

THE HOSPITAL ENGINEER NEWS LETTER

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Contents

EDITORIAL

OUR FIRST
PRESIDENT
PROCEEDINGS
AT FOURTH AN-
NUAL GENERAL
MEETING.

PAPER BY:
JAMES FORSYTH
Esq., (Member).
"PLANNING A
MODERN OPER-
ATING
THEATRE."

PAPER BY:
ALAN H. OWEN,
Esq., on
"LIGHTING."
ANNOUNCE-
MENTS.

ERRATA
"NEWS LETTER"
No. 6.

BRANCH NEWS
BENEVOLENT
FUND RULES.

REVISED
RECOMMEND-
ATIONS OF
J.C.C. RE
SALARIES AND
CONDITIONS
OF SERVICE.

Hon. Editor :
R. G. ROGERS,
"Elmfield,"
Stone, Aylesbury,
Bucks.

EDITORIAL.

THE PRESIDENT OF THE INSTITUTION.

It is with very great pleasure that I am able to make known to you that Lord Calverley has done this Institution the honour of accepting the invitation to become our first President. His Lordship, whose home is at Stanningley, Leeds, has always had the welfare of Hospitals at heart, and the Council are looking forward with pleasure to meeting him on the occasion of their next meeting which will be held at Leeds early in March. 1948.

* * *

On the 22nd July last, a deputation consisting of Mr. Hargreaves, Mr. Tomlinson, Mr. R. E. Rogers and Mr. R. G. Rogers, had an interview with officials of the Ministry of Health at the Offices of the Ministry in Whitehall. The object of this interview was to state the case for the Hospital Engineer and to outline the position with a view to seeing that the Hospital Engineer would get his rightful place and status in the new National Health Service. We were met by Mr. Read and Mr. Hughes of the Ministry who listened carefully to all we had to say, and a very full and frank discussion took place.

* * *

A meeting of the J.C.C. of the M.H.A. with the I.H.E. was held on the 17th October 1947 at the request of the I.H.E. to consider certain alterations in the wording of conditions of service which might possibly operate to the detriment of the Engineer, and also to hear appeals by the I.H.E. against four authorities regarding the non-adoption of the recommendations concerning salaries and conditions dated the 11th July 1948. In one case the conditions were met and the appeal was withdrawn. In two cases the appeals were upheld and in the other case the matter was referred back for the consideration of the authorities concerned. The question of salaries particularly as applied to Assistant Engineers was also reviewed. These matters now await ratification or otherwise by the Executive Committee of the M.H.A.

* * *

Representatives of the I.H.E., (Mr. Hargreaves, Mr. R. E. Rogers, Mr. J. Forsyth, and Mr. R. G. Rogers), attended a meeting at the Ministry of Health, Whitehall on the 31st October, 1947 to discuss the Draft constitution of a Whitley Council for Regional Hospital Board Employees. The Chair was taken by Mr. Firth, Director of Establishments, who was supported by Mr. Mayne of the Ministry of Health, and Mr. Hancock of the Ministry of Health for Scotland. The meeting was well attended by members of many branches of Hospital staffs. Many aspects of Hospital service and conditions were discussed, particularly regarding the grouping of the various functional councils, a matter with which your delegates were much concerned regarding the group into which we might be placed.

* * *

Negotiations with the B.H.A. were carried a step further on the 12th December when a deputation, consisting of Mr. Hargreaves, Mr. Tomlinson, Mr. R. E. Rogers, Mr. J. Forsyth and Mr. R. G. Rogers, met representatives of the B.H.A. and Mr. Wetenhall, the Secretary at their Offices in London. A full and frank discussion took place concerning our aims and objects. We pointed out that we had been endeavouring to arrange a meeting with the B.H.A. for about 3 years with the object of setting up a J.C.C. on similar lines to that existing between ourselves and the M.H.A. The Chairman expressed the appreciation of the B.H.A. in the work of the I.H.E. which they hoped would continue. The discussions are being reported to the Executive Committee of the B.H.A. by their representatives, and we now await their early decision with interest.

* * *

The Council were at full strength at the Meeting held at Newcastle on the 5th September, 1947.

The Chairman referred to the loss of Mr. Brain (a member of Council) and Mr. Neal, since the last meeting, and the members stood in silence as a token of respect for their late colleagues.

The vacancy on the examination sub-committee, caused by the death of Mr. Braine, was filled by the appointment of Mr. H. Adams of Bristol.

There were 24 applications for membership before Council, and of these 4 were admitted to membership, 9 to associateship, 5 to graduateship, 4 wished to take the Institute's examination and 2 were rejected.

REPORT OF THE FOURTH ANNUAL GENERAL MEETING.

The 4th Annual General Meeting of the Institution of Hospital Engineers was held at the Royal Station Hotel, Newcastle, on Saturday, 6th September 1947. The Chairman, Mr. Hargreaves, opening the proceedings, extended a welcome to Alderman Sir Walter Thompson, D.C.L., J.P., Chairman of the North Regional Hospitals Board, and said the Institution felt honoured by his presence at this meeting and had much pleasure in asking him to address the members.

Sir Walter, addressing the meeting, welcomed members to the very old city of Newcastle, a city of great traditions and achievements and expressed the hope that their visit would be a happy one and their conference very successful. Having been connected with hospitals in the city for a period of 26 years Sir Walter claimed to have some knowledge of the increasing importance of the work where hospital engineers are concerned as part and parcel of the new Health Service. It is hoped to create a health service through which there will be available to every member of the community, either in their thousands or units, the best possible surgical and medical skill that is available. In that Health Service the engineers play a very important part, unfortunately not often seen by those who have to manage hospitals. It is increasing in importance because with the advance of science and scientific instruments you have duties to perform now as engineers which engineers did not have 35 years ago. By bringing yourselves together in this way you are increasing your own sense of responsibility and value and knowledge of how you can best serve, but see that this value is recognised by proper remuneration.

