The Journal of the Institute of Hospital Engineering June 1981

HOSPITAL ENGINEERING

International Federation Issue

Royal Opening of Institute Symposium

'Hospital Engineering' is published monthly, except in January and July, by Mallard Publications

Individual copies cost
£2.95 UK postage paid

The annual subscription is UK: £24.00
Overseas: £30.00 Americas: $60

Average circulation per issue
(January-December 1980): 2799

ABC

Editor
Christopher Tanous TD

Advertisement Manager
Kate Oriel

All correspondence relating to the Journal should be addressed to:

'Hospital Engineering'
Mallard Publications
48 Southwark Street
London SE1 1UN, England
Telephone: 01-403 6166

UK ISSN 0309-7498

Printed by JB Offset Printers
(Marks Tey) Ltd
Station Approach, North Lane
Marks Tey, Colchester, Essex

The Institute of Hospital Engineering
20 Landport Terrace
Southsea, Hants PO1 2RG, England
Telephone:
Portsmouth (STD 0705) 823186

Secretary
J. E. Furness MBE VRD*

Hon Librarian
D. L. Hall Esq., FIHospE MIPlantE
MRSH MBIM LHA
49 Fitzroy Avenue
Harborne
Birmingham B17 8RL
Tel: 021-554 3801, ext. 4838 (Office hours)

The International Federation of
Hospital Engineering
126 Albert Street
London NW1 7NF, England

HOSPITAL ENGINEERING

The Journal of the Institute of Hospital Engineering

I.F.H.E.

International Federation Issue No. 38

Contents

Volume 35 No. 5 June 1981

Front Cover: The President, Mr Lawrence Turner, welcoming His Royal Highness the Duke of Gloucester to the Royal Festival Hall. (see page 2)

Institute News 1

Sommaires français des articles 4

The Technical Department in a Large Hospital
Ing L Wullaert 6

Technology and Health Care
Ing L Wullaert 9

Installation and use of Clinical Anaesthetics
Jan Fialla 10

Biomedical Engineering Department in a US 500-Bed Acute Care Hospital
George H Breed 14

Legionnaires' Disease
T Geffen 17

Boiler Fuels — Their Applications
J R Fielding 19

Equipment for the Disabled
AmosMillington 23

Product News 25

Institute News

International Seminar
for Senior Engineering Managers

At the request of Council of the International Federation the Institute of Hospital Engineering is to hold a second International Seminar under the title of 'Focus on Appropriate Technology'.

The residential Seminar will be held at the National Health Service Hospital Engineering Training Centre, Falfield, England from 18th April to 7th May 1982. This is immediately before the IFHE Congress to be held in Amsterdam from 9th to 15th May and thus it is hoped that some may be able to attend both events.

Seminar leaflets are enclosed in this copy of the Journal and details are being distributed to the national representatives of IFHE member Countries.

Information may be obtained from The Secretary, The Institute of Hospital Engineering, 20 Landport Terrace, Southsea PO1 2RG.

Association Nationale des Ingénieurs Hospitaliers — France

The board members for 1981 have recently been announced, and are as follows:

President:
Denis Berard, Ingénieur en Chef des Hôpitaux, Centre Hospitalier & Universitaire, 63003 Clermont-Ferrand, Cédex.

Vice-Presidents:
Gabriel Courteville, Ingénieur en Chef, Directeur des Services Techniques, Centre Hospitalier Regional, 2 boulevard Tonnellé, 37044 Tours, Cédex;
Marc Holveck, Ingénieur, Directeur des Services Techniques, Centre Hospitalier General, 9 place Winston Churchill, 08000 Charleville-Mezieres.
Jean-Paul Rosso, Ingénieur Principal Biomedical, Centre Hospitalier Regional, 80 rue Brochier, 13005 Marseille.

Secretary:
Jean-Louis Van Asten, Chef des Services Techniques, Institut Curie, 26 rue d'Ulm, 75231 Paris, Cédex 05.

Treasurer:
Alain Planes, Ingénieur Principal, Centre Hospitalier Regional, Hôpital Pellegrin, Place Amélie Raba-Léon, 33076 Bordeaux, Cédex.

Management Training Needs Research

The Huddersfield Polytechnic is researching the management training needs of technical managers, in various sectors, with the aim of publishing a report to help design training programmes.

As they are now trying to obtain opinions from as many sources as possible, we have been asked to promulgate their request for assistance.

Anyone who would be prepared to help by filling in a questionnaire can contact:
Ian Barclay, Management Studies Dept., The Polytechnic, Queensgate, Huddersfield. Telephone: 0484 22288, extn 2135.

Diary Note
September Symposium
The new DHAs and Works Organisations

The Institute will hold a symposium at the Institution of Mechanical Engineers, Birdcage Walk, Westminister, London on Wednesday, 30 September 1981, when the topic will be:
The Re-organisation of the new DHA's in Estate Management and the Implications for Works Organisations.

Full details of the programme will appear in the next issue of *Hospital Engineering*

Member's Examination Success

Excellent examination results have led to two awards for a Member of the Institute.

Mr Stanley Clark is an Acting Senior Engineer at Loughborough General Hospital, and his paper for the City & Guilds Mechanical Engineering Technicians Course, Part III examination won him the first prize and Silver Medal. The Institution of Plant Engineers has also chosen him for their Award — which is given annually to the student who presents the best paper in the City & Guilds Examinations.

The Institute would like to take this opportunity to congratulate Mr Clark on his successes.

North Western Branch

At the Annual General Meeting on 19 March, 1981, the following were elected Officials and Committee Members of the branch:

Chairman:
Mr A. W. Schaffel.
Vice-Chairman:
Mr R. Richards.
Secretary/Treasurer:
Mr J. Sunderland.
Members:
Mr D. Cunliffe; Mr W. J. Smith; Mr T. Hardacre; Mr J. S. Lemonofides; Mr D. Mellows; Mr A. Millington; Mr P.R. Tansey; Mr D. H. Foster; Mr H. Potts; Mr R. D. Buckley; Mr M. Beatty; Mr E. A. Hateley.

London Branch

The Branch Officers for 1981 are:

Chairman:
D. L. Davies.
Vice-Chairman:
W. A. Askew.
Secretary:
P. C. Vedast, 59 Oakfield Gardens, Edmonton, London N18 1NY.
Treasurer:
W. P. Lawrence.
Committee:
R. J. Ashton;
R. Blackman;
G. C. Bushill;
R. T. Doubleday;
M. W. Markwell;
W. Upton.

Obituary
Ronald David Broadhurst

We are sorry to have to report the death of Mr Ronald Broadhurst, who died on 16th April 1981, aged 78.

Mr Broadhurst was Hospital Engineer at the George Eliot Hospital, Nuneaton, Warwickshire from 1945–1968, and during these years was a loyal supporter of the Midlands Branch.

He will be missed by his many friends in the Warwickshire area and leaves behind a widow and married daughter.

