THE OUTSHINING

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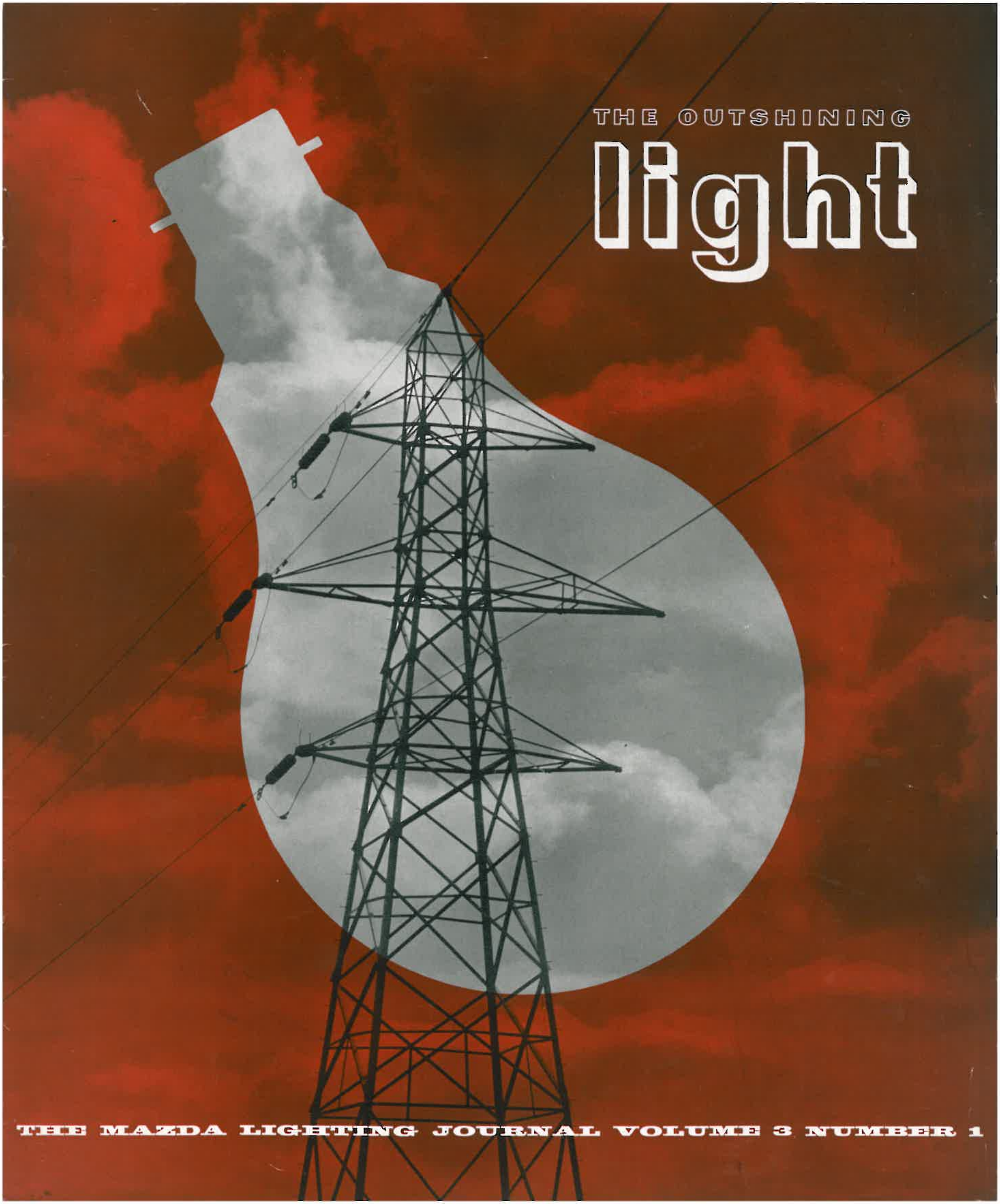

THE MAZDA LIGHTING JOURNAL VOLUME 3 NUMBER 1

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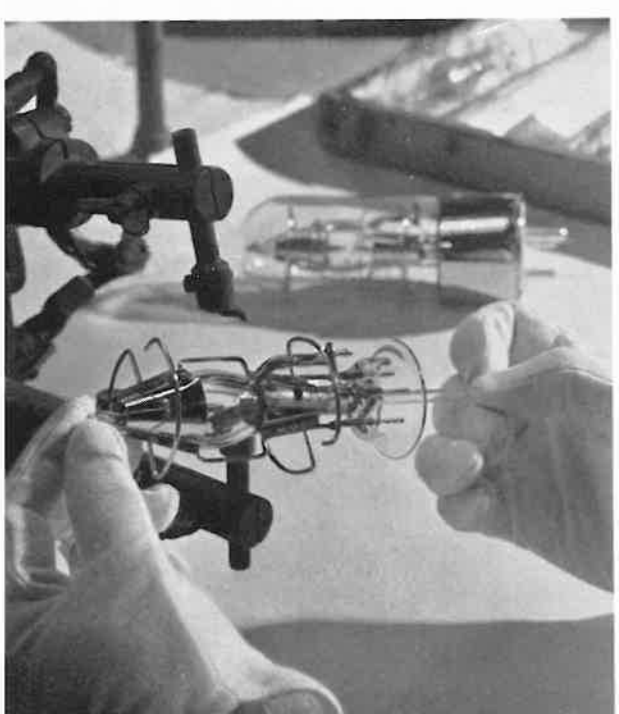
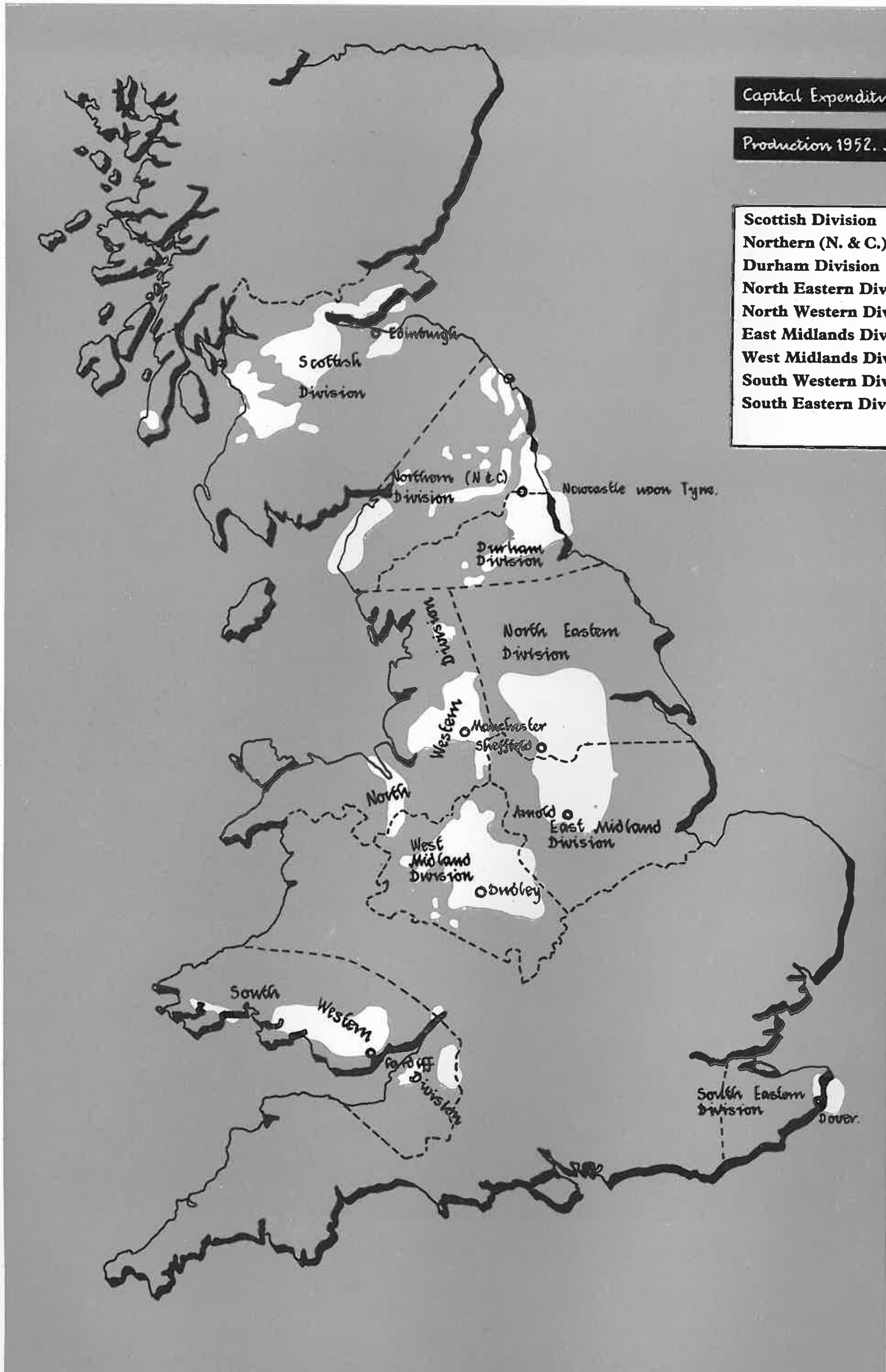
Volume 3 - - - - - - Number 1
Published by The British Thomson-Houston Co., Ltd.,
Editorial Offices: 18 Bedford Square, London, W.C.1

Cover Picture: As this issue of our journal comes off the press, delegates will be assembling for the annual British Electrical Power Convention. Complementary to the post-war development of electrical power has been the great improvement in the design and efficiency of lamps and lighting fittings. The primary object of this journal is to show the ways in which these improvements can be utilized to convert power into effective light.



Craftsmanship in industry. Of the thousands of special lamps made each year by The British Thomson-Houston Company none demands more precision in manufacture than the compact source type used for high intensity lighting purposes. The keen eye and steady hands of this highly skilled technician ensure that the finished product conforms to all the exacting standards demanded of lamps which operate at great temperatures and which are the key to many vital processes in scientific research, manufacture and film making.



	Production 1952. Million Tons	Capital Expenditure up to 1952. Million Pounds
Scottish Division	23·16	14·0
Northern (N. & C.) Division ..	13·30	6·5
Durham Division	26·61	12·2
North Eastern Division	45·04	17·9
North Western Division	15·53	12·9
East Midlands Division	44·05	21·4
West Midlands Division	18·24	6·6
South Western Division	25·01	16·2
South Eastern Division	1·74	1·8
	212·68	110

COA

(1) Mansfield Colliery, one of the modern, mechanized mines of the East Midlands Division, where output has gone up rapidly since nationalization.

L AND LIGHT

A bright star shines in the firmament of nationalized industry. It is called, prosaically enough, the East Midlands Division of the National Coal Board.

During 1953 the mines in this area achieved a record output of 44,453,101 tons of saleable coal, an increase of nearly 12 million tons over 1946—the year before nationalization. In those seven years the output for each manshift at the coal face has increased by just over 10 cwt. and the output for all men employed in the pits has increased by 7 cwt. per manshift. The production for each wage earner in the East Midlands during 1953 was more than 144 tons greater than the average for the country. An impressive record!

Before we can assess the reasons for this remarkable effort, however, we must look at the other side of the picture.

The industry as a whole produced over 220 million tons of coal last year—30 millions more than in 1946, *but* 4 million tons less than in 1938. Figures for the East Midlands show an increase of nearly 14 million tons over 1938.

The average weekly earning of a miner in 1938 was £2 : 17 : 11d. In 1953 it was £11 : 7 : 0d. Then, the pithead price of a ton of coal averaged 17 shillings; now, 60s. 8d.

What conclusions are to be drawn from these cold but telling figures? Firstly, output over the entire industry is steadily increasing, but it has yet to catch up with the production figure of 15 years ago. In one region only, comprising the Derbyshire, Nottinghamshire and Leicestershire pits, has there been a continuous increase in output and the progress achieved in this Division shows no sign of abating. Yet any mining man will tell us that coal, even in the East Midlands, is becoming increasingly difficult to obtain. Seams are narrowing, many of the most productive coal faces of the past have been completely exhausted, workable seams are being extended further and further from the pit head. The industry faces the growing problems of diminishing quantities, deteriorating quality and increasing distances for transporting underground workers and the coal itself.

How are these problems to be solved? The difference in the production figures for the East Midlands and for the country as a whole provides a clear and urgent pointer.

Modern Mines

Take a look at one of Britain's model coal mines. Mansfield, or as the miners still call it, Crown Farm, is one of the collieries in the East

(2) The canteen, first call of the miners before the long shift below ground. (3) The Changing and Bathing rooms . . . a locker for each man . . . a warm shower after work . . . two of the amenities of every modern pit. (4) The surgery; medical attention by a trained nurse is always available, a doctor calls twice a week; and, as an additional safeguard in this inevitably dangerous work, first-aid is part of the training of every recruit.

Midlands which have contributed so largely to a national output sufficient to meet the needs of hearths, the factories, railways and power stations of the nation, and to leave a small surplus for export. Like the great majority of the mines in this area, it puts the emphasis not only on production but training, safety and welfare also. In the words of Mr. J. B. Perry, the Manager, 'If we are not getting better results than in the past then we are not doing our jobs properly'. Mr. Perry is in no doubt about the advantages of proper training and good working conditions. Young people in this area go to work nowadays with a thorough grasp of their jobs, with an awareness of the importance of safety precautions and with a knowledge of the new machines and the latest developments in mechanized coal-cutting and haulage which are constantly being tried out underground. And, an extremely important factor, the morale of the men is higher due to brighter underground areas, modern bathing and medical facilities, canteens and the many other amenities of the best pits.

Mr. J. Hancock, Training Officer to No. 3 Area, which includes Mansfield, echoes the confidence of Mr. Perry in the new approach to the problem of increasing the productivity of the individual miner. He has so far trained 5500 recruits for underground work and results have been excellent. He believes that safety is one of the most important aspects of training for work in the mines. 'A man who gives us a record output for a week and is then off sick for a fortnight is not much use', comments Mr. Hancock. The accident figures for the area, and the excellent production results, prove that the mechanization, the training and welfare facilities at Mansfield are by no means a waste of time or money.

The Miner at Work

Let us join the morning shift at the point where a stream of double decker buses bring in the men from outlying towns and villages.

First call is naturally enough the canteen, nowadays a well-equipped, brightly decorated building where a final cup of tea or bottle of 'Coke' can be enjoyed in attractive and comfortable surroundings. Drinking bottles (water only) filled for the eight hour shift below ground, the men move off to the pithead baths and changing rooms, perhaps the most important of the new coalfield amenities. Each miner has two personal lockers—one for his pit clothes, the other for the clean garb which he will change into when he returns from work. The miner no longer goes home in his dirty working clothes.

Then to the Lamp Room, key to the safety and identification of every man who goes below ground. Since the N.C.B. took over the mines, the principle of self-service lamp rooms has been extended throughout the country's coalfields. On returning from the previous shift, the miner has plugged his cap lamp into its numbered socket so that the battery is fully charged by the next morning. Before going on duty again, he removes the lamp together with his personal ticket, checks the lamp and leaves the ticket with the office. Thus a record of the identity of every underground worker is available in case of emergency. The automatic charging process, combined with regular tests and inspections of lighting efficiency, carried out by the lamp room superintendent, ensures that this vital piece of equipment, often a man's only means of seeing or of communication, is in perfect working order.