I hope that this General Meeting will set a hall mark upon all succeeding ones and in the years to come you will come into your rightful position in the hospital service and continue to render even increased efficiency and increased services in this very important part of the hospital.

The Chairman said he was expressing the feeling of the meeting in saying to Sir Walter a very, very hearty "thank you" for his kind advice.

The Chairman welcomed especially the two members from Northern Ireland as well as those from the Scottish branches.

The Chairman also welcomed Mr. J. Hollins, one of the Institution's greatest friends, who, when he heard of the Annual General Meeting taking place in Newcastle asked if he could have the privilege of coming to the meeting. He had come from the far corner of Essex to be present to-day.

The report of the last Annual General Meeting was adopted.

Mr. G. Jones, Honorary Treasurer, presented the financial report and drew attention to the sum of £11 "general donations" being donations made by Engineers who were not actually members of the Association and too near the retiring age to join the Association, but they had made these donations in thanks for work done by the Institution.

An Interim Report for 1947 was also presented by Mr. Jones.

Mr. Armstrong proposed and Mr. Chestney seconded the adoption of the report.

Mr. Hargreaves presenting the Annual Report of the Council stated that since the last Annual General Meeting a fair amount of progress and the finding of some stumbling blocks could be reported. From the inception they had tried to make contact with the B.H.A. but were not successful until October of last year. Mr. Hargreaves reported that a meeting was arranged with Mr. Wetenhall and Mr. J. Tomlinson, Mr. R. E. Rogers, Mr. R. C. Rogers and Mr. Hargreaves attended. When it was explained to Mr. Wetenhall that the aim of the Institution were to look after the interests of engineers in different types of hospitals and to establish a really efficient hospital engineering service for the future, he drew up a report which said he would be presented to every member of every committee on which he sat. Since then the only communication received was stating that Mr. Wetenhall was on holiday and the matter would have to stand over. Mr. Hargreaves assured the members that the Council was not leaving the B.H.A. 'stand.'

The Chairman reported that one member of the Examination Sub-Committee, Mr. Brain, had died, and he paid tribute to the fine work he had done for the Institution. The Examination Sub-Committee comprising Mr. Clark of Gateshead, Mr. Tomlinson

of King's College, Mr. Adams of Bristol, who had succeeded Mr. Braine, had compiled a suitable examination syllabus and stated that there were 16 or 17 candidates for the first examination which was to be held in London in October.

The work of the J.C.C. with Mental Hospitals had continued. Although some authorities had not adopted the agreement which was drawn up between the Mental Hospitals Association and the Institution. It was felt that the Engineers who were not receiving, in their opinion, their just dues, would soon receive satisfaction.

With regard to the new Superannuation Scheme under the National Health Service, the Chairman reported that a draft of the Bill for Officers under the New National Health Service was submitted to the Institution for "vetting" and return with criticisms for consideration by the Minister before he put the Bill through Parliament. It was felt that the best way to deal with the matter would be to form a sub-committee consisting of 2 members from this association, 8 from the M.H.A., 2 from I.H.A., 2 from C.O.H.S.E. and 2 members from the R.M.P.A. The Chairman paid the Honorary Secretary a compliment when he said that Mr. Rogers was the only one who picked on something which was detrimental and which everyone else had missed. So far as the Institution was concerned, the Minister's ruling on the matter must be accepted, but it was agreed that the Ministry had acknowledged the existence of the Institution. On July 22nd a deputation, consisting of Mr. Tomlinson, Mr. R. E. Rogers, Mr. R. G. Rogers and Mr. Hargreaves was received by one of the Under Secretaries of the Ministry of Health. The deputation was well received and the point arose "What is a big hospital and what is a small hospital?" It was pointed out that the size of a hospital cannot be judged on bed state.

Turning to the future, the Chairman remarked that it might be a good idea, in view of the fact that the hospital engineer in the main should be hospital trained in the hospital world, for an apprenticeship scheme to be formed whereby apprentices could be "farmed out" to the equipment manufacturers and different branches of suppliers to the hospitals for periods of three to six months in the shops and thus learn the internal construction of the equipment with which they are called upon to deal.

In relation to Scotland, it was reported that a meeting had been arranged with the Glasgow Corporation but that this had been temporarily postponed.

No progress could be reported in regard to Northern Ireland but the expenses had been paid by the Ministry of Health in Northern Ireland for one or two members from Northern Ireland who were present at this conference.

The Chairman thanked most heartily the Institution representatives and his colleagues on the Council for the support given him during the past twelve months and stated that whilst he assured the members that the Council had done, and will do, all in its power to promote the interests of each and every one of the hospital engineers in this Institution, it was his and their sincere belief that this Institution stands or falls by the interest and enthusiasm of each individual member himself, and asked members to go back and try to instil into the whole of their branches the spirit of keenness and enthusiasm for this Institution in the ensuing twelve months.

On the motion of Mr. F. Grey, seconded by Mr. Heald, the report was adopted.

The recommendation from the Council "that due to increased charges for travel and accommodation the expenses of Council members be made up to £1 10s. 0d. per day." was then discussed.

This was proposed by Mr. F. Gray and seconded by Mr. Green.

Mr. Chestney proposed an amendment "that Council members be paid all out of pocket expenses." This was seconded by Mr. Black of Newcastle.

It was unanimously agreed that the recommendation "that Council members be paid all reasonable out of pocket expenses" be adopted.

Matters arising from the Council Meeting on September 5th.

Mr. Tomlinson reported that careful consideration had been given to the question of the Benevolent Fund and submitted the suggested rules to the members for their approval. Mr. Heald proposed that these be adopted.