International Year of Disabled People

Royal Opening of Symposium

Accommodating the Disabled

The Institute was honoured that His Royal Highness the Duke of Gloucester opened the symposium *Accommodating the Disabled* which was held at the Royal Festival Hall in London on 29 April.

The symposium was held to bring together architects, engineers, surveyors and all those responsible for preparing operational policies and briefs for buildings that are to be used by disabled people.

It was particularly appropriate for the Duke of Gloucester to open the symposium, since he is of course an architect by profession, and takes a special interest in the disabled. Before the official opening, the Duke met a number of speakers, guests and Institute Council Members, who were presented to him by the President of the Institute, Mr Lawrence Turner.

Several of the papers given at the symposium (for which the detailed programme was given on page 2 of the March 1981 issue of *Hospital Engineering*) will be published in future issues.

Above: *The formal opening, with the President introducing the Duke of Gloucester. On the right is the Chairman for the day, Mr Kit Aston, while the first speaker, Mr Peter Large, is on the left.* **Below:** *The President presents another speaker, Mr C. Wycliffe Noble, and (back to camera) keeps His Royal Highness and Mr John Constable amused.*

The Institute of Hospital Engineering

37th Annual Conference Sheffield 13-15 May 1981

The 1981 Annual Conference was held in the pleasant surroundings of the Hallam Tower Hotel, Sheffield, which catered very well for the 150 or so members attending.

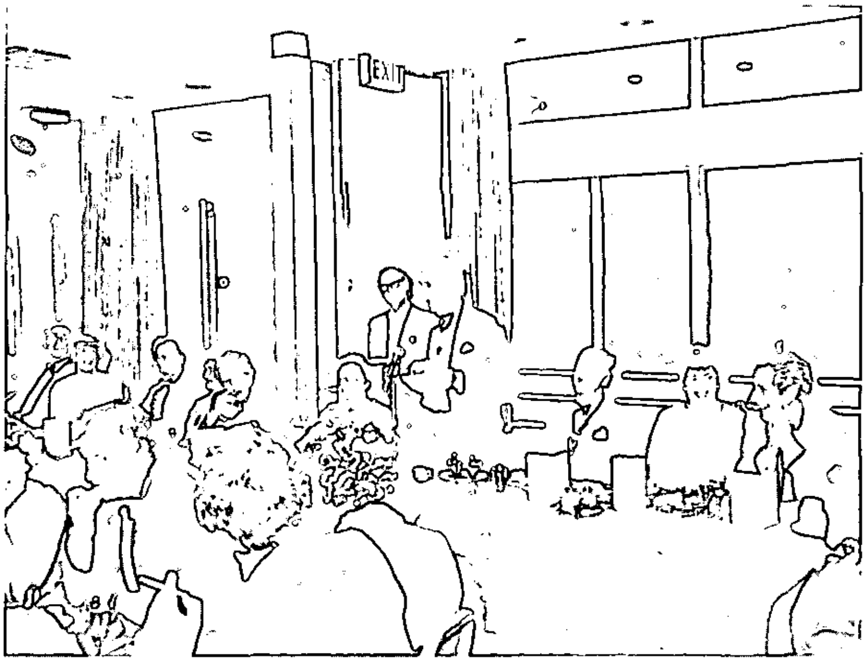
Following the well-established pattern of previous years, members were kept very busy with a series of excellent papers on a wide variety of subjects, while the ladies had their own programme of visits to places of interest in and around the city.

On the Thursday evening the Conference Dinner-Dance was enlivened not only by some commendably brief and lighthearted speeches, but by the regular announcements during the meal by the President, Mr Lawrence Turner, of the goals being scored at the Wembley replay of the Cup Final. Since Tottenham Hotspur beat Manchester City 3-2, this required several interruptions to the proceedings!

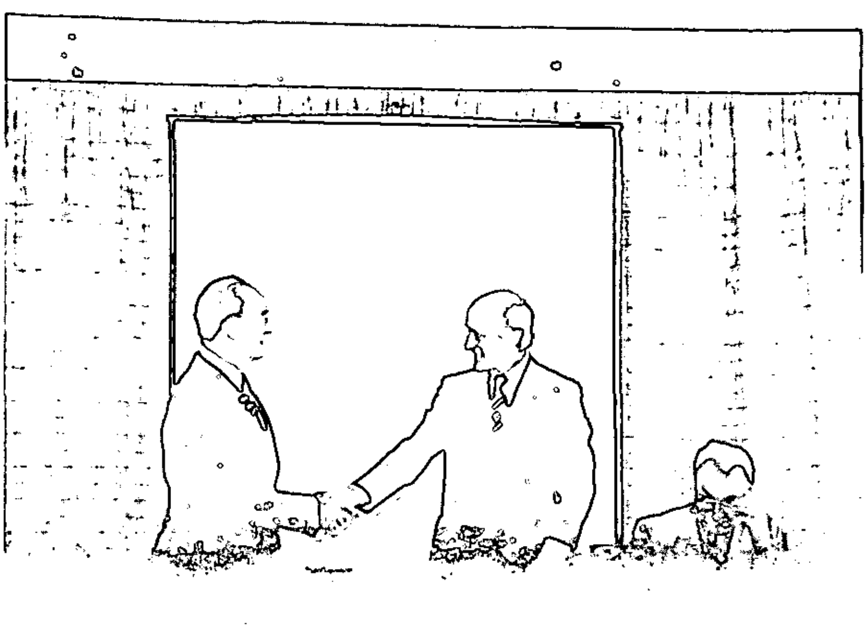
The chief guest at the Dinner-Dance was the Lord Mayor of Sheffield, Councillor William Owen, who gave a typical Yorkshire welcome to Sheffield, in which he expressed some sympathy with any Mancunians present, while making it clear that this was really an expression of passing sympathy with fellow-Northerners in the face of tribulation brought upon them by Southerners. Normally, said the Lord Mayor, he regarded Manchester as the beach between Sheffield and the Irish Sea!

The toast to the Institute was proposed by Mr W J W Sharrard, a surgeon in Sheffield, who remarked how much things had changed since the days when the Hospital Engineer was a rather distant individual who one never really met. Mr Sharrard said that he never ceased to be impressed by Institute Members' abilities — how on earth did they know where all the pipes went to? Clearly the need for training was growing all the time, and he was delighted to see how much attention

On the Friday morning the Annual General Meeting was held, at which the outgoing President installed his successor, Mr John Constable. Afterwards the final paper of the Conference was presented, and Members dispersed after lunch, pleased with the diet of interesting professional information and contact in pleasant surroundings.



Above: *The Lord Mayor of Sheffield keeps his welcoming speech at the Dinner Dance lighthearted.* **Below:** *The incoming President, John Constable, is congratulated by his predecessor Lawrence Turner — the Institute Secretary, John Furness, looks on.*



Robin Manser Retires

Mr Robin Manser BSc(Eng) CEng FIMechE FIEE FIHospE, Assistant Chief Engineer at the Department of Health and Social Security, has retired after a distinguished career. He was President of the Institute from 1971 to 1973, and has long played a considerable part in the affairs of the Institute and of the IFHE. For example, he has presented a paper at every International Congress since the first one, for which he shared the responsibility of organisation and chairmanship with George Rooley.

