dirigido hacia abajo alojando lámparas de proyección con filamentos agrupados, en reflectores parabólicos que se apoyaban en sombreretes de gran conicidad montados en grupos de cuatro en el techo falso. Debido a que la vida útil de estas lámparas era de corta duración, fueron reemplazadas por lámparas de 1000W en reflectores modificados los cuales aumentaron la cargo hasta 64 kW.

En 1975, el creciente costo de la electricidad había tornado este sistema poco económico y la mitad de las lámparas estaba desconectada, lo que resultaba en una iluminación muy desigual. Thorn fue solicitado para que preparase un esquema menos caro, usando los dispositivos luminosos existentes. Después de algunos experimentos, se instaló un esquema usando 32 lámparas de haloide-metalico de 400 Watts en los 32 dispositives originales, montadas en pares con los reflectores originales. Esto redujo la carga a los 12,8 kW suministrando considerablemente más luz. Un hecho realmente extraordinario.

**INVESTIGACIONES SOBRE EL FUNCIONAMIENTO DE LÁMPARAS DE DESCARGA LUMINOSA DE ALTA PRESIÓN** 17
*D O Wharmby*
Las lámparas de descarga de alta presión, que se encuentran a la vanguardia de los desarrollos actuales, normalmente funcionan en la gama de 1-10 atmósferas con una temperatura de pared del tubo de descarga de 800-1200°C. La luz es producida por el gas a una temperatura de hasta 6000°C en el centro del arco, y las mediciones y el conocimiento de las propiedades de este gas caliente y luminoso es esencial para la investigación.

El análisis espectral de la radiación del arco revelará las temperaturas del gas, la naturaleza y distribución de los átomos y las moléculas en el arco, su color y el índice de restitución de colores, las proporciones U.V. visibles y la radiación I.R. etc.

Un espectroradiómetro, que normalmente se construye especialmente para este fin, mide la cantidad de radiación en bandas estrechas de longitud de onda. La lámpara puede ser colocada en un cuarto obscuro detrás del instrumento para escudar a los operadores contra radiaciones peligrosas, usando una computadora para trazar el espectro de la lámpara y para calcular sus cualidades. Las lámparas de la línea de producción pueden ser medidas al igual que aquellas que se encuentran en las etapas experimentales. Se usa un baño de indio derretido para controlar las presiones del vapor en el último caso. Se usa un espectrógrafo para medir los espectros con muchas líneas finas para determinar si la radiación proviene de estructuras atómicas complicadas, o de las moléculas. El espectro se registra en una chapa fotográfica, y esto sirve de gran ayuda para identificar la fuente de radiación detectando así las impurezas.

Otro tipo de espectrómetro se usa para localizar el origen de la luz en un arco, y las condiciones físicas y químicas del gas caliente. Se necesitan considerables conocimientos y pericia técnica de la radiación de las descargas para operar estos instrumentos.

**MINA DE CARBÓN DE BETTESHANGER. UNA APLICACIÓN DE ILUMINACIÓN POCO USUAL** 23
*P Barton*
La automatización de la construcción de escoriales para carbón y desperdicios en una de las más importantes minas de carbón del condado de Kent, exigió un alto nivel de iluminación proyectada para permitir el control del crecimiento de los escoriales por medio de televisión por circuito cerrado.

Se instaló un sistema con siete torres de 17,5 metros, cada una con tres a seis lámparas multi-vabor lineares de 1600 W en proyectores Thorn ON 1600, mas una lámpara de tungsteno-halogeno de 1kW en una proyector Haline para iluminación de emergéncia. Un consumo total de 62kW produjo una luminosidad promedio de 150 lux sobre la superficie de los escoriales.

**SONLINE, UNA LÁMPARA DE PROYECCIÓN ÁREAS** 26
*B J Cannell*
La aplicación de lámparas de sodio de alta presión, originalmente confinada a la iluminación de calles e instalaciones industriales de naves altas, ha sido extendida, primero a la iluminación de áreas grandes y después a una amplia gama de usos, desde oficinas y edificios públicos hasta piscinas e inclusive iglesias. Los tipos originales eran de formas elípticas y tubulares pero ahora hay una nueva lámpara tubular de extremo doble, especialmente diseñada para la iluminación de proyección. Sus propiedades de apariencia de color, y restitución del mismo, son similares a las otras lámparas de sodio de alta presión.