The Chairman, explaining how the Benevolent Fund was formed, stated that the auditor, when paid his fee, handed it back saying that the Institution might feel like starting a Benevolent Fund and wished his fee to be the nucleus of such a fund.

The Chairman stated that a number of questions had been asked as to who operated the Benevolent Fund, how it worked and requesting more details, but said that Mr. Tomlinson would explain this later. He said that the Council had deliberated at length on the rules and it was wondered if a person would ask for relief. It was felt that it was not up to a person in distress to ask for assistance but rather that the branch secretary and the Council member of that branch would have the interests of every member at heart, and if they knew of anyone needing assistance they would write to the Benevolent Fund Committee informing them of the case.

It was pointed out that the Benevolent Fund was purely voluntary.

Mr. Chynnoweth moved that the basic rules be adopted. This was seconded by Mr. Heald and carried unanimously.

Mr. Tomlinson stated that three trustees should be appointed by the Council and nominated Mr. Clark, Gateshead ; Mr. Gray, Northern Ireland ; and Mr. MacGregor, Edinburgh. These were proposed by Mr. Forsyth and seconded by Mr. Wilson.

Members nominated for the Committee were Mr. C. Oliver, Secretary and Treasurer ; Mr. H. Smith of Glasgow and Mr. H. Adams of Bristol, and these were elected unanimously.

Education.

Mr. Tomlinson stressed the importance of the examinations of the I.H.E. and urged engineers to educate themselves and to take every opportunity themselves au fait with every item in the syllabus of the examination, pointing out that every engineer had to deal with heat, mechanics, electricity, and building construction, be it only maintenance. Mr. Tomlinson invited members to write to the Council if there was any information they would like on any special matter and said he would be happy to receive a galaxy of letters on his return.

The Chairman then invited Mr. Hollins to address the members.

Mr. Hollins congratulated members on the progress made during the last few years and stated that the Institution had every reason to be proud of such progress and every reason to see that every engineer possible who is eligible to become a member is drawn in. He assured members that if he could be of any assistance in future negotiations his services would be at the Institution's disposal.

The Chairman thanked Mr. Hollins for his few words and especially for the assurance that he would be very willing to help the Institution in future negotiations. The Chairman told the members that the Institution would be where it is now but for the assistance Mr. Hollins had kindly given in the past. It was through his good offices that the Council had the pleasure of an interview with the Parliamentary Secretary to the Ministry of Labour. This was the first step on the first rung of the ladder.

Mr. R. E. Rogers, Hon. General Secretary, presenting his report said we must do all we possibly can to get into our confines every eligible member. There were still a few qualified men who were not members who think that all the Institution strives for is a 44 hour week and higher wages.

The Honorary Secretary reported that following last year's Annual Meeting the Ministry of Fuel asked if the Institution would like to make some contribution towards the Annual Conference in October at the Central Hall, Westminster. This meant the Institution was coming before the public in no uncertain manner.

Reverting to the question of lack of progress with the B.H.A., Mr. Rogers stated that neither the Institution, the Ministries of Labour and Health could force the hand of a voluntary organisation

like the B.H.A. He then gave a resume of negotiations to date and read an extract from correspondence.

Mr. Rogers stated that the Regional Boards were already in being and some of the Secretaries and Medical Officers have been and are being appointed. The Institution is fortunate in knowing so many of the people who have been appointed.

He endorsed Mr. Tomlinson's remarks about Education and urged engineers to get to know the apparatus with which they had to deal.

Mr. Rogers reported that tickets had been received for the Marine Exhibition being held in London.

The Honorary Secretary reported a change in the work he had undertaken for the Institution in that owing to the increase in membership he had had to enlist the help of Mr. Clark of Gateshead, who was now acting as Membership Secretary and whom he would like to thank for his services.

The Chairman, in moving the adoption of the Report, said he would like to couple with it the Institution's very hearty thanks for the hard work Mr. Rogers had put in for the Institution, saying that the results bear sufficient testimony to Mr. Rogers' ability. Mr. Kirby seconded this motion.

Question Time.

Mr. Grey of Sunderland Mental Hospital asked for the position regarding shift engineers classified as graduate members to be clarified. The Chairman replied that the shift engineers in this classification should make application for associate membership, the matter to come forward at the next Council meeting.

Mr. Slade of Leeds complained of lack of information received of Council proceedings and negotiations and voiced his dissatisfaction at the non-recognition by the B.H.A. Mr. Rogers, replying, stated that if the lack of information had been general, other complaints would have been received by now and pointed out that the Council member for the Yorkshire branch is issued with the Minutes of Council meetings. Regarding recognition by the B.H.A., Mr. Rogers said it was impossible to force the hand of the B.H.A. and that in his opinion it would do more harm than good to approach an M.P. with a view to getting the matter raised in the House. He asked for Mr. Hollins' opinion on the matter.

Mr. Hollins stated that the only remedy would be to wait until the General Health Scheme comes into operation.

Mr. Chestney, Sheriff Hill, stated that in the Northern Area a number of engineers had been approached by their local authorities for their salary scale. As there was not an accepted scale Mr. Chestney asked if they could be given authority to submit the M.H.A. scale pending the adoption of a General Hospital scale and suggested

that a scale be drawn up, even if it is only temporary, which could be submitted to the authorities. Discussion took place regarding this question and it was agreed that negotiations with local authorities were a matter for the Council.

The resolution "That the Council give consideration to approaching the governing body of individual hospitals with a salary scale for consideration by them regarding the engineers in their employ" was proposed by Mr. Chestney and seconded by Mr. Gray.

Mr. Black of Newcastle asked if there was any liaison between the I.H.E. and the J.I.C., or if any other body could take the matter up. Mr. Rogers replied that if a member of this Institution was also a member of N.A.L.G.O., he had every right to make an appeal to the appropriate committee and that an appeal brought forward by N.A.L.G.O. would receive consideration.