Mr Manser joined the National Health Service in 1968, with a broad experience in engineering ranging from heavy industrial plants to research projects, atomic and biochemical plant and rocketry, as well as more conventional large-scale construction programmes.

Starting his engineering career a few years before the Second World War, Mr Manser trained with Metropolitan-Vickers, and had a spell working in Lapland and then at home in power stations, before joining the Air Ministry in 1939. During the war he worked on night landing aids, and then on the construction of bridges, air fields etc, in Malta (during the famous siege) and in the Middle East.

After the war he joined the then Ministry of Works, and worked on biological and veterinary projects, atomic research facilities, and then a really elaborate project, the design and construction of the Spadeadam Rocket Establishment, costing £20m with a 3 year programme on an 8000 acre site.

Then followed a period he still looks back on with pleasure, working on large scientific projects, some of which involved him in dealing with leading astronomers — people he found delightfully individual in their approach, which was brilliant if sometimes single-minded.

Since joining the Health Service, Mr Manser has primarily been involved in the development of engineering policy, with latterly a considerable involvement with energy matters, including membership of an inter-Departmental Committee on Energy Conservation.

In this brief survey it is impossible to give full details of what Mr Manser has found to be a very full professional life in which he says he has enjoyed 'nearly every minute'. Retiring on reaching 65 he is neither glad nor sorry — in a typically practical reaction he regards it as a natural progression, and hopes to devote a little more time to his hobby of photography, and perhaps will travel a little more. Whether he will have time is possibly another matter — he is doing a little professional consultancy work, is writing a chapter on the hospital aspects for a new book on *Electrical Services in Buildings* and hopes soon to join a District Health Committee.

Clearly, Robin Manser is going to keep busy in his retirement — we wish him a long and happy one.

Robin Manser

Sommaires Français des Articles

Le service technique d'un grande centre hospitalier

Etant donné la multitude, la complexité et la diversité des nouveaux appareils et équipements hospitaliers, il importe d'assurer un entretien plus préventif que curatif. Il s'ensuit que l'entretien préventif exécuté logiquement réussira à contribuer sensiblement au confort des utilisateurs, car les petites défaillances seront détectées plus tôt et bien avant qu'elles ne conduisent à des pannes majeures.

Le présent exposé examine les besoins d'un service technique et les moyens de satisfaire à ces besoins précisés avec soin. Sont analysés en outre les fonctions du service technique et la façon de développer celui-ci pour qu'il puisse procurer, efficacement et rentablement, un soutien au personnel médical. *(page 6)*

La technologie et les soins de santé

Pourquoi nous efforçons-nous de former un groupe de techniciens hautement qualifiés qui constituerait une sorte de Conseil technique supérieur?

Parce que la technologie, de haut et de bas niveau, joue un rôle important au sein de l'hôpital moderne. Plus que dans tout autre domaine, le rapport entre la technologie et la médecine est complexe, précaire et délicat. En plus du lien direct représenté par les appareils de diagnostic et de traitement, il existe aussi un lien indirect à travers le contexte technologique et la place qu'il est venu occuper dans l'infrastructure des activités médicales.

L'exposé décrit comment la tension entre les diverses catégories de dirigeants peut être amenuisée par la discussion des problèmes et la mise en avant de solutions. Il est affirmé que la centralisation des informations suscite l'amélioration de la qualité et la baisse du coût des soins de santé. La fonction de chef d'un service technique y est examinée, ainsi que son apport à l'optimisation de l'efficacité au sein de l'hôpital, y compris son concours dans la prise des décisions d'achat qui est analysé de façon approfondie. *(page 9)*

Installation et utilisation de l'anesthésie pour les diagnostics

Cet article décrit les travaux menés par l'Institut hospitalier danois, pour lequel travaille l'auteur.

Sont examinés en particulier les recherches visant à minimiser les risques d'explosion dans les zones d'utilisation des gaz anesthésiques explosifs, et les recueils de directives pratiques applicables à l'installation et l'entretien des systèmes d'alimentation en gaz médicaux. Il est également proposé des recommandations visant à amenuiser la pollution des blocs opératoires, etc., provoquée par l'échappement des gaz anesthésiques. *(page 10)*

Le génie biomédical dans un centre hospitalier pour malades aigus de 500 lits aux Etats-Unis

Ces dix dernières années, les hôpitaux américains ont commencé à embaucher du personnel capable d'assurer l'entretien et la réparation des appareils biomédicaux utilisés en nombre toujours croissant. Il est rare aujourd'hui que des hôpitaux de 300 lits ou plus n'aient pas au moins un technicien employé à plein temps pour s'occuper du matériel biomédical. La plupart des hôpitaux de taille moyenne, ainsi que tous les grands hôpitaux ont un service Génie biomédical.

L'auteur de l'exposé décrit fe façon très détaillée le service technique biomédical type d'un hôpital américain et il explique les lois réglementant la sécurité en ce domaine, les fonctions du Comité de sécurité ainsi que la formation et les tâches de l'ingénieur du service Génie biomédical.

En conclusion, sont examinés l'équipement nécessaire à un service Génie biomédical efficace, et le rôle de la Commission de certification des ingénieurs chargés des appareils d'examen clinique. *(page 14)*

La maladie des légionnaires

Les premiers cas de maladie des légionnaires furent reconnus comme tels en 1976, lorsqu'un certain nombre d'anciens combattants américains, qui avaient assisté à un congrès de l'American Legion à Philadelphie, furent atteints d'une maladie pulmonaire comportant d'étranges symptômes épidémiologiques. Ce sont ces symptômes qui sont analysés dans le présent exposé.

L'auteur brosse ensuite l'historique de la maladie et il établit la relation avec les infections pneumoniques types par rapport à ses causes probables. *(page 17)*

Les combustibles de chaudières

Leurs applications

Le combustible primaire est un mélange composé d'une ou de plusieurs matières premières coûteuses, acquises dans le but de procurer un degré de confort et de soins adéquat — tout juste adéquat et pas plus.

De tous les types de combustibles le plus communément employés dans les chaudières — le mazout, le gazole et le charbon — c'est toujours le pétrole qui représente l'un des combustibles les plus polyvalents, bien qu'onéreux. Notre planète, affirme-t-on, possède des ressources pétrolières suffisantes pour satisfaire à ses besoins actuels pendant seulement 80 ans. Or, la consommation énergétique mondiale est passée de 22 millions de barils par jour en 1960 à 65 millions de barils par jour en 1980.

Le prix du gaz industriel continue de grimper en séquence avec le prix du pétrole. Aujourd'hui, le prix du gaz au Royaume-Uni est plus élevé que chez la plupart de ses voisins industriels. Il est estimé que les réserves mondiales de gaz seront suffisantes pour produire ce combustible pendant pas beaucoup plus de 72 ans.