En los lámparas originales un gas inerte rellena el espacio entre la camisa exterior de fino cuarzo y el tubo de descarga, aumentando la vida útil de la lámpara y el rendiemento de lumenes; debido a su diámetro reducido, las nuevas lamparas deben instalarse en luminaries selladas. Su largo es el mismo de las lámparas tubulares de tungsteno-halógeno de 1000W y 1500W, para que puedan ser usadas en los proyectores 'Haline' diseñadas para esta.

Se usa un ignitor por pulsos de alto voltaje proporcionando un arranque de alta fiabilidad inclusive a bajas temperaturas. Las lámparas tardan de 4 a 5 minutos para alcanzar su luminosidad total y normalmente reestablecen el arco un minuto después de su extinción. Deben ser operadas horizontalmente y poseen un buen período de vida útil y redimiento. Su delgado alojamiento permite que se usen reflectores más pequeños que los que se usaban con la lámpara tubular anterior, y su reducido consumo de corriente, vida útil más larga, y producción de luz mejorada hace que los costos de su funcionamiento se puedan comparar rentajosa mente con los de las lámparas tungsteno-halogeno.

Es muy probable que se les de preferencia para iluminar áreas por proyección donde no se exiga una buena restitución de color o una repentina proyección de luz.

# In questa edizione.

### IN GRAN BRETAGNA E ALL'ESTRO 2
*W K Lumsden e W D Tyrrell*

La Thorn Lighting mantiene un servizio completo di progettazione per i propri clienti sia all'estero che in Gran Bretagna. Data però che deve operare a notevoli distanze e non sempre è possibile un contatto diretto con i clienti in Gran Bretagna, l'International Lighting Advisory Service (LAD) (Servizio Internazionale di Consulenza per l'Illuminazione) pur essendo simile come struttura al Lighting Engineering Department (LED) (Ufficio progetti di Illuminazione) in Gran Bretagna, a volte risente della mancanza di informazioni esaurienti e delle difficoltà create dai problemi della lingua e dalle diversità della tensione, frequenza, norme di sicurezza e di illuminazione vigenti nei vari paesi.

Sia LAD che LED si avvalgono della collaborazione di tecnici specializzati ed esperti molti dei quali sono altamente qualificati in un determinato settore degli impianti di illuminazione. Essi hanno a disposizione le risorse tecniche della Società, quali l'accesso agli elaboratori elettronici ed ai laboratori di ricerca.

In questo settore è della massima importanza fornire la giusta quantità e qualità di luce per una data esigenza senza trascurare l'illuminazione dell'ambiente nel suo insieme. Ciò comporta un giusto equilibrio tra l'effetto che si desidera e l'ambiente nel suo insieme evitando che si crei un abbagliamento diretto o riflesso. Questo problema potrà essere risolto soltanto da un tecnico specializzato in possesso di tutti gli elementi necessari, ivi compresi i dati fotometrici degli apparecchi per illuminazione pubblicati nei Volumi dei Dati Fotometrici Thorn.

L'abilità del tecnico creerà le giuste caratteristiche di luminosità sulle superfici che limitano il campo visivo e in LED e LAD egli avrà sempre a disposizione l'esperienza dei colleghi e il supporto dei laboratori di ricerca che effettueranno, se necessario, richerche su larga scala. La Società offre ai propri clienti, ovunque essi si trovino, quanto di meglio esiste nel settore dell'assistenza e consulenza tecnica.

### MIGLIORAMENTI ALLE LAMPADE PER MINIERE 6
*D Brown*

Originariamente le lampade per gli elmetti da minatore erano state studiate per creare una luce diffusa sulla superficie del carbone davanti alla persona, ma l'avvento della meccanizzazione ha permesso al minatore di stare ad una distanza maggiore dalla zona operativa in un'atmosfera molto più polverosa. Per ottenere un fascio di luce più stretto venne sostituito un riflettore concentrante, ma le tolleranze relative alla posizione del filamento nella lampada con diametro di mm 18 riempita di cripton erano rimaste invariate. Le difficoltà per una precisa messa a fuoco a mano venivano aumentate dal fatto che tale operazione doveva essere effettuata dalla parte anteriore del riflettore. Essa era efficace soltanto sull'asse lineare ed un filamento al limite della tolleranza assiale di mm 1 poteva ridurre l'intensità di picco del 50%.