Mr. Kirby asked if the Institution wished members to join the N.A.L.G.O. The Chairman replied that it was not the policy of the Council to advise members to join another organisation. The Institution was formed with the idea of getting professional status for the engineer. If he, as Chairman, told engineers to join N.A.L.G.O., the Confederation of Health Service Employees might demur and wonder why members had not been told to join the Confederation. There was no indication as to which organisation would be considered from the Trades Union angle under the new National Health Scheme. Assurance had been given, however, that if any member of the Institution who was also a member of N.A.L.G.O. had been put into the wrong category in relation to the Charter the matter would be put right.

Mr. Grey, Sunderland Mental Hospital asked for information about superannuation under the new Hospitals Act. Mr. Rogers referred him to Statutory Rules and Orders No. 1245.

Discussion arose about pensions and Mr. Rogers advised various members in this connection and informed them of the following publications :—

National Insurance Act, 1946.

National Health Service Act, 1946.

Draft Rules and Orders, National Health Service Act, 1947.

Mr. Chynnoweth stated that in the Southern Branch they were frequently pressed for a list of members. In view of the fact that there was now a Membership Secretary, would it be possible to circulate a list of all the members of the Institution? Mr. Rogers replied that this would be done forthwith.

Mr. Oliver proposed that "the Council draw up rules and recommendations for the election of officers at branches and if necessary to see that banking of branch accounts is done." This was seconded by Mr. Cheynnoweth and carried unanimously.

Venue and Date of next General Meeting.

Cardiff, Birmingham, London and York were suggested places for the next General Meeting, and on a show of hands it was decided to hold it at Birmingham. The date was fixed for Saturday, Sept. 4th, 1948.

Mr. Rogers expressed the thanks of the Committee to the members of the North Eastern Branch and to Mr. Thomas in particular for the able way in which the Annual General Meeting had been arranged and which, it was felt, had been a very pleasant one.

Mr. Forsyth said he would like to move a hearty vote of thanks to the Chairman for the able manner in which he had conducted the meeting. Mr. Thomas of Sunderland endorsed Mr. Forsyth's statement. The meeting then closed.

PLANNING A MODERN OPERATING THEATRE.

BY JAMES FORSYTH ESQ. (Member).

Paper read at the Southern Branch of the Institute of Hospital Engineers at Dorchester on 31st May, 1947.

In presenting this paper I want you to bear in mind that I have composed it, solely with the idea of opening a discussion and therefore I am not listing all that I think a present day theatre should contain nor am I designing a complete theatre. Rather am I going to give you a few ideas, some of which may sound revolutionary to you but when you consider that a modern operating theatre has not been built during the past eight years in this country, we cannot really claim that existing theatres meet the need of present day requirements.

Now pre 1939 every theatre was generally built in such a position that there was plenty of natural light with usually a very large window facing to the North and the position was generally at a high elevation so as to trap as much daylight as possible and also so that the ether fumes, etc., would not permeate the rest of the hospital. But despite these precautions ether fumes and other obnoxious smells are still found in the precincts of the theatre.

Now here is my first revolutionary idea. My present day theatre would have no windows, as in my opinion present day engineering has developed artificial illumination and mechanical ventilation to the extent that windows in surgical operating rooms have ceased to serve any useful function whatsoever.

Efficient ventilating systems even without air conditioning can provide, not only sterilized, filtered and tempered fresh air but fully automatic devices for the control of temperature, humidity, volume and velocity of air flow. Recent developments have demonstrated that air borne particles as minute as $1/125,000$ of an inch can be electrically cencaved.

The perfection of artificial illumination also, has so far advanced, that natural light has long ceased to be essential, nor is it even desirable. It is not essential for it cannot produce intensities adequate for surgical procedures. It is objectionable because of inconstant intensity and colouration. And being directional, it creates shadows when interrupted. Unless it is supplemented by adequate artificial light, natural light causes obscuration, particularly in deep incisions and is frequently the cause of ocular discomfort.

What is important and I feel of really vital importance, is the determination of both proper intensity at the surgical plane and correct light colouration, as the basis of adequate lighting design. Shadow reduction and heat reduction, elimination of glare and multiple sources of electrical supply are problems from the engineering side which must be tackled. Unfortunately there is a wide diversion of opinion as to the light intensity required in the surgical field varying from 500 to 3,000 ft. candles but I submit in a theatre robbed of all natural light the surgeons would soon arrive at a standard of illumination. Obviously this wide range alone indicates the urgent need for further experimentation in conjunction with the surgical staff. The effect of colour upon tissue is another point requiring intensive study. If it is correctly stated and I believe this is so, that diseased tissue is recognised not solely by texture and consistency but also by colour, then the impact of light upon that tissue assumes equal importance. Colour is an attribute of light and not as often erroneously assumed, an inherent property of matter and substance.

For instance, observe the changing effect of daylight fluorescent lighting upon foodstuffs. or daylight lighting upon fabrics. Obviously then tissue acquires changing appearance under varying lighting conditions and recognition by colour may be less rapid and precise. Conversely of course, recognition and evolution could unquestionably be accelerated under proper illumination. Tests have been made under actual working conditions of a commercial luminaire employing standard fluorescent lamps of various colours. The use of white tubes resulted in an overintensification of red. So called daylight tubes were substituted and red was paled out appreciably. The final test of a combination of white and daylight has resulted in a reasonable fidelity of colour. A lot has still to be done in this field, but I think it is significant of the future of fluorescent lighting in

theatres, that at the present time a committee from the commercial firms interested and representatives from the Royal College of Surgeons are doing some preparatory work for a quantitative and qualitative standard of intensity and colouration. The fact that this research is being done, does not make my windowless theatre seem so revolutionary but on the other hand something which is very imminent.