It is a fast journey by 'cage' to the pit bottom. As we step from the cage it is soon apparent what tremendous advances have been made in the efficiency and comfort of underground conditions. Light, comparable with the illumination of a modern tube railway, stretches from the pit bottom along the expanse of roadway which leads to the face. Diesel and battery driven haulage trucks bring as much as a hundred tons of coal at a time to the shaft. Each truck moves into an automatic tippler, is swivelled round, emptied and moved forward. Speed in unloading is one of the most remarkable of recent achievements in the mines.

But as we pass along the roadways, moving between the constant stream of coal-laden traffic, it is the brightness, the almost unbelievable contrast between the darkness which we so often associate with mining and the present-day illumination, which is most striking.

(5) Returning from work at the coal face, the miner puts his cap lamp on automatic charge. (6) Next day it is ready for use and is removed along with the man's personal check. (7) The check is left with the office—a record of each miner's whereabouts in case of emergency. (8) The Lamp Room Manager regularly tests the lamps for lighting efficiency. Today there is little likelihood of this vital equipment failing in the dark and often critical conditions of the miner's work.

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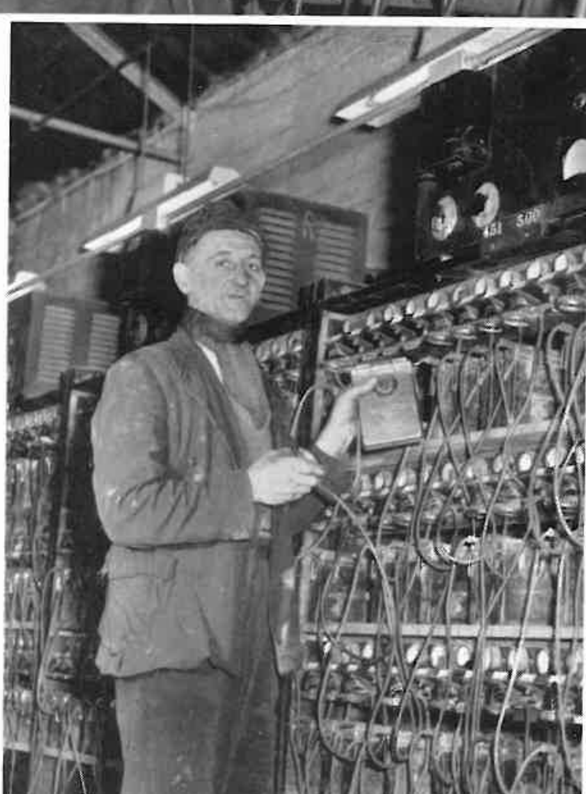


Lighting Underground

If one asked the mining expert, the technician, what was the fundamental requirement of coal mining, he would almost certainly reply—'Lighting'. From the time he enters the cage on his descent to the pit bottom to his arrival at the face, the miner is powerless to act without the aid of artificial lighting.

There is an absolute minimum of light without which work is impossible below ground. In the past that illumination was provided by the Davy Lamp, the oil burning flame which was carried by hand and which detected atmospheric gas as well as showing the way, fitfully, from one step to the next.

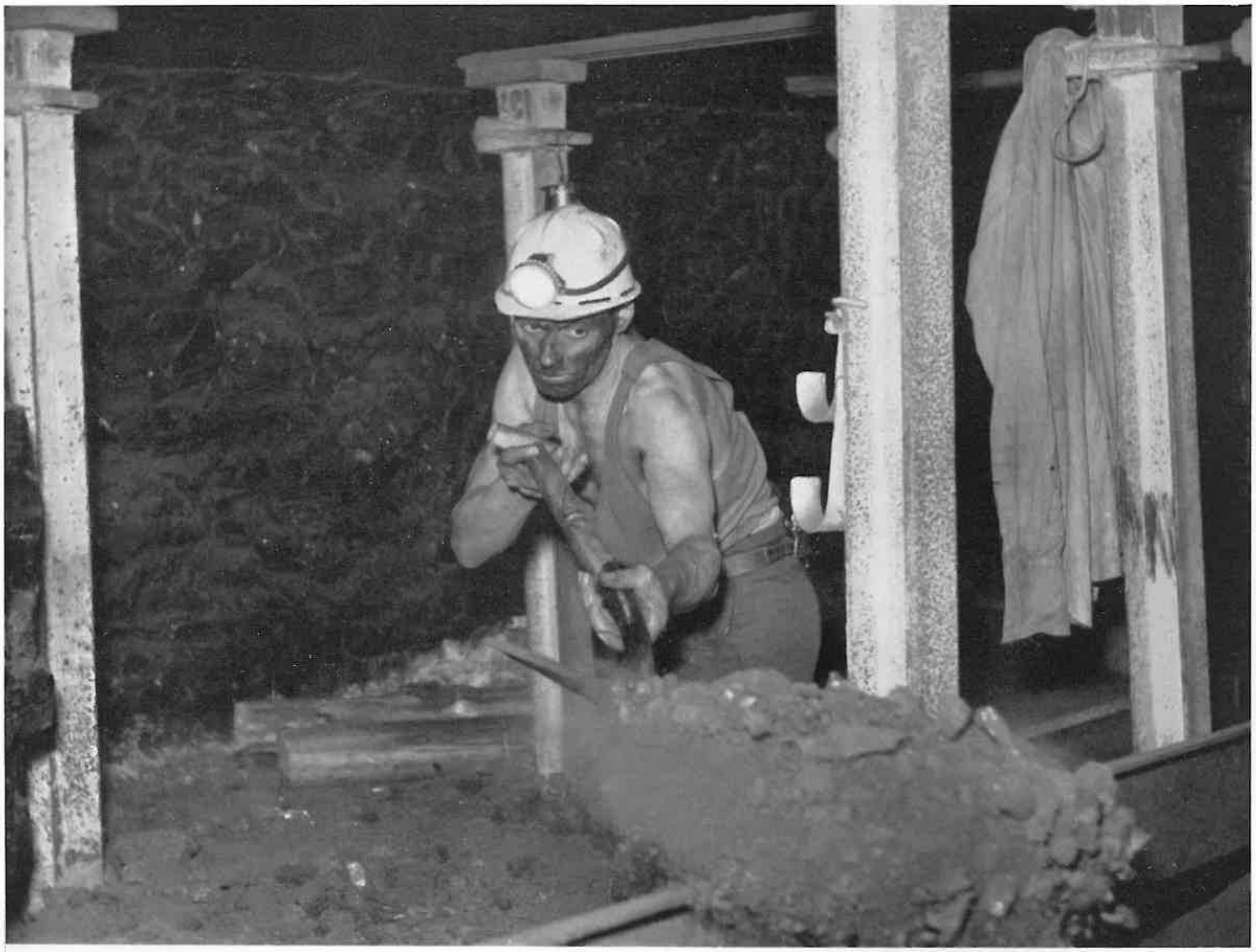
The Cap Lamp

Nowadays the cap lamp is in general use. Many of the electric-light bulbs for these lamps are made by The British Thomson-Houston Company at Rugby. Before leaving the factory they are thoroughly tested for length of life, operating efficiency, filament strength, toughness of the glass envelope and for reliable operation in every contingency which it is likely to meet in service. These are not the only safeguards, however, against failure at the crucial moment. The cap lamp manufacturers, chief of whom are Oldhams Ltd., of Manchester, submit all the bulbs supplied with their equipment to additional confirmatory tests. A lamp room, identical with that to be found in any modern colliery, is used for charging and testing this vital equipment. There are also research tests which check every constituent part of the cap lamp and bulb, often to an accuracy of 1 part in 100,000. There is even an artificial mine in which equipment can be tested under actual working conditions. In addition, the Coal Board has set up its own Miner's Lamp Bulb Testing Station at Treorchy in South Wales where routine and check testing is carried out on all types of bulbs.

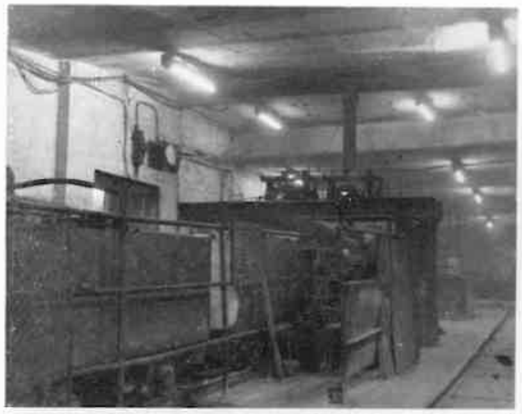
The bulb used in the miner's cap lamp must give maximum illumination and reliable service in the often hazardous conditions in which it is employed. Its most important characteristic must be a finely balanced co-ordination of light output and filament life. BTH research has shown that by reducing the filament life from a test bench average of 300 hours to 200, and using a krypton gas filling, an increase of 30 per cent in light output is achieved. This is the balance of properties which obtains for all Mazda cap lamp bulbs.

A feature of the latest cap lamps is the elimination of the danger of acid spilling from the batteries. Research carried out by Oldhams Ltd. has led to the general use of balsa-wood separators and specially moulded containers which ensure that whatever the position of the battery there is no possible danger of the acid spilling over.

Today, over half a million portable lamps are in use in the mines.



SAFETY LAMPS (9) A model coal mine maintained by Oldhams Ltd., largest producers of miners' safety lamps, to test the equipment under working conditions.



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(10) With progress in mining practice, the complexity of underground roadways has increased rapidly. Interweaving haulage traffic, loading points, control rooms—all need good lighting for this safe and efficient operation. Here, the bright conditions provided by a modern fluorescent system are obvious. (11) Loaded trucks pass from the coal face to the shaft along a well-lit road to be unloaded by the fast, automatic 'tippler' seen in the foreground. (12) Fluorescent fittings stretch as far as the eye can see along another busy roadway.

General Lighting

The local illumination provided by these lamps is insufficient, however, to meet the needs of the worker in an industry which is constantly striving to increase efficiency and safety. General lighting is of great importance to the complicated organization, the fast-moving traffic, the mechanical processes of cutting, loading and conveying, and the safety of the modern mine. And this requirement sets perhaps the biggest problem of all.

Lighting underground presents some unique difficulties. In no other industry is the provision of artificial illumination so fraught with problems. In no other industry is artificial illumination so necessary. Safety is the first and most obvious consideration, but there are many others.

For the roadways, the pit bottom, telephone exchanges and other areas away from the face the problem is slightly less difficult. Here, at least, a lighting installation can be considered as a permanent fixture; once fittings have been devised which comply with the safety requirements, they can be installed and maintained fairly easily, though the design of suitable standard fittings has been a long and by no means simple task.

The coal face presents considerable difficulties, however. Flameproof requirements for any fittings used in this area are necessarily stringent; and portability, the moving forward of the lighting as the face extends, has presented one of the biggest problems in the attempt to apply general lighting.

Fluorescent Lighting

For both roadways and the coal face, fluorescent lighting with its high efficiency, reduction of glare and good colour properties, has held out the greatest promise. In 1947, soon after vesting day in the coal industry, BTH was one of two companies which were asked by the N.C.B. to give urgent attention to the possibilities of using this comparatively new form of lighting underground.

The results, as far as areas remote from the face are concerned, have been extremely satisfactory. Mr. Frank Widnall, Lighting Equipment Engineer to the Company, has been responsible for the development of a number of the fittings for use with fluorescent lamps which have solved, or are helping to solve, the problems of underground illumination.

Other types of lighting have been developed for these areas and, in addition to the fluorescent units, BTH has played a leading part in developing safe and efficient tungsten fittings. But these can never be operated as economically as fluorescent fittings, since the tungsten lamp gives far less light than its fluorescent counterpart in relation to current consumption. In general, the future of roadway and pit bottom lighting rests with the fluorescent lamps and fittings which, in less than six years, have converted many underground areas from depressing gloominess to a brightness comparable with working areas in surface industries.

Mansfield Colliery provides some outstanding examples of modern underground illumination. Its numerous roadways testify to the better, safer and more efficient working conditions which adequate attention to lighting ensures.

Some of the difficulties of illuminating the coal-face have already been stated. Mr. D. A. Strachan, Lighting Engineer to the N.C.B., who has been largely responsible for efforts to solve these difficulties, hopes that they will eventually be overcome and the coal-face worker provided with a form of general lighting which will at least enable him to see without the strain, and often the danger, associated with the dark and dismal conditions which still prevail. That the task is by no means a simple one is demonstrated, however, by the fact that tests were being carried out as long ago as 1927 in the Midlands, always prominent in the implementation of new methods and ideas, to establish the effectiveness of mains lighting at the coal face. But the 25 and 110 volt lamps used in those distant experiments failed because of voltage drop over the length of face and of excessive lamp failures. Other attempts proved equally disappointing due to the unsuitability of equipment available, high brightness of the lamp and the heavy cost of maintenance. It was the advent of the new fluorescent lamps in 18 and 24 inch sizes which gave a fresh impetus to research after the war. Before describing the subsequent attempts made to apply these lamps to the conditions of the present day face, however, it is important to take note of some of the main obstacles. *Height is generally very restricted. The coal-face advances during each shift; lighting fittings may be 6 ft. from the face at the beginning of the shift and 12 ft. distant at the end of it. Coal absorbs between 80 and 97 per cent of the light directed onto it. There is a danger of equipment being damaged by shot-firing if it is not thoroughly protected. Glare, which is extremely difficult to avoid in the dark surroundings of the face, is extremely dangerous. It is difficult to suspend fittings in this temporary location and to space them so that a reasonably uniform level of illumination is obtained.*

An experiment designed to overcome these difficulties was carried out by BTH at Birch Coppice Colliery in 1946. Specially made fittings using 15-watt 18-inch fluorescent lamps were installed in a continuous-cable system. They were spaced at 12 ft. centres and suspended from props as close as possible to the roof. Pairs of fittings were permanently joined and successive pairs connected with cable couplings. This arrangement enables the system to be carried forward with the advancing face and, in the particular conditions of this mine, has proved extremely efficient. The experimental installation has since been extended and Birch Coppice can now claim one of the finest systems of coal-face lighting in the world.