I tecnici specializzati della Thorn in collaborazione con i fabbricanti di lampade per elmetti da minatore ne hanno migliorato il design prendendo come punto di partenza la lampada flash da 11mm di diametro. E' stata ora sviluppata una lampada riempita di cripton da 4V 1,0 amp che presenta tolleranze molto più strette delle lampade precedenti. Essa ha un attacco prefocus e viene inserita attraverso la parte posteriore del riflettore con regolazione automatica nel suo punto focale. Il nuovo modello è stato controllato ed approvato dall'Ente Britannico di Ricerca per la Sicurezza nelle Miniere (British Safety in Mines Research Establishment) e la norma BS 535 1973 che specifica le sorgenti luminose per lampade portatili da minatore è stata emendata in tal senso.

### L'ILLUMINAZIONE DELLA CATTEDRALE DI LICHFIELD E DI COVENTRY 8
*P Bleasby*

In netto contrasto con le linee moderne della Cattedrale di Coventry, quella di Lichfield è una costruzione tipica dello stile gotico inglese e risale quasi per intero al XIII° e XIV° secolo, con tre guglie e la Cappella della Madonna situata nell'abside sotto il proseguimento della volta principale del coro.

Circa 20 anni fa venne completamente rinnovato l'impianto elettrico ed in quell'occasione furono installati alcuni lampadari che risultarono di scarsa efficacia. Al momento di sostituire le apparecchiature venne deciso di orientarsi verso una illuminazione indiretta e verso tecniche di illuminazione per proiezione utilizzando lampade ed apparecchi standard.

Il coro e la Cappella della Madonna sono illuminati da "Darklighters" da 150W regolabili nascosti dietro i montanti delle finestre che danno sul tetto delle navate laterali con illuminazione supplementare sugli stalli. Un proiettore spot a bassa tensione montato nella galleria del clerestorio crea una zona di alta luce sulla croce dell'altere maggiore.

Le lampade alogene da 300W nei "Sunspots" installate nei trifori della navata e del transetto illuminano trasversalmente la chiesa ed all'estremità ovest della navata viene fornita illuminazione supplementare per i concerti. Anche l'altare all'incrocio della navata, il pulpito, la cattedra del vescovo ed un grande trittico situato nella Cappella della Madonna vengono illuminati con particolari accorgimenti.

L'illuminazione indiretta delle volte principali mediante lampade SONline in proiettori "Haline" montati nel triforio nella parte sud della navata e nel clerestorio lungo le pareti del coro creano una luce diffusa nelle scure giornate invernali. Il carico ellettrico totale non supéra quello dello schema originale, ma viene fornita una illuminazione maggiore con notevole assenza di abbagliamento.

Quando la Cattedrale di Coventry venne ricostruita nel 1962 la navata ed il coro furono illuminati mediante 64 "downlighters" nei quali erano alloggiate lampade da proiezione con filamento a zig-zag in proiettori parabolici corredati di schermi neri montati a gruppi di quattro nel controsoffitto. Poiché la durata di queste lampade era piuttosto breve, esse vennero presto sostituite con lampade da 1000W in proiettori modificati con aumento del carico a 64 kW.

A causa dei continui aumenti del costo dell'energia ellettrica, nel 1975 questo sistema era diventato poco economico e la metà delle lampade vennero spente con il risultato che l'illuminazione divenne molto irregolare. Alla Thorn venne richiesta una soluzione meno costosa pur impiegando le apparecchiature di illuminazione già esistenti. Dopo vari esperimenti fu installato un sistema che utilizzava 32 lampade da 400W ad alogenuri metallici negli apparecchi originali, montati a coppie riducendo in tal modo il carico a 12,8 kW e fornendo una maggiore illuminazione — un risultato veramente eccezionale.

### RICERCA SUL FUNZIONAMENTO DELLE LAMPADE A SCARICA AD ALTA PRESSIONE 17
*D O Wharmby*

Le lampade a scarica ad alta pressione, che si trovano all'avanguardia degli sviluppi tecnologici moderni, funzionano di solito nella gamma da 1 a 10 atmosfere con una temperatura del bruciatore di 800°-1000°C. La luce viene prodotta dal gas ad una temperatura che può raggiungere 6000°C nel centro dell'arco e la misurazione e conoscenza delle proprietà di questo gas luminoso caldo è di fondamentale importanza per qualsiasi tipo di ricerca.