Advantages of theatre standard lighting could be many. A surgeon or theatre personnel in any area or even transferring his or their activities from one theatre to another in the same hospital could then operate with increased visual acuity, and without the need of optical adjustment. Complete avoidance of unnecessary eyestrain and fatigue could be attained and I daresay speed of vision would be enhanced. Of course it can be pleaded that the omission of natural light would involve added burdens of capital investment and maintenance. True a complete system of automatic mechanical ventilation would necessitate additional equipment and space allotment. The maintenance cost would be increased slightly but will there not be the commensurate compensation in increased comfort to the surgeon, staff and patient.

The best temperature for an air conditioned operating theatre room, gleaned from time to time from various surgeons, is 72° F with a relative humidity of about 55 per cent. The reason for this suggested temperature as against the text book 75° F. and higher is that the surgeon and personnel are more comfortable. The higher temperature is definitely fine for the patient but definitely too warm for everyone else. The patient of course can be kept warmer by electric blanket or other means in order to allay shock and he is therefore in no way endangered through the lower temperature.

An ideal ventilating system consists of an exhaust fan and supply blower. The blower draws in fresh air which can be filtered or sterilized or both, finally passing over heating coils for winter operation or optionally, through a water spray or other cooling element during extreme warm weather.

One great benefit of a windowless theatre is that it can be placed at ground level, thereby cutting down long service mains, etc. for sterilizing and autoclaves. Another is the initial saving on window installation and maintenance with consequent saving of the usual heat losses resulting from air infiltration and uninsulated exterior glass surfaces. Another is the saving of the installation of blinds, etc., so necessary in E.N.T. and other operations for blackout purposes.

The theatre walls should be finished in Opalite or other material of a tiled finish preferably of a pleasing colour such as Eau de Nil. Floors should be of Terrazo or similar finish laid in blocks and

divided by metal bars. A glazed gulley should run all round the room as it should be possible to hose a theatre down at least daily.

There should be no scrub up basins but foot operated mixing valves controlling taps on one wall, the wash up taking place over the gulley and protection against splashing be given by fixing plate glass screens roughly at one angle of 30° from the base of the wall and finishing about knee high. All cupboards should be built in, finishing flush with the walls and also viewing boxes should be built in. Ample power plugs should be allowed of the interlocking pattern for such things as Diathermy, Cautery, stomach pumps, etc. and should be placed on a panel suspended from the ceiling near the table so that there are no cables crossing the floor.

An anaesthetic control panel must be inserted and again I would not have cylinders of any kind in my theatre. Rather would I have a separate room for all cylinders with service pipes being led to the theatre. Invariably cylinders are transported through the streets in open lorries, are handled by porters, etc. and no attempt is made at all to see that they are reasonably clean before entering the theatre. This, to my mind, is something of extreme importance and is not given the consideration which hygiene conditions demand.

My theatre doors would be of the sliding pattern preferably electrically operated and the theatre side of the door would be finished in opalite the same as the walls—thereby reducing distraction.

The theatre position should be preferably adjacent to a lift for obvious reasons. Ease of access is of great importance and a floor area of about 400 sq. ft. and an average height of about 15 ft. satisfies most requirements. Ancillary rooms necessary in a modern theatre suite would be sink room for washing mackintoshes, etc. Sterilizing room. Surgeon's room for changing etc., Nurses' room for changing etc. Anaesthetic room where again pipe lines should be installed through which oxygen, carbon dioxide, etc. are conveyed from a central anaesthetizing plant. Instrument room adjoining the sterilizing room and if possible other rooms such as Stores, Linen and Soiled Linen. Plaster Room.

I look forward to the day when all electro medical apparatus will be standardised on two voltages, *viz.*, mains voltage and standard low voltage.

It is obvious, of course, that the design of a theatre depends to a great extent on local requirements, but, in planning, all things possible should be taken into consideration. Too many mistakes have been made in the past through lack of consultation with all the personnel concerned.

I would suggest that a meeting could, with great advantage, take place between the surgeon, the architect, the consulting engineer, the theatre sister, and the hospital engineer. Through a frank

exchange of views, the architect should be able to eliminate some of the past mistakes in planning and the consulting engineer to plan the most efficient equipment.

In conclusion I would stress these points that a theatre must be correctly lighted and ventilated and it must be as dustproof as possible with a minimum of fittings and must be easily and quickly cleaned.

LIGHTING.

Paper given at the Engineers' Club, Manchester, by ALAN H. OWEN, on the 17th May, 1947, to the Institution of Hospital Engineers.

Before discussing lighting of the future, should we for a moment consider lighting of the past? artificial lighting of course. Lighting has very little past I am afraid. It's history is covered in the lifetime of men of my own age.

Towards the end of the last Century, I remember hearing people discussing the new lighting, by means of a gas mantle invented by *Welsbach*. I well recollect the day when my father brought one of the new burners home, and after carefully reading the instructions, he succeeded in fitting one in our living room. The whole family of us were thrilled at the new sensation, for hitherto our light source after dark had only been that provided by the open flame gas burner. Except for convenience, this open flame gas burner was no improvement on the open flame oil burner, a golden specimen of which was removed from the tomb of Queen Shuo in Egypt, and she died over 5,000 years ago. You see then that all lighting progress has developed during the past 45 years or so. I should mention that the electric Carbon Filament lamp had been discovered some 20 years earlier, but at an efficiency of 3 l.p.w., a 16 c.p. lamp was little better than our open flame gas burner, and when it could be installed, the cost of current at about 1/- per unit made it's use—except as a novelty—almost prohibitive.

I mention this almost gruesome history as I believe it often affects our power to think clearly on lighting matters. We seem to put costs in the way of progressive lighting practice.