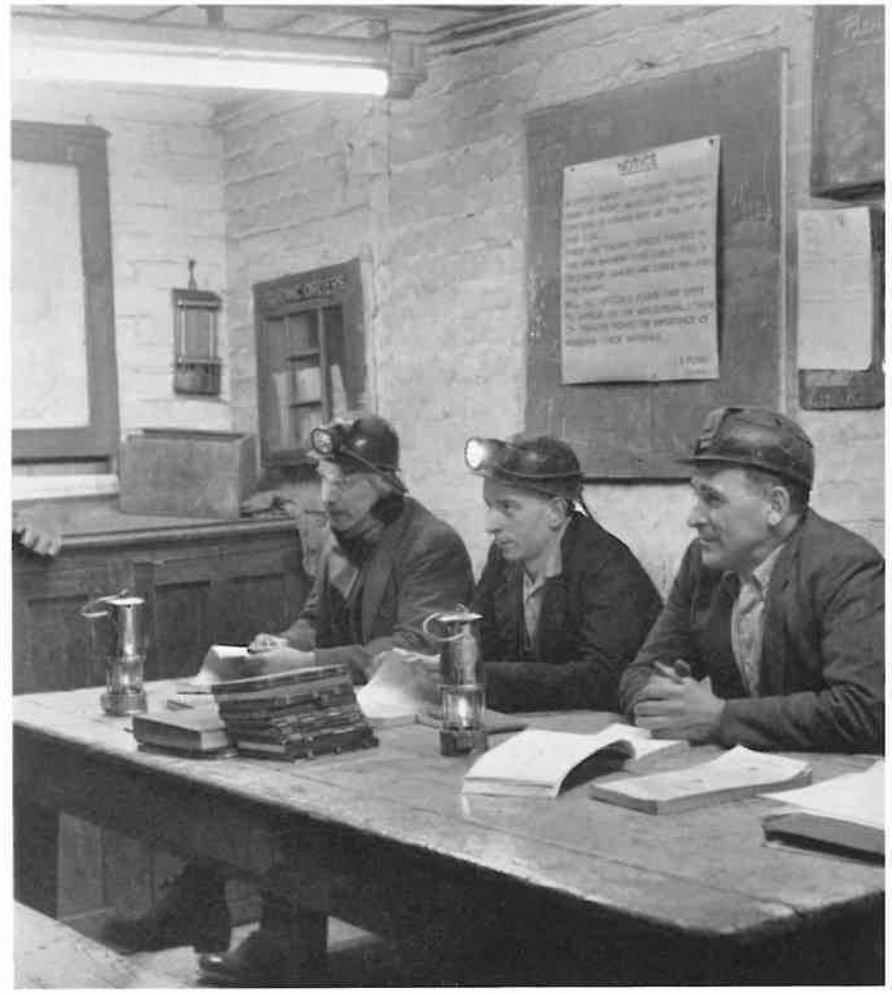
A circular fluorescent fitting for use with a 40-watt 10-inch diameter lamp has been designed recently to give an extremely uniform illumination along the entire working area when mounted vertically. Control gear for the lamps is accommodated within the fitting.

Another important development concerns the mounting of fittings on the conveyors, a development which would remove the light source from the region where it is susceptible to breakage from shot firing and where it is likely to impede coal cutting.

Without question, the fluorescent lamp has provided the most hopeful solution to the urgent problem of illuminating the work of the miner at the coal-face. The 30- and 40-watt lamps now in use, in place of the early experimental 15- and 20-watt sizes, have been shown to provide an adequate level of general illumination. With the improvements in design and application which are at present being investigated, it will almost certainly play an increasingly important part in securing safer and more efficient working conditions at the face.

An Alternative

Progress is often associated with a reversion to older methods and principles, and it is significant that one of the most recent developments in face lighting has been the use of tungsten filament lamps in specially designed flameproof fittings. Accommodating 60-watt lamps, these fittings give a diffuse light and reduce glare to a minimum. This is achieved by fixing a dished cover of high transmission opal acrylic plastic over the flat plate of armourplate glass normally used for fittings of this type.



(13) In the Inspectors' Office, just off the main underground roadway at Mansfield, the same high-level of illumination is obtained. Mazda 5-ft. fluorescent fittings provide lighting comparable with that in offices above ground.

Mansfield, to return to our original journey, is one of the pits in which face lighting has so far proved unsatisfactory. One of the best illuminated mines in the country from the point of view of roadways, it proves a study in gloomy contrasts as we pass from the comparative brilliance of its arteries to the darkness of the extremities where the coal is cut and loaded. But Mansfield, like many other mines throughout the country, will surely benefit from the intensive and now almost completed experiments which are expected to result in one or more forms of lighting which can be applied easily, effectively and economically to virtually any coal-face.

Mechanization and the Cost

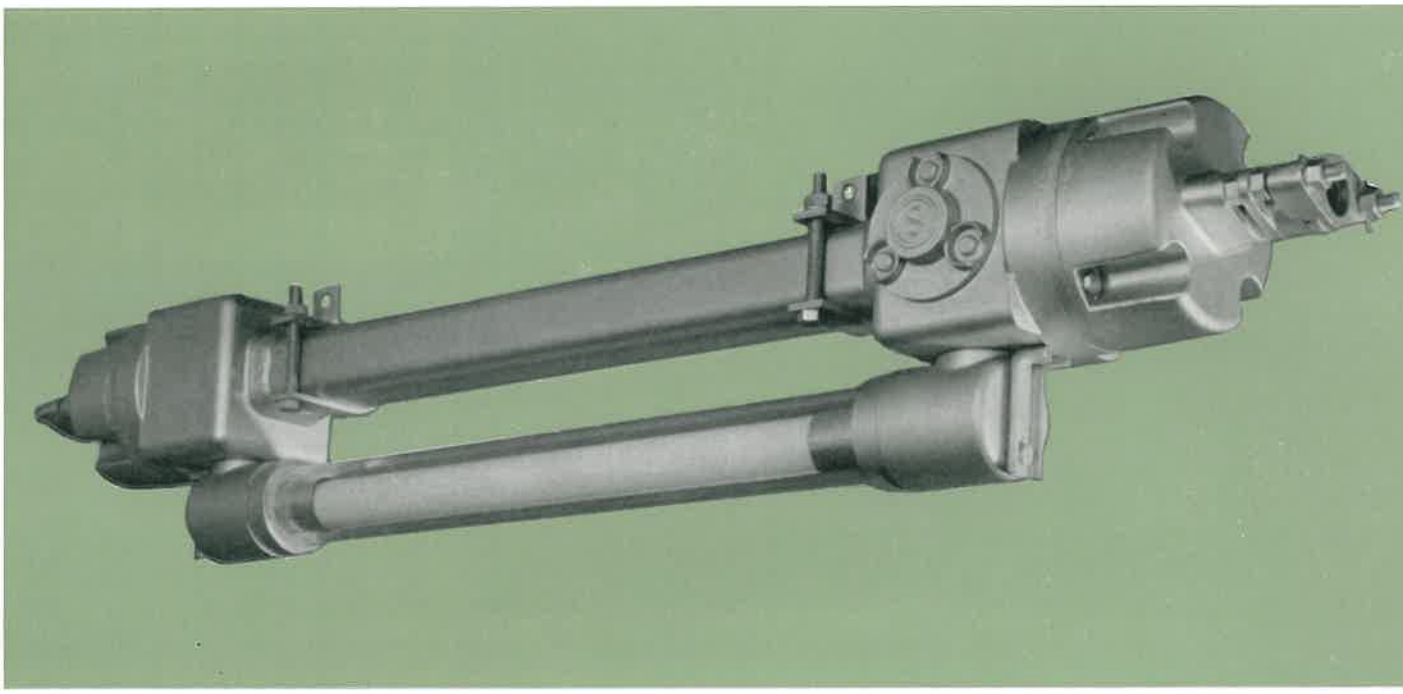
It would be a mistake to view any aspect of modern mining development in isolation. Important though it is, lighting must be considered in relation to the many other facilities and mechanized developments in the mines.

Mr. C. R. Thorne, Sub-Area Electrical Engineer No. 3 Area of the East Midlands Division of the National Coal Board, has a clear conception of the many needs of the modern mines which depend for their implementation on the provision of electrical power. At Mansfield, power has to be supplied, not merely for the underground lighting which is perhaps the most obvious and impressive manifestation of the use of electricity, but also for the vital means of cutting, conveying and hauling of the coal which are in constant use and which are constantly being developed. There is the vast new coal treatment plant at this colliery,

[*Continued on page 13*

MAZDA FLUORESCENT LIGHTING FITTINGS FOR MINES

F 1122, F 1123 & F 1124



Mazda F 1124/1/4024 Fluorescent Mines Roadway Fitting

Roadway Fittings (F 1122 & F 1123)

Two main types of fittings are available for underground use in mines. They are 20-watt 2-ft. and 40-watt 2-ft. and 4-ft. units with either single or double cable entry according to the method of installation.

They are of the same general construction. A silicon-aluminium alloy channel houses the lamp auxiliary gear which is carried on a metal strap. The lamp is protected by a 'Perspex' or toughened glass cylinder. For removal of lamp or protective cylinder it is only necessary to remove one bolt from each end of the fitting.

The Series F 1122 and F 1123 fittings are designed for lighting roadways, pit bottom and underground offices. Fittings in the F 1122 Series have provision for double cable entry and can be connected end to end along the length of a roadway. The F 1123 Series fittings have a single 'T' cable entry at one end and are for use with armoured cable.

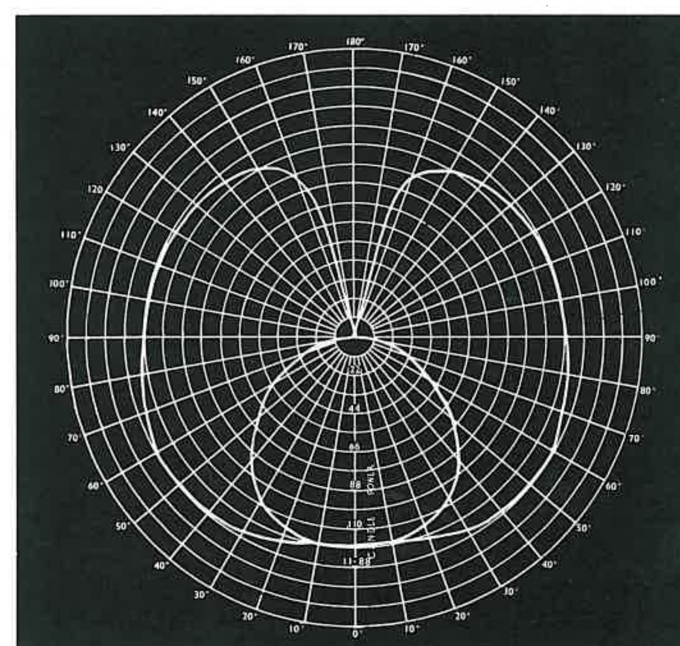
Those units which have a glass lamp cylinder are certified as fully flameproof for Group 1 gases under Buxton Certificate FLP 2742. With a 'Perspex' cylinder they are not certified as flameproof but are approved under the Coal Mines (Lighting) General Regulations 1947.

Coal Face Fitting (F 1124)

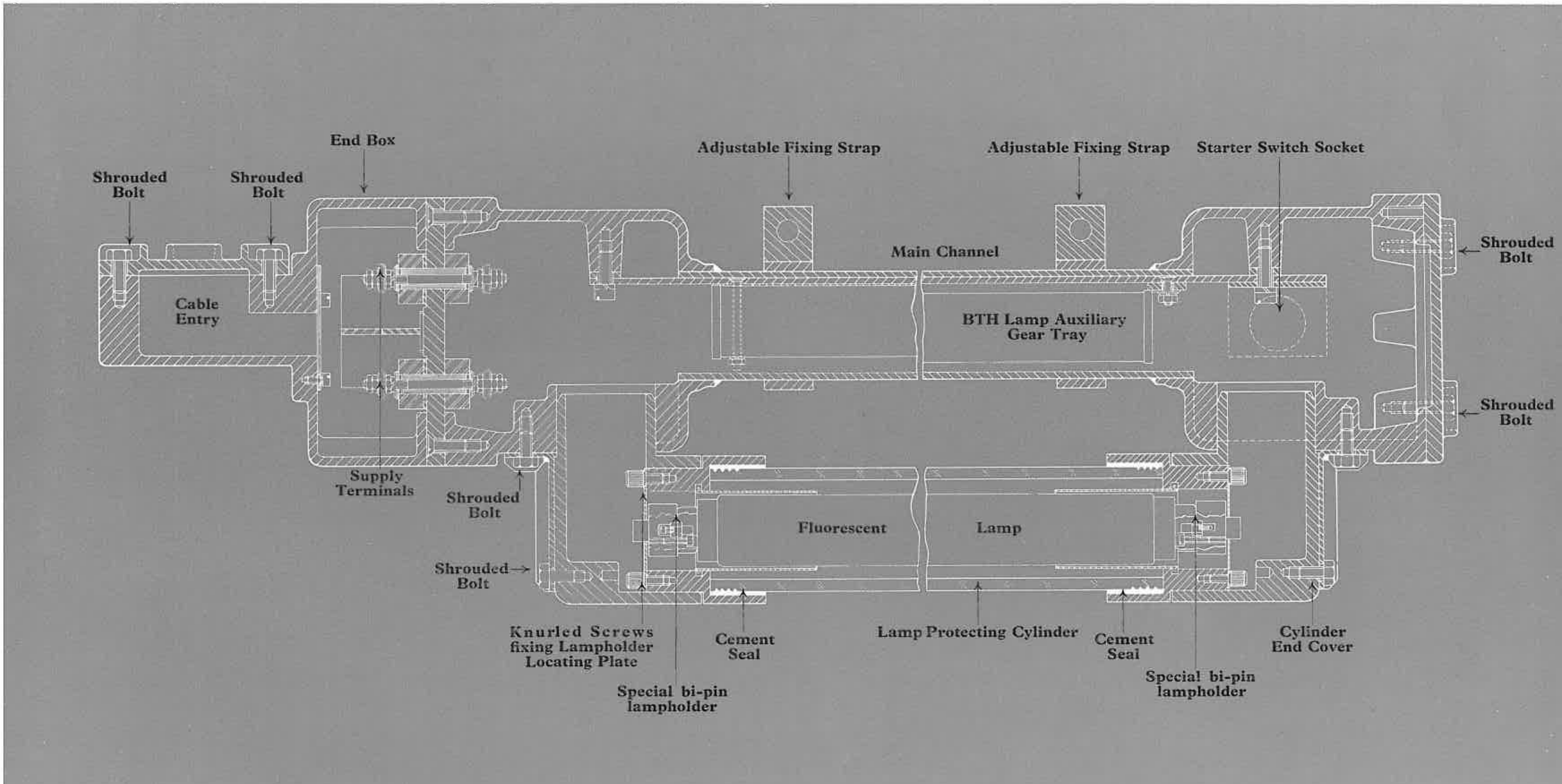
This fitting employs a single 40-watt 2-ft. fluorescent lamp which is enclosed by an outer tube of armour-plate glass or 'Perspex'. A semi-cylindrical metal shield acts as a reflector which can be rotated to direct the light or to protect the lamp against shot firing. Ejector type safety switches, one at each end of the lamp, maintain a spring pressure on the lamp and will open the circuit immediately in the event of damage.

The cable boxes are designed for use with a special face lighting cable with four cores—for line, neutral, earth and pilot or safety leads. Fittings can be coupled continuously for any run.

For operation on 105-120 volts A.C. the fittings are certified for use in mines as follows: With a 'Perspex' protection cylinder Lights Approval Certificate 10/4; with a glass cylinder FLP 2742.



Polar Curves showing average light distribution of a 40-watt 2-ft. fluorescent lamp in a fitting of the type described on this page. The outer curve shows candle-power distribution through the major axis and the inner curve shows distribution through the minor axis.