L'analisi spettrale delle radiazioni emesse dall'arco rivelerà le temperature del gas, la natura e la distribuzione degli atomi e delle molecole nell'arco, il suo colore e l'indice di resa cromatica, le proporzioni di radiazioni ultraviolette, visibili e infrarosse, ecc.

Uno spettroradiometro che viene di solito appositamente costruito per una particolare applicazione, misura la quantità di radiazioni presente in bande strette di lunghezza d'onda. La lampada può essere posta in una camera oscura dietro lo strumento per proteggere gli operatori dal pericolo delle radiazioni, impiegando un elaboratore per tracciare lo spettro della lampada e per calcolarne la qualità. In questo modo è possibile controllare le lampade provenienti dalla linea di produzione come pure le lampade che sono ancora allo stadio sperimentale. In quest'ultimo caso viene usato un bagno di indio fuso per controllare la pressione del vapore. Per misurare gli spettri viene impiegato uno spettrografo con molte righe sottili per determinare se le radiazioni provengono da complicate strutture atomiche o da molecole. Lo spettro viene registrato su una lastra fotografica che permette uno studio più accurato per identificare la fonte delle radiazioni ed individuare le impurità.

Per individuare l'origine della luce in una scarica e le condizioni fisiche e chimiche del gas caldo viene utilizzato un altro tipo di spettrometro. Per l'impiego di questi strumenti sono necessarie una notevole capacità tecnica e l'approfondita conoscenza delle radiazioni da scariche.

### LA MINIERA DI BETTESHANGER. UN'APPLICAZIONE POCO COMUNE DELL'ILLUMINAZIONE 23
*P Barton*

L'automazione delle operazioni di accumulo del carbone e di scarico dei depositi in una delle più importanti miniere del Kent ha richiesto un alto livello di illuminazione per poter controllare la crescita dei depositi mediante impianti televisivi a circuito chiuso.

A tal fine è stato installato un sistema composto da sette torri alte m 17,5 su ciascuna delle quali sono montate da tre a sei lampade lineari ad alogenuri metallici da 1600W in proiettori Thorn ON 1600 ed una lampada alogena da 1 kW in un proiettore "Haline" per illuminazione di emergenza. Con un carico globale di 62 kW viene prodotto un illuminamento medio di 150 lux sui cumuli.

### SONLINE — LA LAMPADA PER ILLUMINAZIONE DI GRANDI AREE 26
*B J Cannell*

L'utilizzazione di lampade al sodio ad alta pressione che all'inizio era limitata soltanto agli impianti di illuminazione stradale ed installazioni industriali di grande altezza è stata estesa prima all'illuminazione di grandi aree ed in seguito a numerosi altri usi, dagli uffici ed edifici pubblici alle piscine ed alle chiese. Ai tipi di lampade a forma ellittica e tubolare è stata ora aggiunta una lampada lineare appositamente studiata per illuminazione a proiezione.

Benché lo spazio tra il sottile involucro esterno di quarzo ed il bruciatore sia riempito di gas inerte che aumenta la durata della lampada e mantiene costante il flusso, a causa del diametro ridotto le lampade devono essere impiegate in apparecchi chiusi. La loro lunghezza è uguale a quella delle lampade lineari ad alogeno da 1000W e 1500W in modo da poter essere utilizzate in riflettori "Haline" appositamente studiati per queste ultime.

L'uso di un accenditore esterno ad impulsi ad alta tensione risolve eventuali problemi di innesco anche a basse temperature. Le lampade raggiungono il regime in 4 o 5 minuti ed in caso di spegnimento il reinnesco avviene di solito entro un minuto. Esse devono essere utilizzate orizzontalmente e possiedono una buona costanza di flusso e durata. La loro forma sottile permette di usare proiettori più piccoli di quanto fosse possibile con la lampada tubolare ed il minor consumo di energia elettrica, la maggiore durata ed un maggiore flusso le rendono più economiche rispetto ai costi di esercizio delle lampade alogene. Esse saranno probabilmente la prima scelta per l'illuminazione dove non siano necessarie una buona resa del colore o una istantanea emissione di luce.

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