Artificial light is one of the cheapest of life's modern amenities. With a hundred watt lamp at 12 l.p.w.—4 times as efficient as the old Carbon filament lamp and domestic power often available at a ha'penny a unit, we don't seem to realize that this 100 watt lamp can be switched on at 5 o'clock in the afternoon, and burn continuously until we go to bed at 11; and the cost of one week's electricity supply is just equal to that which would purchase one cigarette.

The lighting of the streets of London in peace time costs the citizens a matter of a farthing a week. For another farthing they could obtain 10 times more light. The coloured fairy lights of Lord Street, Southport—120 yards long, 72 yards wide—have helped to make that street one of the most famous in the country. The complete maintenance of that lighting, summer and winter, costs 2½d. a head of the population per year.

We are now in the midst of a lighting revolution, and I doubt if we are in a position to deal with it. Our knowledge is not good enough. It seems invidious for me to mention that we see with our eyes and with light. Obviously we should know something about both. Some time ago someone used an analogy which I think was appropriate. The eyes were likened to a motor car and it was said that our knowledge of them was about sufficient to enable us to drive in bottom gear, and that is what we are doing—driving our eyes in bottom gear and thus wearing them out, just because we have not learned to use the other gears. But eyes are useless without light. You see me through the medium of your eyes, but if the lights were turned out, your eyes would be useless.

I would still be here, but you would be unable to see me. How then do our eyes take in all the details of an object and judge its appearance and position? When waves of light fall on an object, they are scattered; if the scattered rays come to our eyes we can judge their direction. The eye is moved so that the waves scattered from an object are clearly impressed on the most sensitive spot of the retina. We receive different impressions from each point of the object, and these are telegraphed along the nerves that lead to the brain. There they are collected and examined, and long practice has enabled us to interpret them as due to the scattering of light by the object. You see then the brain plays a part in seeing, and our long experience in seeing is a point we should keep in mind. The eye has often been likened to a camera. Its functions are very similar, but the eye is human. A camera will take a photograph which shows a person to have big feet out of all proportion, just because they are nearest to the camera, but the human eye sees them in their correct proportion. Most people are unaware that the retina picture is upside down, but we have learned how to distinguish high from low and top from bottom. An interesting experiment can be made if we prick a small hole in a card and look through the hole at a bright surface. The lens is unable to bring to a point the wide rays which pass through such a small hole, and if you hold a pin close to the eye, the shadow passes on to the retina which must be right way up, but the interpretation of the brain will be that it is upside down as it appears if you can get the pin head between the hole and the eye.

There are of course many optical illusions. These may be due to faults in the optical system, but they are often the result of carelessness and lack of experience. For instance the well known illusion of the relative lengths of horizontal lines is largely the result of not taking trouble, the top line looks the smaller because the eye locates its end somewhere in the arrow head and does not follow it to the tip. A practised draughtsman is not misled in this way, and he does not make the mistake of thinking that the two lines shown on the rough drawing are inclined to one another.

A well known optical illusion is the apparent enlargement of the moon when near the horizon. A full moon when immediately it rises like a big red disc, looks very much larger than when it is high in the sky, but it isn't. It can be measured. A half-penny placed 9 feet away from the eye, will just cover the moon, whether it be just rising or at its zenith. Illusions are not due to the fault of the eye. They are due to errors in interpretation. We are so accustomed to associate objects on the horizon as very small—like birds or areoplances in the distance, and when we see the moon in that position, we measure it on that scale, and so it looks enormous.

Light can enter the eye though it may not be in a straight line. Light waves travel through glass and water at a slower speed. An old experiment is to take a bowl and place a penny on the bottom. Fix the eye and the bowl in such a position that the coin can just be hidden by the rim of the bowl. When water is poured into the bowl, the penny becomes visible through the bending of the light rays reflected from it. In the same way the sun is visible on the horizon when it has actually set below it.

I must resist the temptation to dwell too long on the eye. I am not an ophthalmologist, though I wish I was. It is a most interesting subject, and the eye is really a wonderful organ. It can see by the dim light of the stars at an intensity of only a ten thousandth part of a foot candle, and it also functions with light a hundred million times greater—at 10,000 foot candles, at noon on a mid-summer's day.

There are two kinds of vision—macula—that vision which can distinguish colour and can only concentrate on a very small point, and peripheral vision which enables one to see over a very large area. In the past very little attention has been given to the part which peripheral vision can play in the process of comfortable seeing. But the peripheral region of the retina require stimulation by light in order to reduce retinal exhaustion, and enhance visual acuity. That can be proved by the fact that a person can read up to a certain line on an optician's chart when the room is in darkness except for the chart being illuminated. A torch shone in the corner of the patient's eye would cause glare one would think and thus retard the

ability to see so well. The opposite is the case. The periphery is stimulated by the light and the patient is able to read another line of smaller print. The same result can be obtained if the room is evenly illuminated—though the intensity of the lighting on the chart be the same as before.

There are also certain optical illusions regarding colour. Blue, for instance, looks larger than red. This was experienced many years ago when the French Tricolour was re-designed. It was originally made that the blue, white and red were equal in proportion, but people complained that the blue was larger than the red. A commission of experts sat and fixed percentages of the colours as follows :—Blue 30% ; White, 33% ; and Red, 37%. All French National flags are designed in this proportion. The eye fatigues very rapidly if it concentrates on practically any colour. Some colours are of course, more susceptible to this than others. If you gaze at a certain colour without glancing away, a complimentary image to that colour comes into view when placed against a white background. A well known experiment illustrates this :—Viewing a red lamp through the slit in the disc soon makes the lamp appear green when the white hides the lamp. If the black part of the disc followed the slit, the lamp would still appear red and there would be no re-action.