Mazda Fluorescent Mines Roadway Fitting for Transverse Mounting (F1123/1/4024)

Certificate Number 2742

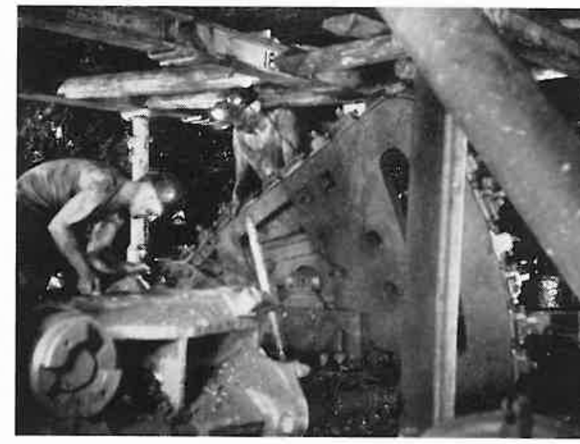
This Mazda Fitting is designed for transverse installation across a mines roadway; a similar model is also made for end-to-end mounting along the run of the road. Both models are fitted with glands to receive armoured cabling. Fixing straps may be moved at will along the back channel, and detachable stoved enamelled steel reflectors may be quickly fixed when required. Full details of these and other 'flameproof', dustproof and corrosion-resistant lighting fittings and auxiliaries may be obtained from any BTH Office, Depot or Agent.

built at a cost of £600,000 to sort and wash 485 tons of coal an hour. There are the surface buildings, the offices and storerooms, lamp rooms, canteens, surgeries and baths—places which offer ample evidence of the great advances which have been made in the efficient treatment and transport of coal and the welfare of the men who mine it, and which require a constant supply of electricity. The task confronting Mr. Thorne and other area officials is to strike a balance between the urgent need of the pits for electrical equipment and the power and, needless to say, the money available. Mr. G. M. Harvey, Consulting Electrical Engineer to the Coal Board, will tell us that machinery in use underground in the mines today totals 2 million horsepower. The great majority of the power required to drive this machinery is electrical. The organization which provides the nation's most vital fuel is itself one of the largest consumers of it.

In 1952, the Coal Board's expenditure on capital equipment was £45 million. In 1947 it was £19 million. In 1953 the bill was even higher than for the previous year, though final figures are not yet available. Only a small part of this immense sum has been devoted to the improvement of lighting, but this will almost certainly increase as experimental work produces systems and equipment which have a more nearly universal application.

What is the view of the miner on mechanization, on the cost of modern organization in the industry? Perhaps the most succinct comment was that of the coal-face worker at Mansfield who remarked that he was

(14) The first experimental installation of fluorescent lighting was carried out at Birch Coppice Colliery in the Midlands with BTH equipment. The permanent system of today, probably the finest in the world, points to the future of coal face lighting—a level of illumination which will do much to improve working conditions.



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POWER AND MECHANIZATION

(15) A coal cutter operating on a Python conveyor. These new devices combine with modern coal face lighting to provide the efficient, continuous mining methods which alone can surmount the problems of increased coal production. (16) The supply of power for mechanical equipment of nearly $3\frac{1}{2}$ million horse-power is one of the biggest tasks of the Coal Board. New power machinery and economy in the use of fuels help to meet the growing needs of the industry. Here, the latest BTH switchgear gives impetus to the supply of power for new cutting, conveying and haulage machinery, for modern lighting systems underground and for surface installations. (17) One of the new mechanical coal cutters—the Meco-Moore in action.

perfectly content with present day working conditions. 'We earn as much as £20 a week nowadays' he volunteered. And then he added, 'But there's a lot of waste, there are too many £1000 a year men in high places'.

More to the point was the comment of one of the oldest men in the pit, a worker who remembers the days when there was an ever present and imminent danger attached to every mine, who had to detect the dangers by the evidence of his own senses: 'This machinery is fine for getting the coal', he said, 'but the trouble is you can't hear the earth when it speaks to you'.

To such fears, the figures again provide an answer, impersonal but beyond question a tribute to the effective way in which new machinery and improved training have affected the industry. Last year the number of fatal accidents in the mines was the lowest ever recorded. The number of serious, non-fatal accidents fell from 2438 in 1947 to 1899 in 1953, again the lowest on record.

As for the cost of improvements, the N.C.B. believes that it is still, at over £50 million a year, spending less than is required to ensure that the tired and overworked seams of the nation's coalfields are enabled to yield that amount of fuel which will meet our essential needs in the next few years.

It cannot be over-stressed that coal becomes increasingly harder to obtain. Only mechanization can make up for the growing deficiencies in the quantity and availability of this vital fuel.

It is worth remembering that more than the heating of our rooms and the supply of power to industry depends upon the success of present efforts to secure more coal and a more economical use of the fuel available. There is an almost infinite variety of by-products—plastics, sulphates, dyes, paints, drugs, explosives, antiseptics, oils and gas—to be obtained from coal. In a recent lecture Mr. E. H. Browne, Director General of Production to the N.C.B., stressed the importance of not only improving the technical resources of coal mining—of substituting 'brain power for muscle power'—but also of devising new and more efficient methods of burning the ever diminishing supplies of coal which are available. It may be that the economic future of this country will depend upon the effectiveness of schemes—such as the National Policy for the Use of Fuel and Power—which are designed to provide a long-term production programme based upon mechanization and to ensure a greatly reduced wastage of the fuel which is burned in such tremendous quantities.

The steps taken by the Board to rectify the downward trend in production which existed when it took over have already had a considerable effect. In a recent statement Sir Hubert Houldsworth, Q.C., Chairman of the N.C.B. drew attention to the progress which has been made in improving the quality of coal by spending money on the best pits and in increasing quantity by mechanization and raising the efficiency of coal cutting and handling. The trend of the industry is encouraging, but the mines of the country as a whole have a long way to go before they equal the outstanding achievements of a few collieries, such as Mansfield in the East Midlands, and before the needs of the nation are fully realized.

ADAMJEE JUTE MILLS

A manufacturing town—a third as large as the City of London—with a population of over 100,000 is being built on a man-made island in the Ganges Delta at a place which normally lies 5 ft. or more under water for five months in the year. Though enquiries were made to most of the larger engineering countries, the plant and equipment used was almost exclusively British.

IN MARCH, 1950, Mr. Abdul Waheed Adamjee cut the first sod out of a pit which was to be extended to provide 12½ million cubic feet of soil—the basis for the first jute mill in Pakistan. On that ground arose the largest jute mill building in the world. Production began in 1951.

The processing of jute requires a considerable amount of power, and the three mills constructed by Adamjee, together with the domestic site accommodating about 100,000 people, will consume some 10 to 11 Megawatts. Power in Pakistan is very costly and is likely to remain so. There is no indiginous fuel and imported fuel is very expensive, with coal at about £8 per ton on site, and diesel fuel about £25 a ton, with transportation from port to site costing a further £2 a ton. In addition to this there are great civil engineering difficulties in the building of power stations in East Bengal where much of the land is subject to yearly inundation and so has to be built up above flood level, and the soil is alluvial and of very low bearing capacity. This state of affairs adds to the cost of power and the Government, who had engaged to supply power for these mills, ultimately calculated that they could not afford to sell at a price less than 3¼d. per kWh.

Economy in Power and Lighting

The result of this very high figure for the cost of power on the design of the electrical system of an undertaking consuming about 10 MW and having a load factor of not less than 55 per cent, is that all the normal expedients commonly employed for the reduction of losses become enormously more attractive. Cable sections must be increased to reduce copper loss and Power Factor must be corrected as far as possible into the distribution system to reduce the copper loss of the wattless current. The provision of lighting provided an opportunity for a very substantial saving in these circumstances. Even in this country a case can generally be made for the employment of a more efficient system of lighting than that based on the tungsten filament lamp, but with current at the figure mentioned it was found that the extra cost of fluorescent lamps would be repaid in a trifle over a year.

Power was to be provided by the Government at 11 kV, and the power station was situated immediately adjacent to the mill site. Three cable circuits were brought from the power station each of 0·50 sq. in. 11 kV cable, and in emergency any one of these three feeders would be large enough to supply two of the mills. Interconnecting cable circuits and switchgear were therefore provided to connect the three mills to take advantage of the emergency capacity available in these cables but, as they were not to be normally in use, these interconnections were based on thermal and not economic sections of copper and were installed as 0·20 sq. in. cables.

With a power station almost next door having a potential capacity of 40 MW, generated at 11 kV, it was obvious that the prospective fault on the mill system would need careful watching. The high tension switchgear was rated to rupture 250 MVA, the Government having agreed to restrict the prospective fault to that figure, but the low voltage system became difficult. From economic considerations it would be desirable to install large transformers e.g. five of 1750 kVA running at half load. The requirement of each mill, however, at 0·95 power factor was about 3500 kVA and there were difficulties in providing more than two transformers and an installed spare, the latter being a definite requirement. Short of duplicate busbar equipment serious switching difficulties would arise with more than three transformers in all. It was found that with a 1750 kVA transformer an impedance of 7 per cent was required to restrict the secondary fault to 25 MVA and so any larger unit would require more impedance and produce troubles with voltage regulation. Three 1750 kVA transformers were therefore installed in each mill, one being installed spare and the three being separated by two bus section switches to prevent paralleling of any two secondaries.

All secondary connections of the transformers were made with rectangular section copper bars and, as the post type insulators which had been ordered for the purpose of supporting these connections disappeared in transit, they had to be supported on locally made clamp type insulators with cast iron bases and laminated plastic sheet insulation. The main circuits from the low voltage switchboard were run in duplicate three-core cables and fed H.R.C. fuse-switch distribution boards. In the circuits feeding the preparing section and the finishing section, power factor correcting capacitors were connected from these boards. The circuits feeding the spinning and winding sections of the mill, which account for more than 50 per cent of the power consumption, were arranged to be fed from overhead busbars, and in these cases the capacitors were arranged so that they could be connected directly from the busbars. This brought the power factor correction a stage further into the system with a resulting saving in copper loss. The other important section of the mill, the weaving section, had its motors connected directly from the distribution switchboard and the power factor correction was also on this board.

The weaving section was powered by fourteen 50 h.p. motors and it had originally been intended to drive the looms by a normal overhead lineshaft drive. There was much opposition to this method of drive but individual drive has never been successfully applied to a jute mill in India and there seemed to be no practical alternative. However, late in 1951 when the mill was within a few weeks of starting and the writer took up the question of providing a temporary platform for a motor to drive the one lineshaft which had been erected (the steel fabricators having failed to deliver the platform steel to time) it was found that the motor chain-drives had been supplied for a horizontal drive, and the steel-work for a drive inclined at 45°. This required some radical modification and so it was decided to scrap the overhead lineshaft completely and replace it by an underground lineshaft. This design was hurried through and eventually accepted by the management.

Planning the Lighting

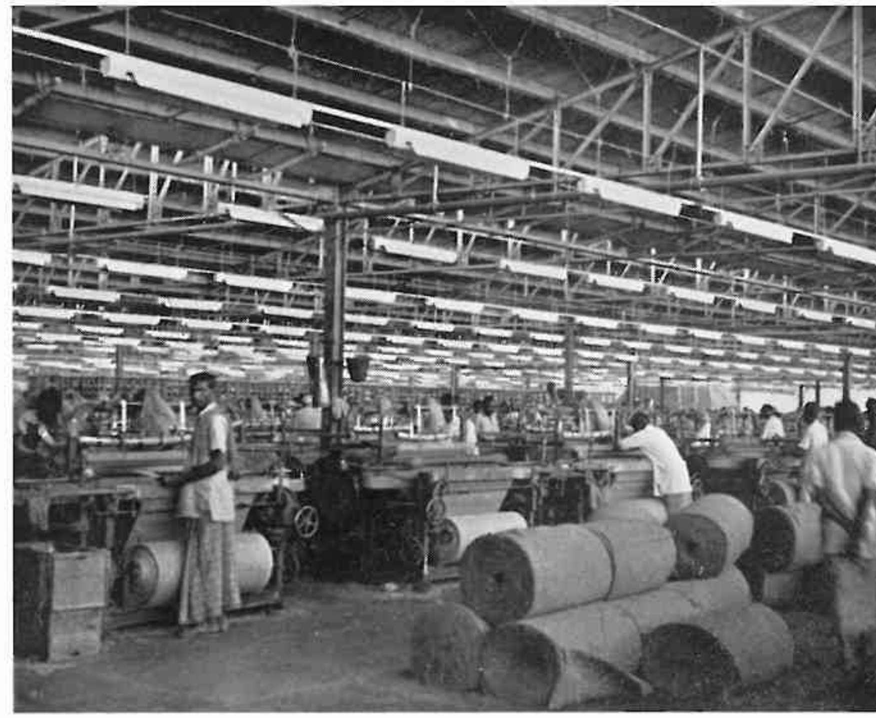
The results achieved by putting this drive underground were very satisfactory, especially in connection with the lighting system. When the lighting was originally planned by the writer and Mr. W. A. Ives of the Lighting Advisory Service of A.E.I. (India), no information could be obtained on the disposition of steel-work or drives in this section. Fittings were therefore allotted to give the desired general illumination in this area and calculations of switching points made on this ideal distribution. When the lineshaft was first erected overhead, it was found that the arrangement of the lineshaft, the columns supporting it and the belts, made this ideal arrangement of fittings impossible and any other practicable arrangement was far from satisfactory since it produced considerably less than the required value of illumination over a large proportion of the area. It was with some relief, therefore, that we saw this lineshaft taken down!

The smaller capacity circuits for this mill produced a very serious problem, arising from the non-availability of electrical conduit. The writer came to London early in 1951 to obtain this as well as some other items, and found that none of the suppliers could give any definite promise for welded steel tube. Solid drawn conduit was rather better but deliveries were of the order of eight months. It was, therefore, decided that armoured paper cable would be used for all power circuits down to the lowest. There were many alterations to be made to a great number of specifications and the promises made by suppliers for producing the necessary modifications were not always lived up to, and this resulted in some rather drastic improvization on site. Despite the fact that cabling for the final sub-circuits of the lighting system presented even more serious problems, the methods adopted there proved highly satisfactory in the end. Orders for some 2200 fluorescent lamps for No. 1 mill had been placed with BTH and the cabling problem was studied in conjunction with the lighting section of their Export Company.

It was eventually decided to use a conduit which was available from stock. It was found that the control gear channel of the fittings could be mounted direct onto the channel conduit end, if it were secured by means of two male-threaded $\frac{3}{4}$ in. conduit bushes and locknuts, two cable entries direct from the conduit were provided at the same time. Two $\frac{3}{4}$ in. standard clearance holes were in the control gear channel of the fitting and it was only necessary to provide two similar holes in the bottom of the channel conduit.