Les plus importantes réserves énergétiques mondiales sont représentées par les gisements houillers. Les techniques d'application du charbon en tant que combustible de chaudières, se sont développées, au cours des ans, pour procurer notamment un lit fluidisé progressivement plus rentable et plus praticable.

L'exposé décrit les methodes de stockage du combustible et les moyens de maximiser la production des calories à partir des trois combustibles les plus courants. Les ingénieurs chargés de la gestion des calories gagneraient donc à connaître parfaitement les caractéristiques et du combustible et des équipments, afin d'arriver à une formule coût-efficacité qui puisse contribuer à économiser l'énergie. *(page 19)*

Des équipements pour les handicapés

Contribution d'un service technique

Les problèmes qui surgissent lorsqu'il s'agit de baigner une personne handicapée ou âgée sont bien connus, et dans cet exposé l'auteur identifie quelques-uns de ces problèmes, en signalant des solutions pour le transport du patient depuis la salle jusque dans la baignoire.

Après avoir examiné plusieurs options disponibles dans le commerce, le service technique des Services de sante de Salford AHA a entrepris l'étude et la construction de la baignoire 'Ladywell'. Un fauteuil roulant a été adapté pour acheminer le malade depuis son lit jusqu'à la salle de bain; une fois celui-ci arrivé à la baignoire, le siège et le dossier du fauteuil se séparent du piètement et se déplacent le long d'une glissière pour 'décharger' dans la baignoire le malade toujours assis; l'une des extrémités de la baignoire a été modifiée pour constituer une 'porte'.

D'autres aides aux handicapés conçues par la même équipe comprennent un évier, une table de cuisson et un four, tous pouvant être relevés ou abaissés grâce au plinthe hydraulique portant l'élément. *(page 23)*

The author of the following two companion papers is Head of the Technical Department of the Sint-Jan Hospital, Bruges, Belgium and is the President of the Belgian Association of Hospital Engineers.

The Technical Department in a Large Hospital

ING L WULLAERT

Introduction

Depending on the size and the nature of the hospital there will be a totally independent technical team, eventually combined with additional teams, more allied to the reception tasks of the hospitals, such as cleaning the kitchens, transport, telephone, etc. These days, most of these teams are brought together and are entitled The Civil Department.

If the Department Chief wants to give his own hospital infrastructure (buildings, installations, and most of all the apparatuses) a satisfactory service, then one must logically have an organized Technical Department available, preferably centrally situated, including a technical storehouse. The last thing necessary is to arrange a system for the reception, distribution and control of materials.

The Technical Department
Some Reflections

A well set-up Technical Department offers a hospital the following advantages:

- its own Technical Department with ready availability can act faster in emergency, increasing the reliability of the hospital;
- the hospital's own technicians are most familiar with its specific needs and requirements;
- although the hospital has to pay the costs of its own Technical Department, there is a striking saving on expensive repairs by dealers and other outsiders;
- the hospital's own technicians can rectify elementary break-downs faster, so that one need not buy so many reserve apparatuses;
- efficient preventive maintenance leads to less breakdowns and expensive repairs. This preventive upkeep is only possible with a Technical Department;
- through the Technical Department's experience of equipment reliability, maintenance needs, repair costs, suppliers' service etc, the hospital is able to buy efficiently;
- the average hourly wages of hospital technicians are much lower than those of contract staff.

Introducing a Technical Department

Once one has decided to introduce a Technical Department, one should also consider the advantages of centralised location;

- a central Technical Department means less disturbance for the clinical, domestic and administrative activities;
- more opportunity for controlling use of repair-apparatus and equipment;
- good control and coordination generally;
- locating elements of the Technical Department in 'spare corners' all over the hospital leads only to an imagined saving;
- efficient stock management through central holding of replacement-parts and repair materials.

A well planned Technical Department will most of all be recognised by its combination of emergency and preventive upkeep. We intend to develop a planned preventative maintenance programme that will be executed by especially trained technical teams that can make use of their own independent technical divisions and stocks.

The Technical Department of the hospital must be developed in such a way that all the new techniques — most of all the medical ones — that are applied in the hospital can keep on working efficiently, reliably and exactly. This concerns all sections of:

- medical installations and infrastructure;
- electromechanical and power installations;
- the buildings.

To be complete, other important aspects for decision and implementation are:

- tasks to be given to the technical teams must be pre-planned, including: the building section;
- the power and electromechanical installation section;
- the instrumental section (medical apparatus and medical technology);
- the relationship between tasks undertaken internally and those given to outsiders;
- planned preventative maintenance;
- whether to have own administration and secretariat;
- own stores management, yes or no?
- an independent purchasing policy, yes or no?
- a departmental security team, yes or no?

The ultimate question is: Where is technical assistance required?

But still, the internal Technical Department is always responsible for a good co-ordination of the different technical teams.

Two factors are essential to bring this to a satisfactory conclusion:

1. The quality and quantity of the technical team.
2. Centralisation of the department as a whole in relation both to location and functions.

The advantages of a centralised approach are obvious:

it leads to a larger stock of expert knowledge, available for all hospital departments;
it assures the continuous specialised guidance of the technicians;
it assures properly equipped workshops for the technicians;
it offers possibilities for the promotion of the technicians within the hospital. By this the hospital acquires a better competitive position with industry in recruiting well-trained technicians;
it assures the continuity of work during holiday periods and in cases of illness;
it allows the centralisation of a large part of the hospital auxiliary apparatus. Consequently, modern machines can be purchased for the same outlay as that needed to fit up smaller, less-developed apparatuses in scattered locations;
it allows a higher degree of utility in view of rationalisation.

The Role of the Technical Department

The Task

This task is threefold:

to assure the reliability of buildings and the equipment;
to execute renewal and modification requirements;
to advise about purchase of new machines and installations, especially about standardisation and the possibilities of maintenance. Eventually, to undertake developments of new systems (research).

In practice this leads to the following activities of the Technical Department:

preparing maintenance instructions for the technical equipment;
planned preventative maintenance of the technical apparatus;
repair and handling of machines in emergency;
assistance in attending to patients with technically intricate machinery and in cases of difficult, technical measurements;
training medical personnel in the use of equipment;
development of methods and apparatus;
registration and replacement of existing apparatuses;
taking technical responsibility for the technical functioning and security of equipment.

Finally the activities can be grouped in 2 categories:

planned activities: preventive maintenance (routine), preparing instructions;
unplanned activities: intervention in case of breakdowns and disturbances, i.e. running repairs.

Possible Fields of Activity

The Technical Department has the following:

building and environment; and apparatus and infra-structure.

In other words, the General Technical Department and the Instrument Department.

'Building and environment' indicates bricklaying, carpenting, painting, papering and gardening.

Under 'apparatus' the medical and non-medical machines and technical installations generally are indicated. In this field, the distinction between electromechanical and electronic parts is useful.

'Infrastructure' includes all the provisions for buildings, as well as for appparatus, e.g. central heating, sanitary, lighting, ventilation, lifts, distribution of medical gases, high- and low-tension distribution, emergency batteries, etc. In other words all the necessary power installations.