With these elementary observations on the eye, they should be considered whenever any lighting scheme is contemplated. Most people will say that they don't mind a dark room so long as they get shaded light on their work. This is not so. Nothing fatigues so much as uneven illumination. If anyone suffers from insomnia, I would recommend that they fix a spot of light on their bed rail to throw a light on the book they are reading, the rest of the room being in total darkness. Nothing I know induces sleep so much as this. We have seen that stimulation of the periphery by light increases our power to see. Therefore, for that reason general illumination should be the basis of your lighting schemes. With industrial reflectors, a spacing of not more than $1\frac{1}{2}$ to 1 should be aimed at. That means that if a lamp is 8 ft. above the plane of work, the spacing of the light should not be more than 12 ft. Lighting points should be fixed as high as possible. If you will work it out you will find that the cost of running an installation of high mounting is no greater; in fact, it is generally less, than using lower mounting—the intensity of illumination on the working plane is the same in every case. You will see that if you keep strictly to the spacing, less points, but larger lamps will be required, as the height is raised. Glare, of course, has to be considered, and I would remind you of the Lighting Order which was made compulsory by the Government for wartime lighting of factories. It provides for light sources which are less

than 16 ft. from floor level. No part of the source of the lighting fitting having a brightness greater than 10 candles per square inch shall be visible to persons normally employed within 100 feet of the source, except where the angle of elevation from the eye to the source or part of the fitting—as the case may be—exceeds 20 degrees. This means that shallow dispersive reflectors shall not be employed at a height of less than 16 feet from the floor. The order also provides that local lights shall be fitted with shades which completely cover the lamp.

I pointed out at the beginning of this talk that we see by the scattered light from surroundings. Surroundings, therefore, should be made to look nice as well as to have a high reflecting value.

We should avoid contrasts in our decorations, and all lighting should be supplementary to the decorations. We should avoid extremes—greys for instance—and the best way is to turn again to nature and attempt to get sunshine into the building. We talk of soft colours. We, of course mean colours which give us pleasure. The colours which we have been accustomed to by thousands of years of evolution out of doors. A spring day is a joy unsurpassed. What makes it so? The eyes have been working in unnatural conditions during the long winter months. Now they come into their own. We have light of high intensity, blue sky splashed with snowy clouds, green grass with trees and shrubs in varying hues, and bright coloured flowers adding relief. These are ideal seeing conditions, and contrast very favourably with the dismal old decorations or the glare of Blackpool Promenade. We should try to keep this nature picture in our minds when planning lighting.

It is remarkable how comforting to the eye green really is. Sir Jeremiah Coleman wrote: "A visitor to a garden said he was thrilled with a sense of 'Peace, perfect Peace.'" What he visualised was a study in Green. Green grass, Green pastures, Green trees, a lake reflecting green, in a setting of green-blue haze, and an atmosphere fragrant with the perfume of green tinted flowers of lime trees."

Colours must blend or contrast with due regard to harmony, or they will offend. A riot of colour irritates. Nature's paint box offers an unlimited choice of colours.

You have never seen colours clash on even the most vivid feathered birds in our zoological gardens. As I have said you cannot overestimate the value of green. It is the product of yellow and blue. It has many values, but the greatest is rest to the eye. Curiously enough it is a very fugitive colour, and it is most difficult to fix even in paints. "Every season has its own range of shades of green and they seem to be most wonderfully suited to each period of the year. Spring with its pale green is in keeping with her pale

flowers and soft rays of early sun. Summer calls for strong shades of green, to balance her vivid colours and challenge the sun's strong rays. Autumn begs gold, the green gives up much of its blue to suit the season. Thus yellow predominates in green and robs it of its strength. Winter turns the tables and asks for deepest shades to give contrast to her white and grey.

Evergreen is winter's call and the wise gardener sees that she gets it." That is a quotation from *A Landscape Gardener*.

There is no doubt that the light of the future will be fluorescent. It has a much greater efficiency than that of any other light source. It is cool and has a low intrinsic brilliancy. Nevertheless, the tungsten lamp will always have its place in lighting. It is easy and cheap to install. It has a high lumen maintenance. The high intrinsic brilliance of a tungsten lamp enables it to be efficiently projected, and an abundance of cheap and scientific fittings are available for this purpose. There is no stroboscopic effect with tungsten lamps.

The fluorescent lamp has been described many times. Roughly it is an electrical discharge which makes use of ultra-violet energy to activate fluorescent materials coated on the inside of the tube. The lamp consists of a tubular bulb with two external contacts. These are connected to filament type electrodes made of coiled tungsten wire. The filament electrodes are coated with an active electron emissive material. Within the bulb there is a small drop of mercury and also a few millimeters of pure argon to facilitate starting. After starting, the current is carried by the mercury vapour. It remains at a low current density and allows only a small temperature rise, resulting in low vapour pressure. Under these conditions the desired radiation of mercury at a wave length of 253 millimicrons is produced. That is in the middle Ultra-violet band.

Fluorescent radiation is of course not new. It was known 80 or 100 years ago. Wood's glass and ultra violet radiation was used for signalling. Forty years ago Cooper Hewitt introduced reflectors coated with Rhodamine—a dyestuff—which fluoresced and added red to light of the mercury vapour lamp. Ten years ago the High pressure mercury lamps were placed in glass bulbs coated with powders which had the effect of giving the monochromatic light a little of the red it badly needed. They have not been very successful, the small amount of red was of little use and did not compensate for the amount of light absorbed by the bulb.

Many colours have been developed by neon sign makers using fluorescent glass tubes and later on, powders. Uranium glass tubes fluoresce yellow under u.v. but when activated by neon, a pleasing green results. For signs it is more simple and effective to use powders and with this development we may see cold cathode lamps used for

general lighting. They will have some advantages and are capable of efficiencies of up to 40 l.p.w. They do not require starters and their life is at least three times that of the hot cathode fluorescent lamp. Cold cathode lamps can be operated at freezing point, but they require transformers as very high voltages must obtain.