The next problem was to arrange for the suspension of the channel from the steel-work of the building which had a saw-tooth roof of 33 ft. pitch and 66 foot bays. The design called for the suspension of fittings both along and across these bays, and it was eventually decided that the runs of conduit should be supported by galvanized steel wire running above the lowest member of the roof girders. This wire was kept level by ties fixed to the purlins. Where the runs of fittings were parallel to the purlins it was generally found possible, without doing serious offence to the design, to run them directly underneath the purlin, but in some cases a double brace in the form of a V had to be used. The final support for the conduit was in the form of a one sided stirrup, which was again attached to the main suspension wire. These stirrups were fitted one at each end of each lighting fitting, and in general no further support was needed for the conduit. The erection of the system in this way was rapid and very economical, and although the materials were somewhat higher in first cost than would have been the case if a conduit system had been used, the extra expenditure was much more than balanced by the exceedingly low cost of installation.

Each of the mill buildings is approximately half a million square feet in extent and the amount of power taken by the fluorescent fittings was found to be about 220 kW. Fairly high levels of illumination were required over certain areas, especially spinning, weaving and sewing, and if the lighting system had been designed to provide a fairly uniform illumination over the whole area a considerably greater number of fittings would have been required and this would have put an unjustifiable burden of cost on the product, which already suffered severely from the high cost of the power necessarily absorbed for the machines. It was therefore decided that the intensity of illumination would be allowed to drop to fairly low values in areas where the process did not require any visual tasks to be performed. For the spinning frames, an intensity of 17-19 lumens per square foot was provided on the working sides of the frames, and this was allowed to drop rather severely on the backs of the frames. In the weaving area there was a general illumination of 13-15 lumens per square foot and the same was provided for the sewing area. In areas where light was required for movement only, the intensity was allowed to drop to 1·5 lumens per square foot.

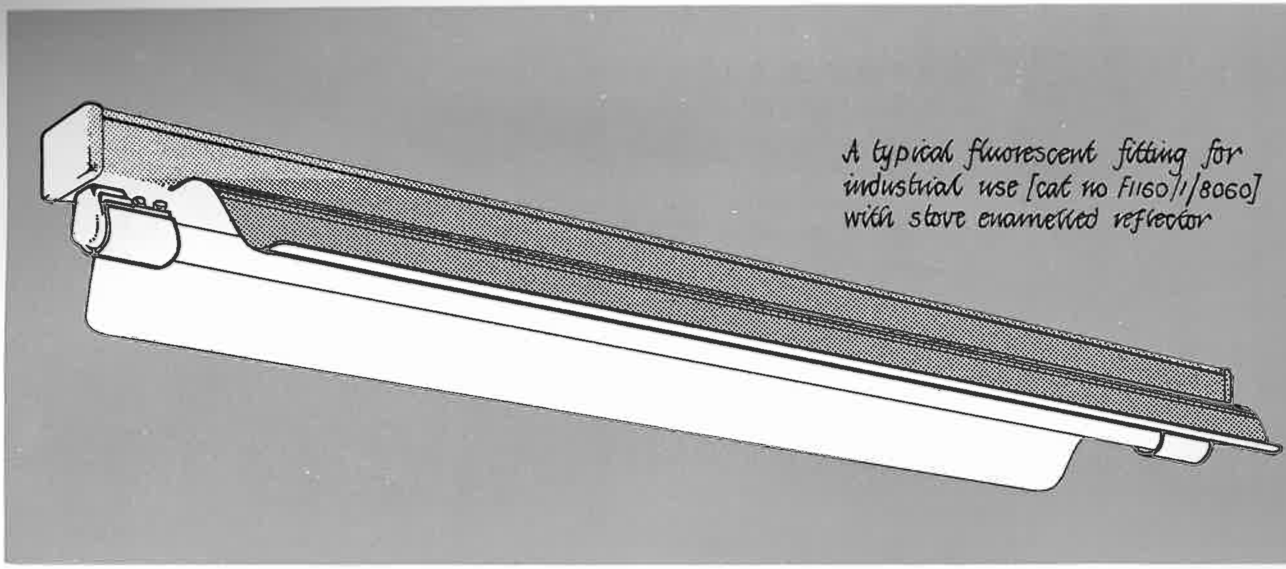


Loom Section of Adamjee No. 1 mill, showing the method by which BTH fittings are suspended by Channel Conduit.

As has already been noted, there was a considerable danger of excessive volt drop owing to the high reactance necessary in the transformers and a considerable amount of trouble was taken to ensure that the voltage would not fall to levels which would make starting difficult. Each one of the 250 or more lighting circuits was separately checked for volt drop and it was found necessary in certain instances to use final sub-circuits in 7/·036 cable to restrict the total drop to the 5 volts which was considered the maximum tolerable.

Instant start fittings were chosen for installation in these mills in order to avoid the troubles which occur with thermal starters especially under the conditions of installation and maintenance which obtain in Eastern Pakistan. This provision was extremely useful in the early days of commissioning the system when power supplies were uncertain and the voltages would frequently fall by 25 or 30 per cent several times a day. Such conditions frequently cause the thermal starter to do as much work in a few minutes as it would normally do in a month or so and casualties in starters are apt to be very high.

When the lighting installation was commissioned in No. 1 Mill it was completely without parallel in Pakistan and the writer was told by Mr. Waheed Adamjee that he was having trouble with all the important local visitors who wished to visit the mills at night rather than in normal hours so that they might have the opportunity of seeing the lights in operation. The sight was described by one visitor as 'A glimpse of Fairyland', which is to say the least of it an unusual description of an industrial application.



A typical fluorescent fitting for industrial use [cat no F1160/1/8060] with stove enamelled reflector

LIGHTING SPECIFICATION SHEET

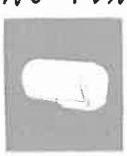
compiled by Joseph Mayo A.R.I.B.A.

Fixed B.C. lamp holder standard on these BTH fluorescent fittings

Standard power - pack assembly Various types of fittings are built up on this basic unit

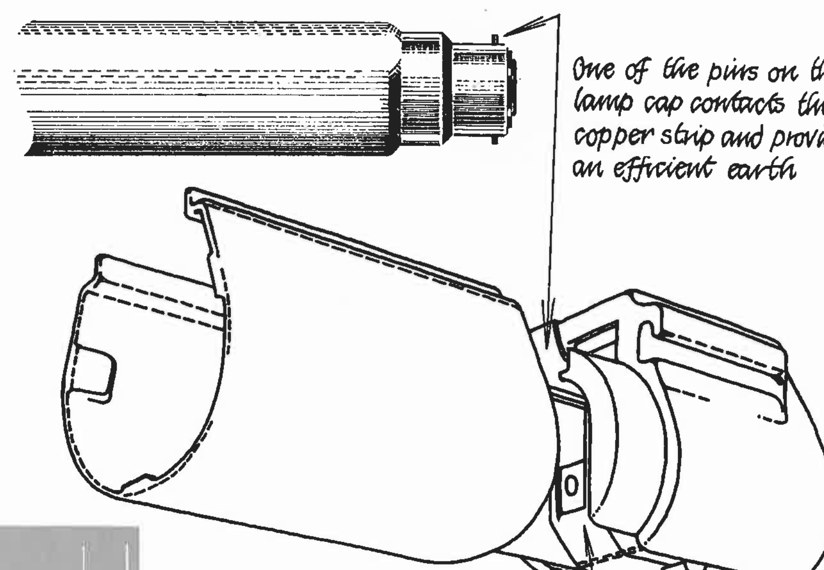
Simplified fixing procedure by means of Pendictone tab washers

The Fixed B.C. Lamp Holder



This lamp holder is made of white plastic, and combines a spring socket for the lamp end connections, with a plastic shield which screens the lamp cap from view

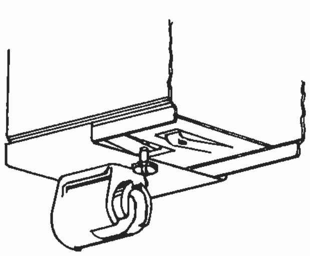
The spring platforms enable fluorescent lamps to be replaced as easily as tungsten lamps



One of the pins on the lamp cap contacts this copper strip and provides an efficient earth

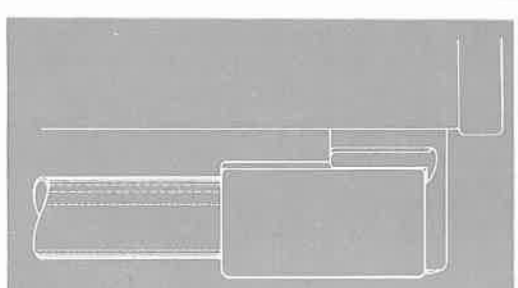
This white plastic shield gives a very neat appearance to the lamp end It must be slid over the lamp before it is offered up

When fitting a lamp, the lamp cap is pressed against this spring platform

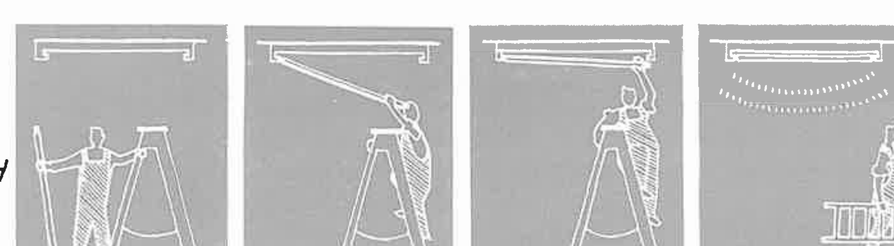


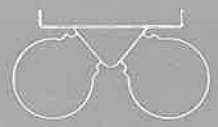
With all fittings based on the Standard Power Pack except the Monolux, the lamp holders are fixed to plates found packed in the main channel When the fitting is assembled these must be screwed to ends of the main channel by means of the captive screw provided

Monolux lamp holders are packed loose in the fitting for screwing direct to the shaped cover [see over]

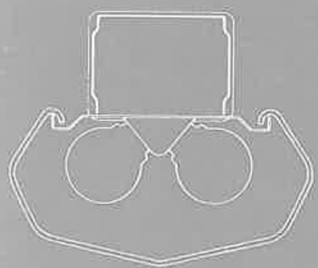


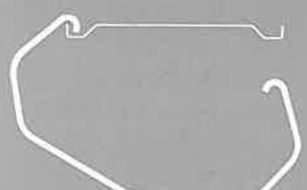
Diagrams to the right shew how the lamp may be fitted or replaced from either end of the fitting using only one hand



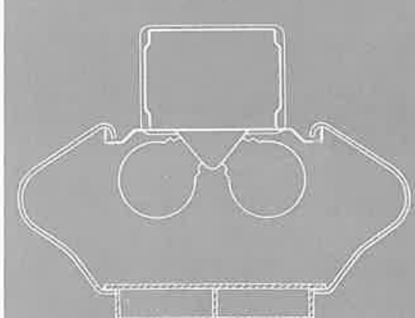


adaption of fixed B.C. lamp holder for a twin-lamp fitting

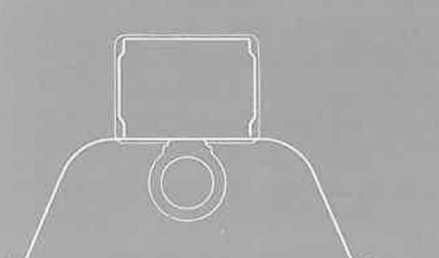




cover with hooked section used to suspend a perspex diffuser with closed ends Access can be gained to lamp without completely removing the diffuser

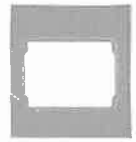


perspex diffuser with built in air tight louvres allowing greater proportion of direct downward light

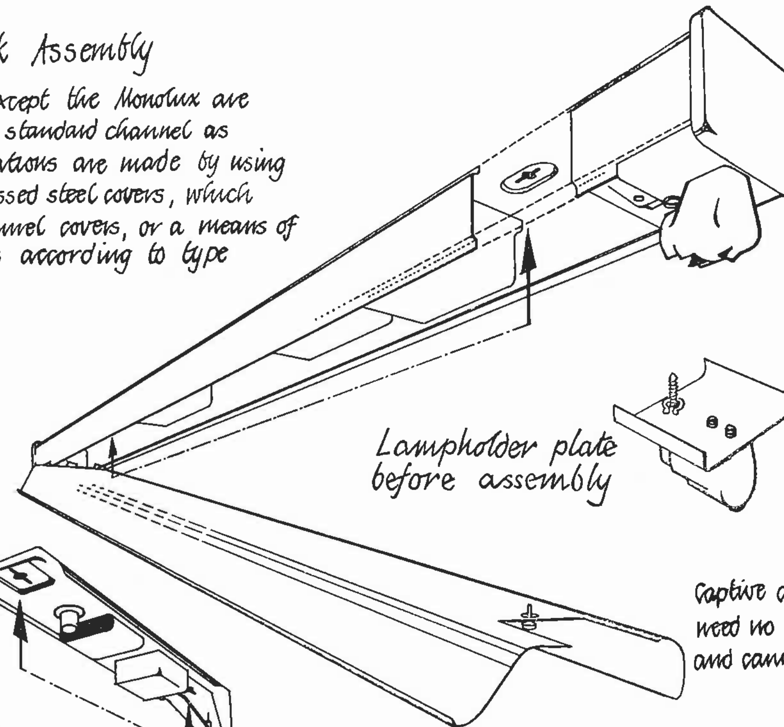


a closed end reflector type of fitting The reflector forms the cover of the standard channel It is coin screwed at both ends

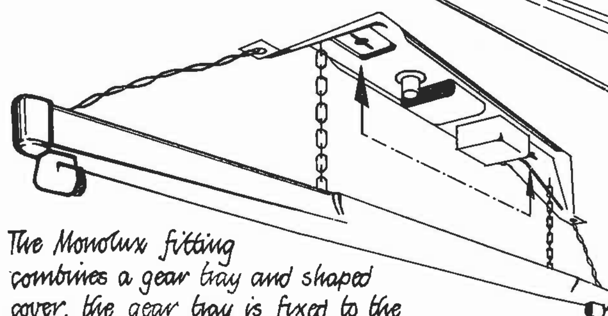
Standard Power Pack Assembly



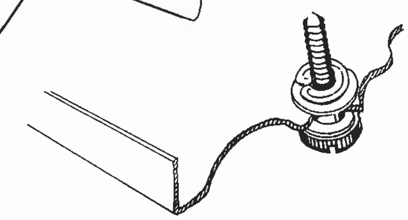
All fittings except the Monolux are based on the standard channel as shewn Variations are made by using different pressed steel covers, which form reflectors, plain channel covers, or a means of hanging perspex diffusers according to type



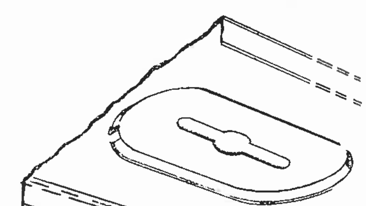
Lampholder plate before assembly



The Monolux fitting combines a gear tray and shaped cover, the gear tray is fixed to the ceiling While fixing proceeds the cover hangs by chains as shewn, and is later secured to the gear tray by coin screws, the lamp holders must first be screwed to the cover