Maintenance problems

The problem of every maintenance service can be summarised as: *Providing a maximum of comfort (security, continous functioning) to the consumer with minimum of upkeep costs.* The desired comfort increases, but maintenance-costs may not increase proportionately.

Management systems

Work instruction systems

To call out the Technical Department, it is necessary to fill out a work request note. Such a system leads to good co-ordination in the execution of the work, better time-planning for the technicians, and is the eventual means for budgetary control.

The work request system should be simple to work efficiently and can be used for maintenance, breakdown and special requests.

A practical system must always be developed for all cases, for all technicians and with possibilities of control and follow-up.

Planning

Owing, among other things, to this work request system, more possibilities for planning in general and time-planning are created. Some aspects of planning are:

the determination of priorities;
equal spreading of work;
materials and equipment provision;
the drawing-up of work instructions.

Preventative upkeep systems

Description, purpose and advantages of preventive maintenance

Preventive maintenance includes a set of planned actions such as:

systematic upkeep — cleaning, adjusting, greasing, etc.;
periodic inspections, eventually followed by replacement or repair of parts.

The purpose of preventive maintenance is the early discovery of defects and wastage. By this, serious breakdowns and disturbances can be avoided. Prevention will control maintenance in the future, that is to say: a preventive policy for everybody from the director to all the subordinates. In practice, this system works via a responsible technician for every Department.

Advantages

the decrease of the number of breakdowns and of the emergency repairs;
longer life of parts;
planned actions can be executed at convenient moments;
upkeep becomes a known factor in the determination of the work distribution and the maintenance budget;
a cost saving after an initial period;
enlarges the availability of equipment and in most cases of its safety.

The introduction of a preventive maintenance system

Moving into a new hospital building is an excellent moment to start a preventive maintenance system for the following reasons:

a systematic control of the (partly unknown) new apparatus is useful and desirable;

more expensive and sometimes also more complex apparatus must be available for use at every moment;
the larger number of apparatuses requires a better maintenance system;
preventive maintenance leads to more exact cost calculations;
during the initial period, the apparatuses have a number of teething problems. Through preventive maintenance, if necessary with a higher frequency, it is possible to keep control over these.

Building up a preventive maintenance system

The construction of such a system essentially depends on teamwork and co-operation. Next a systematic step-by-step approach is a guarantee for success. The different stages which have to be worked through are:

the inventory;
investigation;
planning;
execution;
control.

The first three steps, only required once, must be executed accurately in case one wants to start the system on a good basis.

Conclusion

Because of the large number, the complexity and the differences in new equipment, it is necessary to work almost more preventively. Preventive maintenance logically executed, contributes much to the comfort of the consumers, because one discovers earlier little defects, which could otherwise cause large breakdowns.

By this, a part of the breakdown work is eliminated, and it becomes possible to work in a more planned way. This PPM system also leads to a model maintenance dossier for each apparatus and for each installation.

Cost summary system

It is important to make a periodical summary of the upkeep costs, in separate accounts for breakdown repairs, PPM and other tasks, executed both by outsiders and by the own Technical Department. This information is of great importance in fixing the yearly budget of the Technical Department.

Next to a general cost summary, there is also the possibility of keeping records for each apparatus. This can be useful in case of a purchase of new equipment. It is necessary to aim as much as possible at more standardisation of materials. Experience leads to the following basic principles for standardisation, which offer enormous advantages:

better and more efficient maintenance possibilities;
more economic purchasing;
more efficient stock control in the central stores;
deeper and better knowledge of the apparatus by technicians;
easy use of the apparatus by the personnel of the departments involved, most of all in case of staff rotation.

Lay-out

How should the lay-out of the Technical Department be worked out? The following factors are important:

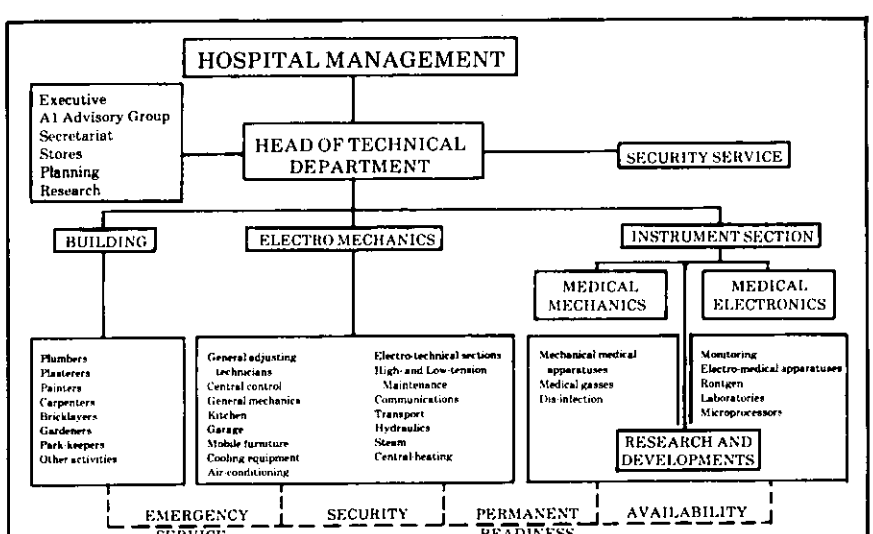
flow of materials and the apparatuses that must be repaired;
arrange a practical entrance and connecting passages;
plan the inter-relationships within the Technical Department — including most of all the flow of people and information;
the necessary floor area for each discipline;
organisation of the Department itself;
the grouping of the quiet and noisy tasks;
the stocking of the necessary materials as close as possible to the point of use. This means a central stores near the workshops;
the introduction of a central control system;
finding locations for the drawing office, blue-prints, classifications, secretariat, reception;
the necessary number of offices for administration and for technical direction;
reception area for salesman and technicians, which can be combined with a meeting-room and a classroom;
a closed stores area to enable efficient stock control.

The following working areas should be taken into account:

electricity;
electronics;
mechanical medical apparatuses;
general mechanics including air-conditioning, central heating, and pumps;
carpentry;
painting and papering;
plumbing;
filing-rooms, planning-rooms and work preparation-rooms;
offices;
meeting rooms, waiting rooms;
reception, secretariat, stock control office;
stores;
garaging and fire-fighting arrangements.

Thus it becomes possible to determine the different fields of action.

The illustration shows an organisation-chart that can be adopted wholly or in part in every Technical Department of every hospital. It is clear that this structure depends completely on the kind of hospital and its tasks. Still, this organisation offers a new way of coping with specific needs and requirements, and thus becomes the means of solving certain problems in the organisation.



Technology and Health Care

ING L WULLAERT

Introduction

Why do we strive towards forming a group of highly qualified technicians in a kind of higher Technical Board?

The main aim in establishing such a board is to solve the many-sided problems of departmental organisation, of modification and development of projects and apparatuses, of contact with medical workers, and of establishing important criteria to influence the highest level of hospital management.