We should keep in mind the fact that these light sources are new babies. Ten years before the war a fluorescent lighting unit of commercial efficiency looked 100 years off.

Improvements are being made almost every day. Starterless lamps are a possibility and it is also possible to make a lamp which can be operated at 200 milliamps or reduced to 100 milliamps at will, and actually in the case of the 100 milliamps, the efficiency is greater than 200 milliamps.

This talk has been somewhat jumbled up, but perhaps I have indicated a few lines of thought which you may enlarge upon. I would ask you to keep in mind the fact that in lighting you are dealing with what is surely God's greatest gift to humanity—a pair of human eyes which cry out for a square deal.

Let us build integrity and public responsibility into our profession, thus serving our fellow man and contributing to the common good.

Discussion.

A long discussion followed the paper, most of which dealt with fluorescent lighting. Mr. Owen emphasized that improvements in this type of lighting will be immense, during the next few years, and while the brightness of the source is as low as 3 candles per square inch, the glare factor cannot be ignored, and especially in hospital wards where patients, having little to do, would often fix their eyes on the light source. Precautions should be taken to minimize the use of bare lamps. Louvres can be improvised by means of sheets of opaque glass, or other similar material. Indirect fluorescent lighting would be ideal, but the cost is rather high. In operating theatres, fluorescent lighting can be employed for general lighting. For table lighting, however, Mr. Owen was doubtful if this could be efficiently employed as the standard of 300 f.c., laid down in the Illuminating Engineering Society Code for operating table lighting. This could more easily be obtained by the projected light of a tungsten lamp. Some firms are experimenting with fittings for operating theatres, and they might reach this standard of efficiency. If that was so, Mr. Owen felt sure that these fittings would be designed to eliminate stroboscopic effect.

ANNOUNCEMENTS.

Members of the Institution are reminded that subscriptions for 1948 become due on the 1st January, 1948. These should be forwarded to the membership secretary :—

Mr. H. S. Clarke,
14 The Villas,
Gateshead Mental Hospital,
Stennington, Morpeth,
Northumberland.

A few subscriptions for 1947 are still outstanding, and these should be forwarded without delay to the above. The attention of members in default is drawn to Rule 17.

ERRATA. "Newsletter No. 6."

The Editor wishes to apologise for certain errors which occurred in the above Newsletter under the heading "The Lancaster Steam Traps and their Application." In particular he offers his apologies to the author of the paper, J. R. A. Brown, Esq., who was wrongly described as J. R. A. Brown.

Other errors are :—Page 9, line 11—"outlet" should read "inlet." Page 11, Para 2, line 10—"Corrode" should read "erode."

BRANCH NEWS.

There is none! Why?

No news of any branch activity has been received by the Editor. Now then, my reader, what about it? You want to know what other branches are doing, so you write and tell me and I'll tell the rest. How's that? You agree? Then send along the news.

EDITOR.

BENEVOLENT FUND RULES.

The following Rules for the government of the fund were adopted at the Fourth Annual General Meeting.

1. The name of the Fund shall be "The Institution of Hospital Engineers Benevolent Fund."
2. The objects of this Fund shall be to disperse grants to members in distress, it shall not be used for legal aid, nor to assist a member who is in dispute with his employer.
3. Three Trustees shall be appointed by Council.

4. A Committee of three, elected annually from Council, shall administer the Fund, and one of these elected members shall be appointed Hon. Secretary-Treasurer.
5. The Institution's Auditors shall examine the Accounts annually, and a copy of the Balance Sheet be presented with the General Balance Sheet.
6. A minimum contribution of 5/- per member shall be due on 1st January each year. Contributions received after 31st March will be credited to the following year. No application will be considered unless applicant is a current contributor and has been so for three consecutive years.
7. Application for assistance should be made by or through the Branch Secretary on behalf of the member concerned and be supported by the Council representative; The Benevolent Fund Committee's decision as to eligibility, and the amount to be given shall be final. In cases of "urgent distress," and upon the recommendation of the Branch Council representative, the Benevolent Fund Secretary-Treasurer is empowered to make an immediate grant of a sum not exceeding £10 (ten pounds). The following were elected as Trustees :—Messrs. Clarke, Gray and MacGregor.
The following were elected as the Fund Committee :—Messrs. Smith, Adams, and Oliver, with Mr. Oliver as Secretary-Treasurer. The Funds to be banked with Barclays Bank Ltd.



**Mental Hospitals Association
Institution of Hospital Engineers.**

Joint Conciliation Committee.

**Salaries and Conditions of Service of Chief Engineers and
their Deputies in Mental Hospitals and Institutions.**

REVISED RECOMMENDATIONS.

The Joint Conciliation Committee **recommends** as follows :—

That the following alterations be made to the recommendations dated the 11th July, 1946 :—

B—QUALIFICATIONS.

That the word "Membership" be substituted for the words "Examination" or "Examinations" wherever these words occur.

K—RECOMMENDED SALARIES.

That the following revised ranges of salaries be substituted.

Chief Engineer :

1500 beds and over	....	£675 to £750 per annum.
1000 to 1499 beds	....	£600 to £675 per annum.
500 to 999 beds	....	£525 to £600 per annum.
499 beds or less	....	£450 to £525 per annum.

Deputy Engineer :

1500 beds and over	....	£480 to £530 per annum.
1000 to 1499 beds	....	£430 to £480 per annum.
500 to 999 beds	....	£380 to £430 per annum.
499 beds or less	....	£330 to £380 per annum.

Additional payments for both grades and all other recommendations to remain as hitherto.

EFFECTIVE DATE.

The foregoing recommendations shall take effect on and from the date of ratification by the Executive Committee of the Mental Hospitals Association, i.e. 10th December, 1947.

L. T. FELDON }
R. E. ROGERS } *Joint Secretaries.*

10th December, 1947.

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