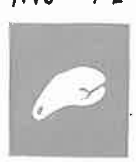


Captive coin screws need no screwdriver and cannot get lost

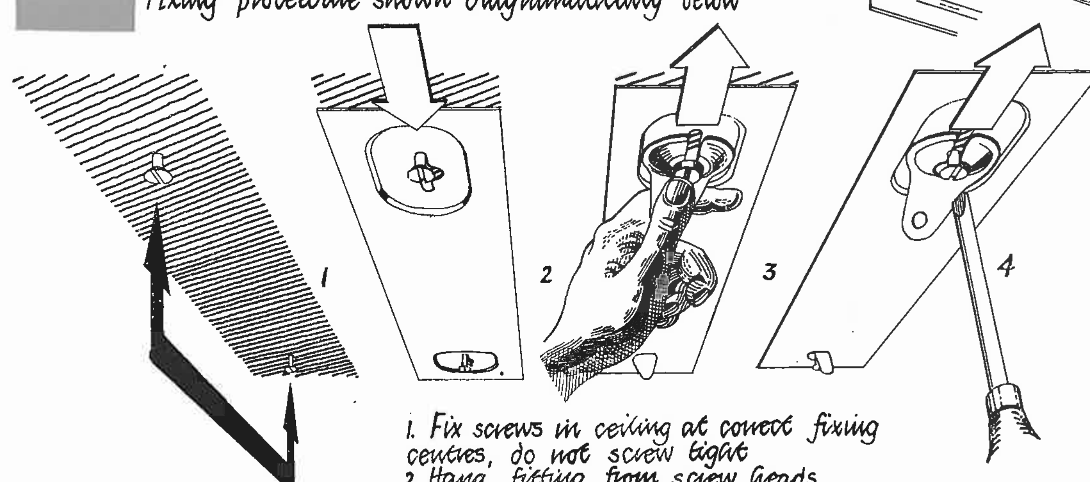


Standard fixing slot common to all fittings

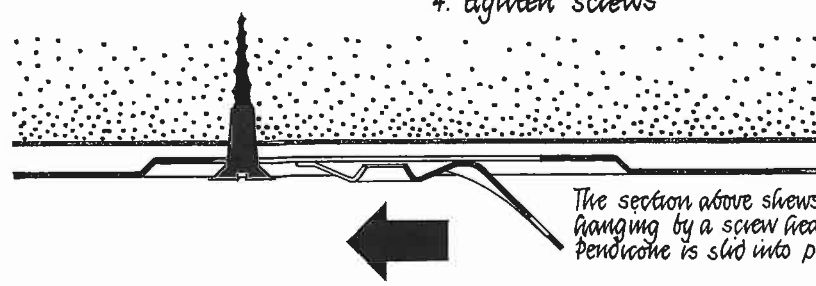
The 'PENDICONE' Tab Washer Fixing detail.



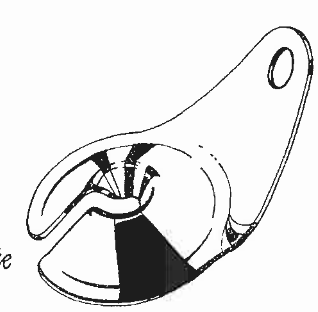
This is a special washer with a tab for sliding it into position while fixing the fitting A pair are provided packed inside the main gear housing of the fitting Fixing procedure shown diagramatically below

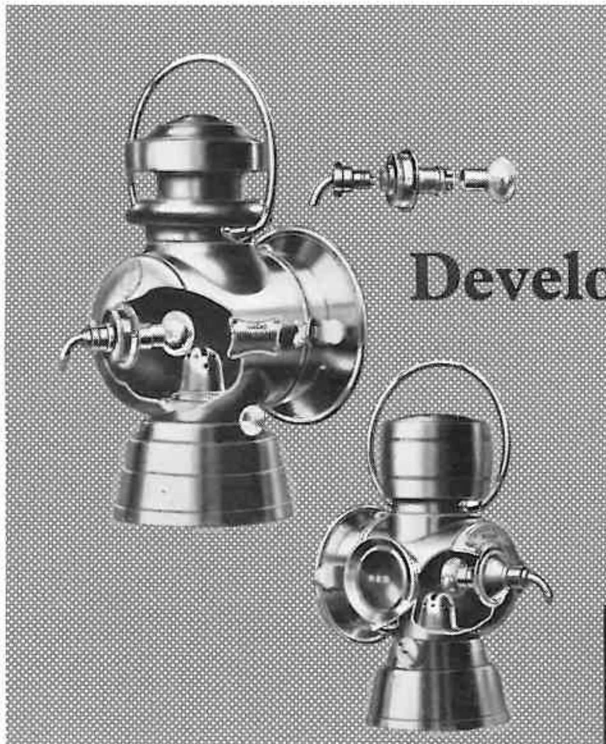


1. Fix screws in ceiling at correct fixing centres, do not screw tight
2. Hang fitting from screw heads
3. Insert pendicones, slide fitting
4. tighten screws



The section above shews a fitting hanging by a screw head while the Pendicone is slid into position





Developments in Motor Car Lighting

By J. H. Nelson, Ph.D., F.I.E.S., A.M.I.Mech.E.
Senior Lighting Engineer, Joseph Lucas Ltd., Birmingham

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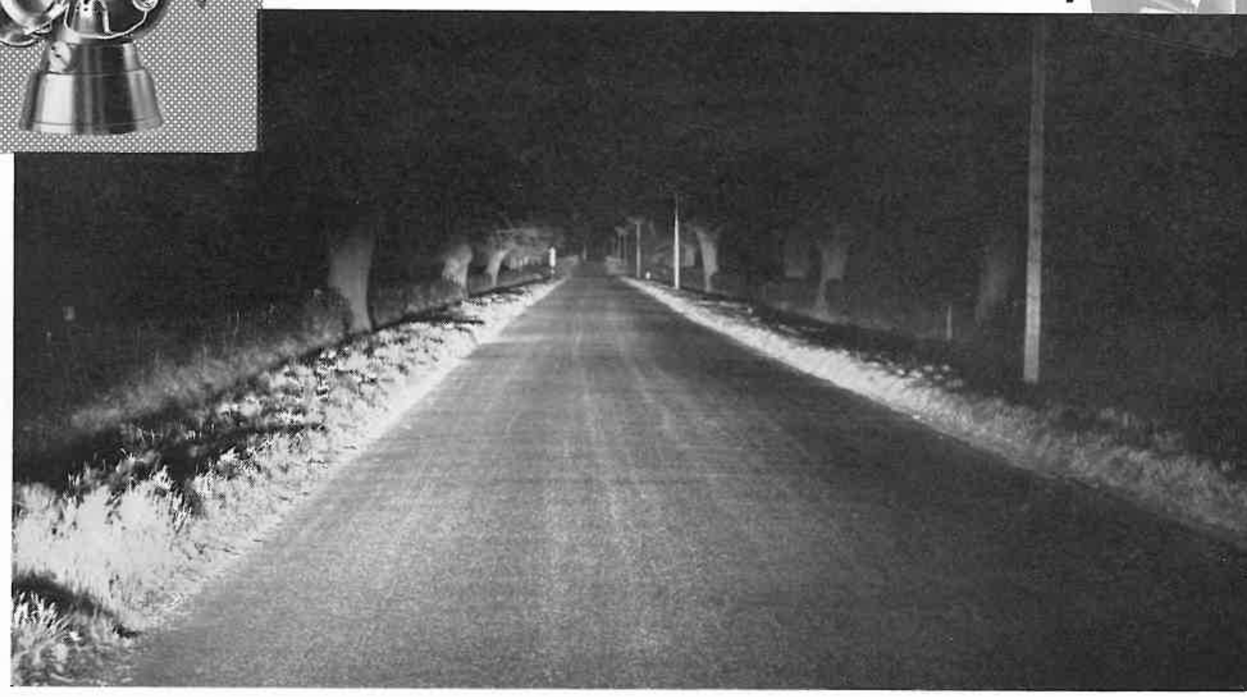

Above: Cutaway views of two of the earliest motor car electric lamps. These are oil lamps which have been converted to electricity by the addition of a lamp in a holder mounted just behind the light source position of the original oil burning wick. This is an example of direct transition from oil to electricity which demonstrates the extremely brief life of the acetylene lamp period which came between the two. On the right: Properly adjusted modern car headlights put the light on the road and verges. No light is wasted in the air or to right or left.

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At a recent conference on Highway Lighting one of the grand old men of the motor industry spoke at length of his experiences during the pioneer days, and finally described with great feeling the excellence of the lighting on his 1912 motor car and how it showed the road in front of him as a white ribbon winding away into the distance. He then proceeded to contrast this with the view of the road he had on his journey to the meeting itself, and in the end left us with the feeling that with all our talk of development in modern lighting we were still a long way behind the days before the first world war.

Pioneer Era of Car Lighting

When improvements in technique are the result of steady application of new knowledge and are, in consequence, very gradual, taking place over years, the user is apt to assert that nothing has taken place at all. He remembers all that is good of the past and compares it with all that is bad of the present. Our pioneer describes the view of the highway on a nice clear night when he is alone and his car happens to be going, and contrasts it with a view of the highway on a murky evening and crowded traffic travelling on a tarmac road. If he had the lamps that appear so rosy in his dreams on the modern motor car he would be just as horrified as if he had no self starter, no electric wipers and tyres that had a habit of developing punctures. He would, in fact, be appalled by his 1912 car in 1954.

The road conditions of the early days and the vehicles that travelled on them were very different from those that exist now, and towards the end of the last century, when the penny farthing bicycle was part of the general scene, the sort of lamp used is shown in Figure 1. This is one of the earliest cycle lamps produced and was mounted on the hub of the front wheel to hang down from it. In those days the lamp manufacturers had to depend on 'lamp oil' for their source of illumination, and for the cyclist this source of illumination lasted well into the second decade of this century.

The motorist, even in the early days, demanded a higher power than the cyclist and soon abandoned the oil lamp for the more powerful, and certainly more temperamental acetylene lamp. Again, the cyclist proves more conservative allowing the acetylene lamp to run right into the 1920's, but as Figure 2 shows, the electric lamp very soon came into the motor world and ousted the short life of the acetylene lamp. In fact, the illustration shows the conversion to electricity of an oil side lamp. From these early beginnings the lighting requirements of the motorist have steadily grown more exacting, and the lamps that have been provided have incorporated successive developments in filament lamp design, projector design and optical knowledge. Filament lamps of the early days with their very open cage-like filaments in large vacuum bulbs are a very different thing from the neat accurately placed filaments of the modern gas filled motor car bulb. The modern lamp is not the product of one set of designers alone but the result of the ever more exacting demands of modern traffic.

Application of Modern Lighting Knowledge

In providing lighting for the modern car we have to cater for vehicles capable of touring continuously at speeds up to 50 and 60 miles an hour and, moreover, the roads have a very much higher density of traffic than in the pioneer days. However, the same knowledge of fundamentals of illuminating engineering which have been learned over the last few decades are available to the designer of motor car headlamps as to engineers in other fields of lighting, so that now we can specify the performance required from a headlamp; the optical requirements of the reflector and lens can be drawn up as an engineering specification, as can the performance required of a filament lamp.

Lighting the highway for the lone driver in the absence of oncoming traffic has always been a relatively easy problem, though increased speeds have made it important to use the utmost economy, since the power available to the automobile headlamp designer is nothing like as generous as, for example, that to the streetlighting engineer. Figure 3 shows a typical view of an English road as seen from a pair of modern headlamps, and it will be evident that as far as possible the beam is tailored to the road, and the light is not permitted to stray up into the leaves of the trees. Because the road is dark the grass verges show up light in contrast with it, but the motorist can see his way, position his car on the road and be sure that there are no hazards.

The Dazzle Problem

When two vehicles are meeting or two streams of traffic are meeting, the problem of the car lighting engineer is very much more severe, and from the very early days the problem of dazzle from the approaching car's headlamps has been one of great seriousness. Almost all solutions that have been offered for solving this menace have consisted, in some way, of restricting the amount of light given by the lamps, and the Patents Library is full of ingenious inventions to this end. Very few of these ideas have approached the problem in a way that the lighting engineer is compelled to do. For him, the problem is not how to prevent dazzle, but how to make it possible for the drivers of both cars to see. If they are dazzled under the conditions in which they see best, well it is unfortunate but it isn't serious, but if in the search for dazzle-free lighting, visibility on the highway is sacrificed, then the dangers are very serious and many accidents have been caused through this false approach.

Designers in Europe differ very considerably with those in Britain and America as to the type of distribution most suitable for the meeting beam. Figure 4 illustrates the sort of meeting beam used on British cars, and except for the fact that the Americans drive on the other side of the road, American beams are very similar to this. The object of the designer has been severely to limit the candlepower in the direction of the oncoming driver, and by deflecting the beams of the two headlamps to the nearside, give the driver the maximum visible range along the nearside kerb, together with a pool of light immediately in front of the vehicle, to position his car accurately on the road.

With such a lighting system, of course, the range of vision is necessarily restricted and the restrictions are not really those of illuminating engineering, but simply those of geometry. The headlamp on the modern vehicle is mounted about 2′ 6″ from the ground, and because of the necessary vertical movement due to the softness of suspension and the vertical curves of the road, any attempt to give a long range in the meeting beam by critical setting must, inevitably, result in extreme discomfort and danger to the oncoming driver.

The presence of the oncoming vehicle, as shown in Figure 5, very considerably changes the view of the road as seen by each driver. It will be evident from comparison of Figures 4 and 5 that the view of the

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Fig. 4 and 5. Above: Double dipped headlights light the road immediately in front of a car. But (Below) this photograph shows that where two cars meet with double dipped headlights the oncoming cars headlights light the offside kerb and help to light the space between the two cars.

Typical Mazda Prefocus Headlamp

road obtained by each driver, is the result not only of his own lighting but of the oncoming driver's lights as well. Admittedly under almost all circumstances the oncoming driver's lamps represent a glare source that would not be considered acceptable from the comfort point of view, but at the same time the oncoming driver's lamps do disclose the offside kerb and fill the whole of the road surface between the two cars. By this means it is possible for the lighting engineer to give the driver visibility conditions such that he can drive knowing that the way in front of him is clear, seeing where the contour of the road goes and positioning his car accurately on the road.

It is only within recent years that Britain, like the rest of the world, has decided to use both headlamps when meeting, and the new double dipping headlamps have been the subject of much controversy. Recent

Typical Mazda Stop/Tail lamp

Fig. 6. A recently developed plastic stop-tail lamp incorporating a reflex reflector. Better lamp design and improved plastic moulding and colour transmission control have resulted in vastly improved side and tail lamps during the post-war period.

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developments in headlamp optics and in filament lamp construction have made it possible to introduce a standard meeting beam suitable for all vehicles, and which has now been adopted by manufacturers for nearly all British vehicles sold in this country and in the Commonwealth.

Tail Lamps and Safety

However important are the lamps fitted to cars in order to show the way, the indicating lights—as they are known in international parlance—namely the side lamps, rear lamps and stop lamps, are even more important from the point of view of road safety. Unlike the headlamps, the stop and tail lamp designers have, within the last few years, had two very big advances placed at their disposal so that improvements between the postwar British passenger car and the prewar have been quite dramatic.