The highly-developed technicians can, through efficient co-operation, deal with these various points.

Co-operation between technicians, doctors and nurses in the hospital is important. That is why we think it is necessary to maintain a steady contact between engineers in the medical departments and the general, technical engineers. Through the suggested co-operation between the doctors (heads of departments) and the heads of other managing boards, polemics will be decreased, so that more uniform advice can be given to management.

This form of co-operation also has consequences in relation to:

Purchase of medical equipment and intallations;
Modifications to buildings and technical equipment;
Training and selection of staff;
Integration with other groups in the hospital;
Training and trial periods.

Through the fact of the higher Technical Board's existence, a Medical–Technical Committee can be founded in our hospitals. This means the Technical Department can become seriously involved in decisions concerning budget, training, research and assessment of medical equipment. The possible contact with University technical services in our own and other countries has also been stressed as an advantage.

The Higher Technical Board in Hospital Management

High- and low-level technology plays an important part in the modern hospital, as in every field of our civilisation. But more than in any other field, the link between technology and medicine is complex, precarious and delicate. The link is direct through the apparatuses used for perception, diagnosis and therapy. But there is also an indirect link through the background of technology and its place in the infrastructure of medical activities. Here also are included the engineering workers in the Laboratories, and the Radiology and Radio-Therapy departments.

Technology and Medicine are the two poles that create a field of tension in which an important part of the hospital population works, and this has a negative effect on its efficient working. The higher Technical Board can play an important part in relieving this tension between all classes of management.

First of all, who is faced with these problems?

The hospital administration is, in that it is concerned with purchasing, planning and organisation. The doctors and the nursing staff will have problems in using medical equipment. Sometimes even the patients themselves usually feel the tension, but most of all it is the members of the higher Technical Board who are in close contact with these problems.

The engineer or the Head of the Technical Department is certainly the best person to solve these problems, because of his more centralised view-point and his frequent presence in all parts of the hospital. In this short study we will limit ourselves to a closer look to his part in purchasing policy, and secondly in the optimisation and efficiency of the Hospital.

Within the field of purchasing, his task has different levels and different phases.

His first task is to set out all the technical and organisational requirements, concerning the Board's functioning and integration in the hospital, in case of possible aquisition of apparatus and instruments. Only a well-defined requirement can give satisfaction.

The next stage is to help in the interpretation and the comparison of the technical descriptions of the various suppliers, most of them written in a dense, technical jargon.

For more than one reason, the responsible technician also makes an important and final decision. There is, first of all, the comparison and the judgment of the technical aspects of the possible solutions. Secondly, he has to consider which product that will have the lowest running costs including energy-consumption, and taking into account durability, optimum utilisation, repair and service costs.

Last but not least, he has to advise on the best choices in the existing structure, and on possible purchases that help to achieve the general objectives of the Hospital.

Next, as Manager of the Technical Staff, he has to be a technical adviser in the general conduct of purchasing policy.

Why is the engineer the right person?

To answer this question, we have to take a closer look at the requirements for a rational purchase policy. In the first place, it requires a central position, a general orientation, good contacts with every part of the hospital, knowledge of the medical administrative, technical and economic aspects of the hospital.

How is the engineer or Manager of the Technical Department adapted to these requirements?

By his experience, he is technically competent and oriented towards achieving optimum efficiency. His position in the hospital requires a frequent presence in all departments, so that he has a better overall view. The person responsible for the different sections of the technical department, e.g. the electro-medical section, needs a specific knowledge of the medical aspects of the medical equipments, installations and their functions.

From this we may conclude that the centralisation of purchasing will result in an important rationalisation. Even more, the efficiency of the hospital will improve.

Especially in this drive for efficiency there is an important task for the higher Technical Board. The growing importance of the technical aspects of nursing creates problems of incomplete use of equipment, or even worse, may create dangers for operators and patients.

It must be emphasized that, in general, nursing Staff are not technically-minded. The equipments are often difficult to handle and may be very sophisticated to work with. Through intensive use and frequent changes of operator, the equipment may become less effective because of wastage. This may even result in safety hazards.

The higher Technical Board can give a solution for these problems. The technical schooling of the personnel is an important factor in saving time, and in achieving higher efficiency and utilisation of the apparatuses, and of course a higher security. Next it is also necessary for the Managing Board of the Technical Department to secure the continuous follow-up of all equipment, to guarantee its adequate and efficient use in a broader hospital context.

The Board members are the responsible persons to decide on eventual replacements.

In conclusion, we may state that the creation of a higher Technical Board gives improved quality and reduced costs of Health Care. Indeed, it would be a useful clearing-house to which all Departments could give regular information about improvements, new ideas, and even criticism of the use and conception of the installations.

All this information should be centralised in the technical department and be circulated to everyone that can integrate it with their new projects.

The author is from the Danish Hospital Institute, and he presented this paper at the 6th International Congress in Washington in July 1980.

Installation and Use of Clinical Anaesthetics

Safety Precautions

JAN FIALLA MSc

Introduction

This paper deals with the drawing-up of safety precautions for the installation and use of anaesthetic gases. It does not of course deal with the purely clinical aspects, but will concentrate on the following three main areas:

Recommendations for reducing the risks of explosions;
recommendations for the installation of piped medical gas systems;
recommendations for minimizing the pollution of the environment.

Background

Denmark is one of the smaller western European countries, covering an area of 44,000 square kilometres and having a population of approximately 5 million, of whom around 100,000 work in the health sector.

Hospital services in Denmark are paid for through taxes, and are administered by the 14 county councils plus the city council of Copenhagen and Frederiksberg. These 16 authorities are responsible for the administration of the country's 116 somatic and 16 psychiatric hospitals with a total number of 33,000 and 9,000 beds respectively.

The one exception is the largest hospital in Denmark, the Rigshospital, which has approximately 2,000 beds, and is owned and administered by the Ministry of Education.

The Danish Hospital Institute, where I work as the coordinator of technical projects, is owned by these 16 hospital authorities in collaboration with the State, and the main purpose of the Institute is to carry out research and development projects within the health field, and to analyse and disseminate relevant information for use in the administration and forward planning of hospital services.

Organisation

The Institute is a relatively small one, employing only 30 people, of whom only 15 are research workers. It will be appreciated therefore that the Institute does not itself have the expertise or resources required to independently draw up a new set of regulations for the use of medical gas, but has to a large extent been dependent on the active assistance of various individuals and institutions, who are recognised as being amongst the main authorities in Denmark in this area.

The three working groups included 22 experts who represented the hospitals, consulting engineers, research institutions and firms engaged in the delivery of technical equipment and gases to the hospitals. Also included were anaesthesiologists, nurses, electronics, chemical and hospital engineers, pharmacists, physicists and legal experts. Most of them participated free of charge, but we have when necessary commissioned various research institutes and technical high schools to assist us with specific problems on a fee basis.

From the Institute, four of us have participated, a medical engineer, a hospital engineer, and an anaesthesiologist. I have been responsible for co-ordinating the work — I am an MSc in electronics.

Reducing the Risks of Explosions

In many parts of the world, casualties have been recorded due to the use of explosive anaesthetics, such as cyclopropane and ether. In Denmark during the last 20 years, 4 cases have been reported, which in terms of the number of operations that have been carried out, shows that in fact the statistical risk to the patient is very low. Naturally such casualties are unacceptable for various reasons, the main one being that our society insists that a patient in hospital is given at least the same amount of protection from the physical environment that he has in his own home.

We start by investigating the extent to which cyclopropane and ether were used in Danish hospitals, in order to establish the size of the problem. We sent a questionnaire to each and every department of anaesthetics in the country and were surprised to learn that though about one third of the hospitals used one or both of these gases as a routine, as many as 75% of all hospitals kept stocks for occasional use in special cases. Our conclusion was that the use of cyclopropane and ether was so extensive, that it would be impossible to recommend against their use for many years to come. On the basis of this our task was to set out guidelines which would ensure that the conditions in which they are used will be as safe as possible.

The Ignition of Explosive Anaesthetics

In order to obtain ignition, three components must be present at the same time, they are:

a supply of oxygen;
an ignitable material;
a source of ignition.

In conditions where any two of these components are present, every step must be taken to guard against the introduction of the third.

During an operation where explosive anaesthetics are being used, the patient's lungs are filled with two of these components in a concentration where the slighest source of ignition will cause a serious explosion, and will inevitably result in the patient's death. The energy required to ignite cyclopropane or ether in oxygen, or in a mixture of oxygen and nitrous oxide, is as little as 1.3 μJ. Normal electrical sparks contain energy in the μJ or even Joule level, and will readily ignite this mixture, as will most antistatic sparks. It is almost impossible to induce an antistatic spark so weak that it will not cause ignition with these mixtures.

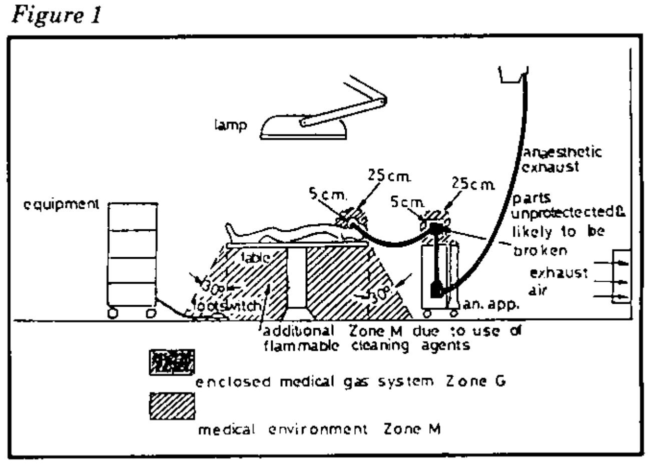
Our work with this subject therefore, has been concentrated on identifying the possible sources of ignition which can be anticipated, in order to draw up recommendations which encompass the design of the buildings, the installations and the equipment, as well as the routines by which they are used, in order to ensure that these sources of ignition are eradicated.

For economic implications, it has been necessary to draw up separate recommendations for those areas where explosive anaesthetics are used, and those areas where they are *not* used. We insist, due to the widespread use of explosive anaesthetics in Denmark, that all new or renovated buildings and fixed installations must conform to our requirements. We have drawn up different regulations for the design of loose equipment, and for maintenance procedures, which are much less strict, where only non-explosive anaesthetic gases are used. While the main factors here initially are economic, we expect that in the long run, the question of convenience will also influence the choice of non-explosive anaesthetics.

In all cases where anaesthetic gases are used (both explosive and non-explosive) we require that the rooms and installations have:

antistatic floors;
one-way ventilation systems;
splash-proof mains sockets.

Figure 1



The antistatic floors must be controlled once annually by the person-loaded electrode test, and the resistance measured from any point of the surface of the floor to the earth must lay within strict limits.

The induction rooms, and operating theatres must be provided with a non-recirculating ventilation system, which must also have the facility for introducing at a later date, the means for regulating the humidity of environment.

The mains socket used in these rooms must be splash-proof, and must not be placed nearer than 50 cm to the zones of risk, as proposed by the I.E.C. (see *Figure 1*)

Further to this, of course, all major metallic components in the room must be properly earthed, this includes the operating lamp, wall arms and ceiling suspensions etc.

In Denmark, all operating theatre tables must be earthed, either directly or via a resistor of 200 kohms approx.

In induction rooms and operating theatres where explosive anaesthetics are used, we demand that in addition to the above-named requirements, the equipment used in the rooms must conform to strict specifications. The equipment includes:

anaesthetic machines;
anaesthetic masks and tubes;
footwear;
clothing;
electronic and electrical equipment;
foot switches;
trolleys etc.

Further to this, the ventilation system in these rooms must be equipped with the facility for regulating the relative humidity to between 50% and 64% under all climatical conditions.

We also require that the induction room and theatre shall be provided with its own hygrometer, and that all operating departments shall have a meter for measuring the conductivity of footwear.

We have incidently found that these meters can, with a little practice, also be used for checking the conductivity of antistatic tubes, bags and masks.

If you, for example, take a tube, hold it in the one hand with one end touching the handle of the meter, and the other end hanging down to the footpiece of the instrument, you can check the conductivity of the tube.

If you place one hand on the handle, and touch the footpiece with a mask which you are holding in the other hand, you can check your own conductivity plus the conductivity of the mask or bag. As we know that the human body has a resistance of approximately 50,000 ohms, what is left — the larger part — gives the conductivity of the item being checked.

Antistatic sheets can be similarly controlled; with practice the process becomes so simple that the clinical staff can reasonable be required to see that everything is checked, every day before use.

Figure 2 shows the values we recommend for resistance of various article and materials.

To summarise, one of the most important aspects of the recommendations which we have drawn up is that we have differentiated between rooms and departments where explosive anaesthetics affect the standards required for loose equipment, and the procedures set out for using and maintaining them. The standards required for building construction and installations are by and large the same,

Item	**Resistance (ohms) Min.**	**Max.**
Antistatic floor:	5×10^4	5×10^7
Rubber tubing per metre:	5×10^4	10^7
Mattresses and pillows:	10^4	10^7
Wheels etc:		10^7
Foowear:		10^7
Foils:	Foils cannot be measured by the hospital themselves. Order approved types	

Figure 2: Recommended values for antistatic materials

and the main benefit in our approach is, that on the one hand, the less stringent requirements mean that it will for economical reasons be more attractive to use *non-explosive* anaesthetics, but that the capital cost implication of switching to the use of explosive anaesthetics is kept to a minimum.

Piped Medical Gas Systems

Work with this subject has been somewhat easier than the previous one, in that there has already existed a comprehensive source of material originating from various others in many countries in the world. Our chief source has been the new ISO draft standard on *Nonflammable medical gas pipeline systems* (ISO/TC 121/SC 6 N 30) which is a very thorough study on the subject. The main area where we have relied to a great extent on our own research is on the problems dealing with the cleaning and welding of pipework.