The availability of durable moulded plastics has given the lamp designer the possibility of using an optical system of an accuracy previously impossible in ordinary glass and, at the same time, research carried out in all parts of the world, and in particular by the Road Research Laboratory in this country, has given the designer a very clear target for the performance of his tail lamps. Having a clear goal to achieve, the new optical techniques have led to further demands on the optical accuracy of the filament lamp. Before the war the average candlepower given by a tail lamp was something about 1/50th of a candle. In 1947 the American S.A.E. Specification called for 1/10th of a candle, and British and American industry had some considerable difficulty in maintaining production to that figure. Due to the improved manufacturing techniques, plastic moulding, colour transmission control and more accurate filament lamp manufacture, the 1953 Draft Specification by the I.S.O. calling for $1\frac{1}{2}$ candlepower can be met with much greater ease than the far lower 1947 Specification was met with the old techniques. In the few years between 1947 and 1953 the specification to which British and American tail lamp designers have worked has, in fact, gone up by a factor of 15 times. The difference between post war and pre-war practice has gone up by 50 to 100 times.

Of all the factors which stimulated the application of this development the knowledge of the extremely restricted range of visibility of the ordinary tail lamp under adverse conditions was perhaps the most important. Even now with a modern tail lamp giving about 1 candlepower, in conditions of rain and glare the visible range of such a lamp may well be below 1000 feet, so that although on a nice clear bright evening the tail lamps in a line of traffic look very brilliant, the safety margin is none too high.

Reflex Reflectors

Another piece of safety equipment that has now become almost universal on road vehicles is the reflex reflector. Although it is not strictly a lamp it is essentially a lighting device, and the recent developments in plastic moulding technique have had a very profound influence on the performance of reflex reflectors as applied to motor cars. The object of the reflex reflector is, in the event of failure, to replace completely the tail lamp. A number of methods of achieving the reflex action are used commercially but probably the most successful is the moulded prismatic reflector. As in the case of a tail lamp, the conditions determining the performance specification must be when the driver is subject to dazzle from oncoming traffic and when rain is, to some extent, impairing vision through the windshield. Under these conditions if the reflex reflector is illuminated by a meeting beam a visible range of at least 3 or 4 hundred feet must be provided.

The Use of Lamps

The problems of reflex reflector design are both difficult and interesting but hardly concern us here except insofar that it is necessary for other drivers to use their lamps if the reflex reflector is to work at all. An American motorist has described England as a place where drivers park their cars with the lamps on and drive with them off! In almost all other countries of the world vehicles may be parked either off the highway or on a lighted highway without lights at all. The lights of the moving vehicles must show up the stationary vehicle when helped by reflex reflectors, which are almost universal.

With this practice, of course, goes the New World practice of always driving with headlamps on after dark, even in the centre of the cities. For some reason the Old World, the Continent of Europe and largely Great Britain, takes the attitude that driving with headlamps on in towns causes dazzle and, therefore, should be stopped. In Australia, Canada and the United States the attitude is that a moving car must have its' headlamps on so that it can be seen and the driver can see his way, and they will treat dazzle as a separate problem by controlling the sort of headlamp he uses, and making him dip.

From the point of view of the driver himself, in most suburban streetlighting the use of the meeting beam (or dipped beam) will enable him to keep his position better on the road and will show obstacles which the surburban streetlighting installation cannot attempt to show. The headlamp serves no purpose in showing him the direction of the road since this is fully marked out by the beacon type of lighting. As he drives on roads with better streetlighting, mainly on the highways or in the city centre, the driver of the vehicle becomes progressively less and less aware of his own headlights, and it is only when there are faults in the streetlighting installation causing dark patches in the roadway, that they serve any useful purpose to the driver himself. The headlamps do, however, provide a salutary warning to pedestrians and other road users in these circumstances because, although the modern city centre streetlighting installation gives a very high standard of lighting, it still is a very poor substitute for daylight, and one is not so completely aware of one's surroundings as by day. At a casual glance a pedestrian may well mistake a car with side lamps on moving towards him for a parked car. If the vehicles have headlamps on then the pedestrian will notice it and will not step casually in front of it.

XENON FLASH *for high-speed photography*

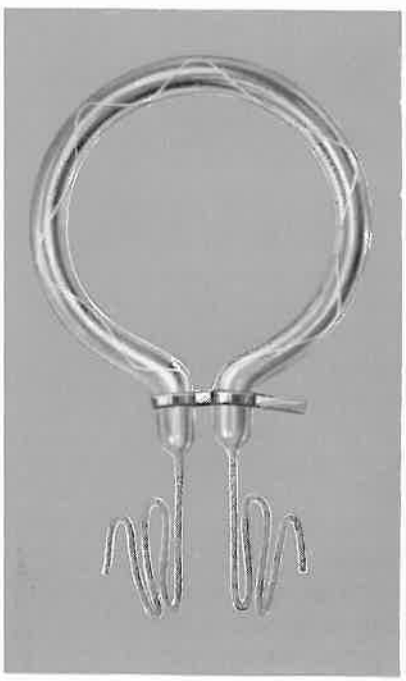
SINCE 1891, when Fox-Talbot first made a photographic exposure using a spark as a light source, high speed flash photography has been gradually improved as a photographic technique. Over 60 years ago, working in London, Sir Charles Vernon Boys succeeded in taking photographs which perfectly arrested bullets in flight and showed their accompanying air pressure waves. The flash tube as we know it today was used experimentally in the late 1920's. Perhaps its most important use was for lighting night photographs taken from bombers flying over the beaches on which our troops landed on D-day.

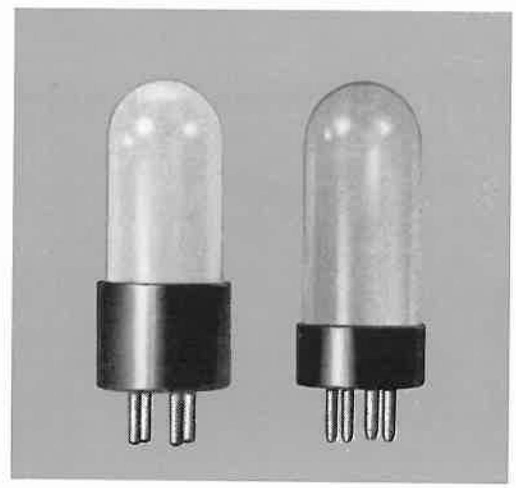
The Modern Xenon Flash Tube

The modern Xenon electronic flash tube is really an enclosed spark gap. Electrical power is stored in a capacitor and when the energy is suddenly released into the tube the Xenon gas filling is excited, emitting an ntense flash of light. Flash tubes operate over a wide range of voltage and recently small power packs operating from miniature dry H.T. batteries have helped to provide the amateur with an inexpensive source of light for synchronized flash photography. Since the effective flash duration is never more than 1/1000 sec. and with higher voltage tubes is nearer 1/10,000 sec., any movement is arrested. Xenon flash is specially suitable for colour photography though its real future has yet to be unfolded in this field.

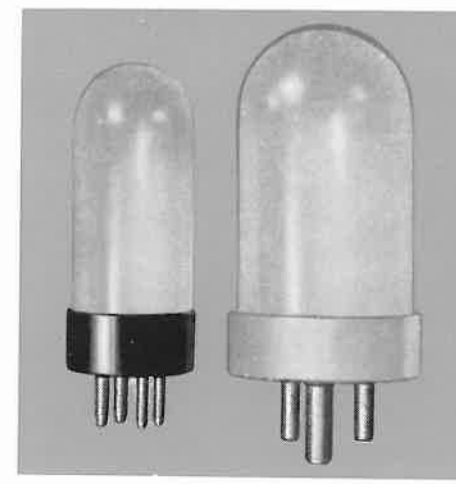
Stroboscopic operation provides extremely brief flashes of light repeated many times a second so that fast moving machinery is apparently slowed down. This permits a slow motion study to be made of machinery operating at high speed.

Both amateur and professional photographers are finding that these lamps can be used for almost every kind of studio, industrial, and outdoor application.





FA 7 and FA 9 mainly for the professional photographer's portable equipment *Type FA 7.* This tube which has a wide range of applications gives efficient light output over the range of 100-200 watt seconds. *Type FA 9.* A tube for the larger portable flash units. Suitable for colour photography.



FA 2S and FA 7S mainly for stroboscopic equipment Designed specifically for stroboscopic applications and widely used in industry for inspecting machinery under working conditions.

FA4 special applications Made to fit round the lens of a camera and used for specialized work such as photographing deep cavities, etc.

FA 5 The Mazda FA 5 Xenon Flash Tube, famous as the "lamp brighter than the sun". Developed by BTH for use by a leading opthalmologist as an aid to retinal colour photography in eye research, this lamp has created world-wide interest. It has a number of special applications and is now included in the standard Mazda range.

FA 1 and FA 2 mainly for studio use by professional photographers *Type FA 1.* A high-power flash tube for studio use with modelling lamp. *Type FA 2.* A specially high output tube.

FA 6, FA 8, FA 10, FA 11 and FA 12 mainly for the amateur in portable equipment *Type FA 6.* One of the most popular flash tubes, widely used in many portable flash units. *Type FA 8.* A miniature low-voltage flash tube, weighing less than 0·7 oz. *Type FA 10 and FA 12.* Tubes specially for the amateur for operation at low voltages. *Type FA 11.* For low-voltage operation with a high-energy output.

.....and for me, it is the
LIGHT OF THE PRESENT

Says Roger Wood whose work in ballet, press and commercial photography attracted great attention at exhibitions given in London recently by Kodak Ltd.

Flash photography is already so well established that, at least with professional photographers, it tends to be taken for granted. Yet I believe that few people, even among my working colleagues, realize the tremendous possibilities of the electronic flash tube, the form of lighting known rather loosely to the trade as 'strobe'.

Personally, I find these tubes, with their speedy and extremely reliable flash, indispensable to many tasks, especially in colour work. There is nothing difficult about their use, either, when you have become accustomed to them. Amateurs as well as professionals will, I am sure, soon come to regard them as an aid to taking both action and posed pictures of very high quality.

I cannot emphasize too strongly the importance that electronic flash will come to have as an illuminant for static subjects, such as still life, etc. Far too many people are apt to think of it as a means of photographing only moving and animated subjects.

Even conventional studio lighting is becoming ousted for many purposes by the multi-flash illumination made possible by 'strobe'. It is often easier to obtain the best shadow effects and modelling of a subject by using flash alone, without ordinary lighting.

In trying out a number of different Mazda flash tubes during recent months, I have obtained outstanding results with such divergent subjects as a sequence of a girl diving at night, an interior of an old Viking house, tropical fish, Paris fashions, performing dogs, acrobats and opera singers. I have found them equally effective in capturing ballet dancers in the perfection of performance or dreary drain pipes being drawn from extrusion presses, in recording travel scenes in bright sunlight and still life in complete gloom.

The advantages of electronic flash are tremendous. Consistent performance instead of having to replace the conventional flash bulbs after every exposure; economy which soon meets the cost of the equipment; accurately determined light output, duration of flash and constant colour temperature which ensure a good picture with the highlights and shadows in the right places; and, for me perhaps the most important feature, they enable one to dispense with the inevitable load of bulbs—never sufficient, however many are packed away—and often with cumbersome studio lights.

Two of the tubes which have given excellent results in test pictures which I have taken recently are the new FA 10 and 12 Xenon types, designed specifically for amateur use. These operate at low voltage yet have a high energy output, so that it is possible to get a good flash with light-weight, easily portable, equipment.

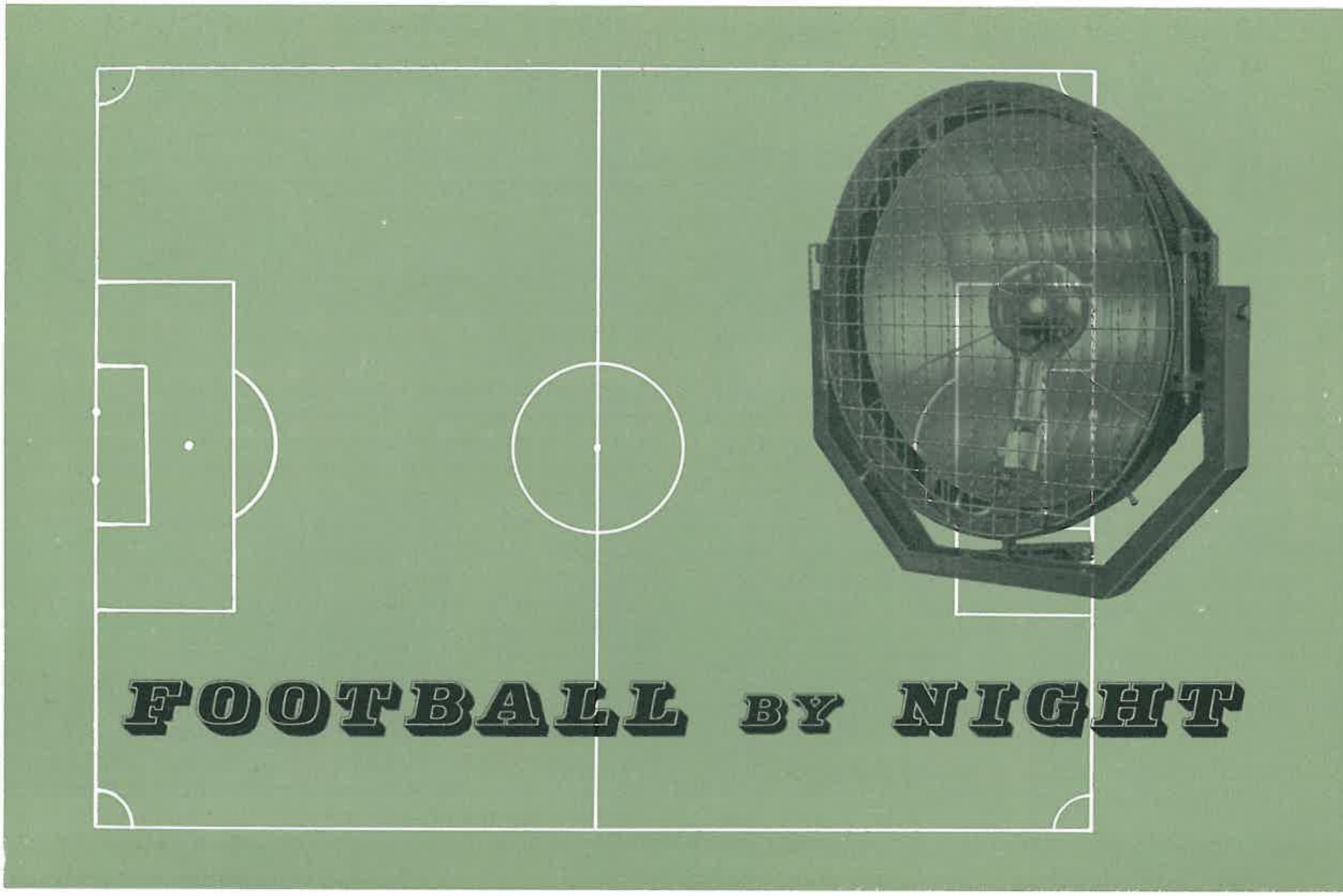
The possibilities held out by these comparatively recent additions to the photographer's stock-in-trade are endless. Sometimes, when confronted with high-speed events which require multi-flash, and an absolutely reliable flash at that, I wonder how we ever managed without them. For me, 'strobe' is the light not only of the Future but of the *Present*.

1

2

3

1. Antonio, the Spanish dancer. An action study taken from a colour transparency made with 4000 joules of electronic flash and four FA 1 tubes. 2. Tropical fish photographed by the light of two small units and FA 6 tubes. What might have been a difficult shot became with electronic flash extremely easy. 3. Sonja Henie at the Palais des Sports, Paris. Photographed with three small units using FA 7 tubes. She granted us about three minutes one evening at midnight after her performance. During that time we shot about two dozen pictures—imagine attempting that if we had had to change the bulbs after each exposure.



The football season has drawn to its close. But football floodlighting—now appealing to authorities and players alike as a means of bringing new support and increased 'takings' to Britain's national game—is very much in the news. Here, Dyke Pearce, well-known writer for the Sunday Empire News, sums up the prospects on the basis of interviews with leading soccer officials.

Floodlit football is not new to Britain. Matches were played under arc lamps as long ago as 70 years. Outdoor floodlighting was one of the first applications suggested by Thomas Edison for the large scale use of the electric lamp he had invented.

In Scotland Queen's Park and Vale of Leven were playing regular matches by floodlight in the 1870's. But in the years that followed Britain allowed other countries to reap the benefit of her inventiveness. To-day Britain lags behind almost every other sporting country. In South America floodlit soccer is as common as daylight. Most spectators—and players—prefer to enjoy their sport in the cool of the evening. Going to a match in the moonlit evening is as fashionable as is a visit to a theatre. South Americans cannot understand the opposition they meet from British teams who insist on daylight games. 'So much pleasanter to play football in the dark', said the director of a famous Argentine club in London last week, 'I cannot understand why Britain neglects such an opportunity'. He was over here placing a contract for more floodlighting for several new South American stadiums.

Climate makes no difference to the success of 'illuminated' matches. Both Switzerland and France regularly play under the arcs. Recently Sir Stanley Rous watched a match in Switzerland—'Magnificent!' was his comment. The light of the arcs has even pierced the Iron Curtain. Crack Russian teams regularly play under floodlight and players are equally at home on the field by day or night. From the Soviet point of view such matches have the benefit of filling grounds without interfering with essential production. Spain and Jugo-Slavia are equally fully converted to the advantages of football by night.

I have spoken to many of the men in this country who are fighting against the prejudice which still exists in the minds of officials of the Football League and the older school of player. Their view is unanimous —'Floodlit football is already here and clubs which get in on the ground floor will reap the benefit'. This is a sober view of what supporters of the system expect would result if official backing was given to a floodlit league. In the first place crowds of 60,000 and £10,000 gates would be quite commonplace. Loss of revenue caused in the dark winter months by the necessity of starting games too early to suit the convenience of the ordinary supporter would not occur. Any club with floodlighting could start at the normal time and play while light lasted. As dusk fell arc lamps could be switched on and matches completed in comfort. If extra time was necessary it would present no problem.

To the player floodlighting would open a new era of prosperity. For years star players have had to be content with rewards that appear paltry in comparison with those earned in other sports. Evening matches would enable even the poorest clubs to double the payment of their players without any risk to their finances. Many players fear that floodlighting would merely mean extra games and harder work without compensation but I am assured by those who are planning the future of the game by night that this would never be tolerated. Players would share the prosperity of their club.

Despite the conservatism of many clubs great progress has been made. Already well over 40 clubs have floodlighting and many more are prepared to adopt it as soon as finances permit. There seems to be a current impression that the cost of floodlighting installations are excessive. The facts belie this. The first 31 clubs to install lighting did so at a cost of under £150,000. Many of these clubs were wealthy and chose the most expensive equipment. Most of them have already recouped their outlay—the future is all profit. One American football manager reported a few weeks ago that in five years floodlighting had paid for itself ten times over. Supporters are confident that similar figures could be achieved here. It was with these figures in mind that Sir Arthur Elvin, Wembley chief, last year asked for tenders to install floodlighting. He was prepared to spend £20,000 and Sir Arthur is one of the shrewdest men in the game.

Then there is the question of coaching. Here is the view of Mr. Arthur Drewry, President of the Football League—'More clubs must use floodlighting for coaching so that training can be carried out under the ideal conditions I found in Brazil'. He regards floodlighting as being as essential to coaching as baths and massage.

BTH are in the vanguard of firms specializing in floodlighting football grounds. Last year they equipped Watford with the most up to date system in the world. Its low cost has aroused world wide interest. It is the result of two years research at the Company's Rugby laboratories.

Perhaps the best summing up of future prospects was made by Mr. S. Seymour, Chairman and Managing Director of Newcastle United, who arranged for his club to spend £5,000 on floodlighting. 'This can open up a new football world for us. I forecast a great future for it'. He has a reputation for forecasting accurately.

A floodlit match between Coventry City and the well-known Scottish club, Queen of the South. Coventry City installed BTH 'Touchline' floodlighting at their ground early last season. The special BTH 'Low Brightness' Football Floodlighting Projectors house 1500-watt general service tungsten lamps.

A fine study of an artist under his fluorescent studio tubes. Hein Heckroth stands back to survey his handiwork.

No need of the Sun

At long last the upper flight of portrait painters have accepted the hard fought claim that there is a substitute for sunlight.

SINCE THE WAR—indeed, one might say, in the last two or three years —a momentous innovation has been creeping into the world of art. It is not the first witnessed by this generation. The modern school of painters, with their faithful adherence to the biblical prohibition against making the likeness of anything in the heavens above or the earth beneath have for thirty years or more been elbowing their way to the front with canvasses of the type shown in a funny weekly's cartoon over the caption 'May I have a word in your eye?' And Chelsea, once the headquarters of flamboyant Bohemianism, has of late switched over to pin stripes and shaven chins; so that today visiting beard-watchers from the suburbs, in search of local colour, find that the taverns of Kings Road, which once blazed with leopard skin waistcoats and flowing ties, have relapsed into a quiet humdrum which would do credit to a business man's snack bar in the City.

In one thing, however, the old and new schools of thought have always agreed—There is No Substitute for Sun. The traditional studio, with its huge, tumble-down superstructure of dusty, rain-teared glass has remained substantially the same since the Rennaissance. To it, have repaired dynasties of formidable dowagers, to enthrone themselves in attitudes of tortured mock-serenity whilst, at the back of their minds, (owing to the hedonistic reputation which legend has hung on to artists of all ages) there has flickered the thought that there was something slightly risqué about their being there at all.

But all this, it seems, is to be changed. For, however much the romantics may deplore it, there is every likelihood that the studio of the late 1950's will be indistinguishable from a modern city executive's office except for its easel and the stack of canvasses in one corner which are kept there to break the conversational ice and give the sitter an opportunity of dropping a few well meant critical bricks. And for this one thing is responsible—the 'artificial daylight' fluorescent tube.

Of course, even a knowledgeable electrical store assistant knows that fluorescent tubes do not reproduce perfect daylight. And painters have therefore, until recently, battled doggedly against working under it. But two things have now pulled them over—the improvement of the lighting itself and the fact that today the majority of sitters who can afford to have their portraits painted or are being done for the walls of board-

At extreme left, a young craftswoman at the Doulton pottery putting coloured glaze on a figure of an eighteenth century fruit seller in her fluorescent lit workshop, and left, a large workroom at Doultons where women hand paint table china. The abundant fluorescent lighting has as beneficial an effect on their morale as on their work.

James Proudfoot, the well-known portrait painter at work in his fluorescent lit Chelsea studio on a portrait of sports writer John MacAdam. Behind the sitter is his portrait of Jasper Plowden which received a lot of notice in the Royal Academy a few years ago. To the left is a nearly finished picture of Hugh Burden, the actor.

rooms and civic council chambers simply cannot give up their daytime working hours for sittings.

It was commercial and industrial art which paved the way for all this. As soon as fluorescent lighting came on the market it was set up in all the larger commercial, press, advertising and textile designing studios. Although, even today, most commercial artists have an ordinary tungsten desk light playing at short range on to their drawing boards, the fluorescent tubes modify its slight colour-distortion and give them the psychologically important feeling that they are working in daylight. They also seem to heighten the ceiling of a low studio which otherwise, for some reason, gives artists a kind of inhibiting aesthetic claustrophobia.

Next came the film and stage art-designers, whose work lay half way between that of the strictly commercial artist and the 'painter'. Hein Heckroth, who won the 'Oscar' for his designs in 'Red Shoes' did the thousands of water colour paintings, from which the film was made, during sessions lasting till three and four in the morning with Michael Powell and Emeric Pressburger looking over his shoulder and dropping in suggestions. And now, the portrait painters are switching over in a body to fluorescent lit studios to complete the revolution.

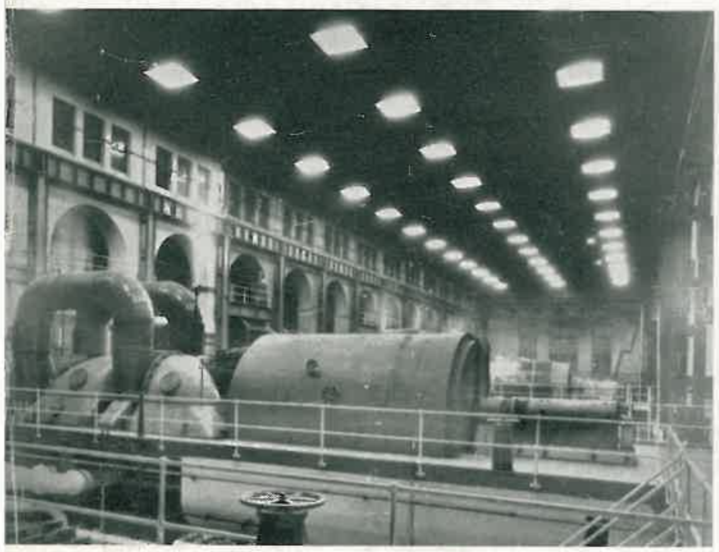
It is, perhaps, surprising that it has not happened sooner. The majority of paintings in galleries and private houses have for long been looked at for most of the time under artificial light. And it might have followed that a light good enough to illuminate a Rembrandt without distorting its colour, was good enough to paint under. But traditions are hard to destroy. Painters, no doubt, felt that to paint by artificial light was a heterodoxy rather like trying to mature wine with chemicals—all arts contain a mystical element and doubtless a lot of these are true ones. None the less, they find that they are painting just as well as before.

Of course, the change over may give the final death blow to Chelsea night life when the bars and subterranean clubs filled up with men who, knowing that they could not be working anyhow, could get together and bandy epigrams over glasses of beer and *Vin Ordinaire* to their hearts' content. But these boisterous sessions were dying out anyhow and had been for years. This writer once asked Augustus John why Chelsea was losing its old time gusto so rapidly and suggested that the reason might be economic.

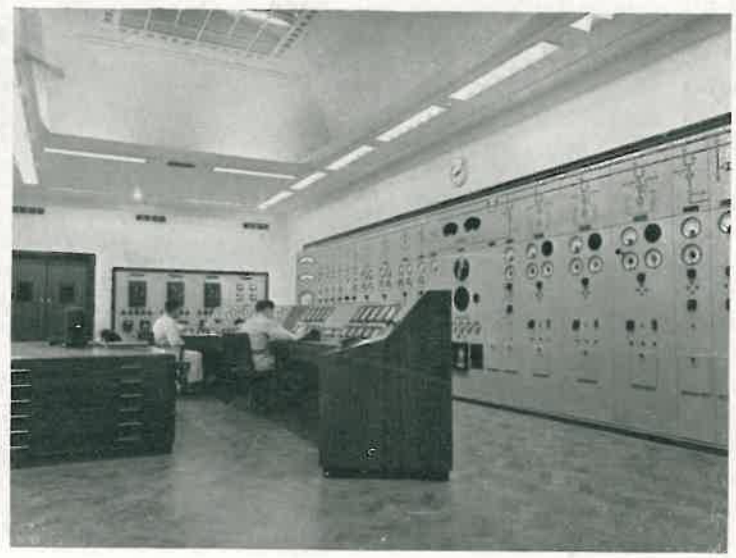
'No', said the great man, 'it isn't that. It has always been possible and always will be to have a lot of fun with very little money. But the whole impulse and spirit has changed. Young artists today don't *use their eyes;*' —he raised his finger to eye level and made an outward drilling movement with it into the room. Then he took a deep, sad breath and added in a sephulchral tone, '*thank God*!'

Mazda Crane Rail Lighting. *When the problem is turbine house lighting, crane rails often provide an excellent mounting for fluorescent fittings. BTH have an unrivalled experience of this application, and have recently completed installations at many of Britain's latest power stations. Shown above is the magnificent effect at Brighton 'B'.*

Mazda Blended Lighting. *A Mazda Blended Light Unit consists of one tungsten filament and either one or two mercury vapour reflectors mounted together on a single control box. This results in high efficiency, economy of operation and good colour rendering. Shown here is the turbine house at Uskmouth.*



Mazda Fluorescent Panel Lighting. *Another approach to turbine house lighting is shown by this BTH installation of fluorescent panels at North Wilford power station. This solution is particularly suitable when the generators are mounted transversely across the hall, resulting in a much greater distance between the crane rails.*



Mazda Control Room Lighting. *Control Rooms demand a high level of general lighting to enable finely calibrated instruments to be read accurately at a glance without visual fatigue. Absence of specular reflection from dial glasses is also essential. Shown here is the Control Room at Brunswick Wharf Power Station.*

Almost every important lighting development in the last 50 years owes something to BTH

The end of the war found British recovery hampered by an almost desperate shortage of electrical power. Industrial production could only be maintained at the expense of severe peak-period cuts in domestic supplies. Yet electrical household appliances were becoming freely available, rural electrification was spreading to enable farmers to grow more food; factories were being built in the drive for more consumer goods and, above all, for more exports.

The story of how this challenge for new generating capacity was met is indeed an inspiring one, and the final chapters have yet to be written. We in BTH are proud to have played a full part in the manufacture and installation of generators, switchgear and transformers for many of Britain's latest power stations and at the same time to have exported similar equipment to many parts of the world.

Modern power stations demand modern lighting. Here again BTH have world-wide experience; some of the many new or extended stations with BTH installations are listed on the right, and the pictures above give some idea of the very high standards now being achieved with Mazda Lamps and Lighting Equipment.

Acton Lane
Agecroft
Alpha Place
Bankside
Bengeworth Rd
Brighton 'B'
Brunswick Wharf
Deptford East
Grangemouth
Isle of Grain
North Wilford
Old Brompton Rd
Plymouth 'B'
Portsmouth
St. Sampson's
Seacoal Lane
Skelton Grange
Staythorpe
Uskmouth
Westwood

L883/11

Printed in England by Albert Frost & Sons, Ltd., Rugby, for the British Thomson-Houston Co., Ltd.