The medical gases in question are: Oxygen, Nitrous Oxide, Compressed air and vacuum. By 'systems' we mean fixed installations including outlets, as well as the transport and storage etc. of gas cylinders. The problems connected with the use of Carbon Dioxide, Carboxide, Nitrogen, and Helium have also been considered, though the use of these gases is not so common.

The main risks which must be considered when dealing with piped medical gas systems fall into two categories:

risks to the patients caused by impurities, high pressure or failure in supply;

fire risks, especially in the case of Oxygen and Nitrous Oxide.

These risks are very real, the number of incidents of all types which have been reported is quite considerable.

Impurities in the gases

Almost every hospital has experienced at some time or another the presence of water in the compressed air system. In Denmark we have also encountered the presence of impurities which are caused by the welding procedures.

High pressure

This is the result of failure in valves and flow regulation. On reaching the patient this can cause serious damage to his breathing system, often with serious consequences.

Failure in supply

Faults in pipework, or gas bottles running out is also a cause of injury or death to patients using breathing equipment, or under anaesthesia.

Fire

Always a serious risk where Oxygen and Nitrous Oxide are present. In the case of Oxygen the risk is increased considerably with the presence of grease, and if Oxygen is under pressure, an explosion can occur. This is an occupational hazard which many welders are all too well aware of.

Oxygen and Nitrous Oxide piped systems are particularly vulnerable in case of fire, and written shut-off instructions in these conditions should be mandatory. Piped medical-gas systems should never be allowed to run unprotected through areas with a high fire risk.

In the recommendations for piped gas systems, we have paid a lot of attention to establishing procedures for cleaning and welding the pipe systems to ensure that no grease or other by-product from the installation process are left inside the pipes to contaminate the gases.

We recommend that as far as possible the pipework is factory cleaned, and that those parts which are cleaned on-site be treated first with Trinatriumphosphate, and then with hot water. The factory cleaning must follow the same procedure, or all parts have to be recleaned on-site. The finished installation should not be rinsed with water but with an inactive gas such as Nitrogen.

We recommend that all welding be carried out according to the German Standard DIN 8513, and further that the welding temperature must be over 650°C, and that ideally soldering rings should be used.

Finally we recommend that before working on a medical gas system, the welder should be specially trained and thereby authorised to carry out the work.

With regard to installation, we recommend that approved signs be used throughout to show the type and direction of the different services, and the positions of the different shut-off valves. In certain rooms, such as operating theatres, ICU's etc., stand-by services should be provided in the form of portable gas cylinders with satellite pressure regulators to ensure an uninterrupted constant supply.

We have placed great importance on the carrying out of correct commissioning and maintenance procedures.

When a new hospital department, or for that matter a whole new hospital, is commissioned and put into use many things have to be checked:

is the whole system tight?
that the pipes have not been switched;
that the gas outlets deliver the correct gases;
that all the valves function correctly;
that the gases from the outlets are clean;
and who is responsible for checking, and who carries it out?

We have drawn up checklists for use with the commissioning of new or modernised installations, as well as for outline maintenance. These are very detailed and set out exactly:

What must be checked;
by what method;
who has the responsibility;
who carries out the checking.

So far these checklists are to be found only in Danish but I would think that they could be well worth translating into other languages.

Minimising Pollution of the Environment

These problems differ somewhat from the others in that very little conclusive information is available at international level in this field.

Quite a lot ot work though has been done in Denmark, and long ago Danish anaesthesiologists became aware that prolonged exposure to anaesthetic gases could have a potentially harmful effect on the hospital staff, particularly female staff.

Studies into the background of this are also going on in the United States, and we have at the present moment no conclusive proof that it is the gases themselves which are the prime cause. What we do know is that the incidence of infertility and the number of miscarriages amongst women working in operating theatre departments is significantly high, and in Denmark we have drawn up recommendations to protect against this.

We have recommended that all rooms where anaesthetic vapours and gases are used must be provided with ventilation and scavenging systems.

Induction rooms must have a minimum of 10 air changes per hour.

Operating theatres must have a minimum of 17 air changes per hour, or the equivalent of at least 2000 cubic metres per hour.

Recovery rooms must have a minimum of 6 air changes per hour, or the equivalent of 500 cubic metres per hour per patient.

These ventilation rates have been checked in practice and have been shown to be sufficient to maintain pollution limits to within the limits accepted in Denmark, that is 25 ppm for Nitrous Oxide and 1 ppm for Halothane.

As mentioned above, as a supplement to the ventilation systems, we also recommend that scavenging systems are employed in all rooms where anaesthetics are used. Effective scavenging reduces the pollution levels by at least 10 times, and often considerable more.

The scavenging systems are very economical to install and are relatively easy to maintain, so we think that they are very worthwhile.

The most difficult problems are encountered perhaps in older buildings, which do not have provisions for artificial ventilation.

Here we demand that pollution is checked from time to time and that the use of the room is reduced, if pollution is too high. Further, we suggest the rotation of female staff to reduce their exposure to polluted environment. This is similar to the measures taken where there is danger of radioactivity or X-rays.

The principal sources of pollution are leakages from anaesthetic apparatus. To keep these leakages to a minimum, we have recommended various procedures. The anaesthetic apparatus, including the patient system, must be checked by the members of staff every time before it is used, and records must be kept. There are several beneficial effects in this. The anaesthesiologist will be more careful when he assembles the system and quickly learns how to regulate the gear which controls the leaks. Registration also has good educational effects.

Levels of pollution can definitely be better controlled in this way but our studies have shown that standards of both technical installations and clinical procedures require to be very high if good results are to be obtained.

We have also developed checklists for use in this area:
Are the rates of air changes as stated?
Is the scavenging equipment functioning properly and well adjusted?
Are the (new) anaesthesia machines in good order? and:
Who is going to check the ventilation systems?
Who is going to check the scavenging systems?
Who is going to check the equipment? and:
Who is responsible for pollution checks?

Conclusion

The Danish Hospital Institute has been able to do some work on this topic, because we employ technicians of various kinds: doctors, nurses, architects, economists, and so forth. And because we have been able to interest a circle of experts in the study and persuaded them to join in — and because we have had resources to go out and commission the necessary advice on what was left over.

We do hope that many will benefit from our work, because these problems are international, and what we find in Denmark will be true in The States, Germany or in the Philippines.

At the time of writing this paper, the author was a member of the Medical Products Group of the Hewlett Packard Company.

Biomedical Engineering Department in a US 500-Bed Acute Care Hospital

Staffing and Operations

GEORGE H BREED

Emergence of Biomedical Engineering Department

Fifteen years ago, hospitals in the USA seldom had anyone on their payroll who attempted to maintain any biomedical equipment more complicated than a vaporizer or suction machine. X-ray machines, electrocardiographs and multi-channel recorders were cared for by manufacturers' representatives. No other complex equipment was in service.

Only in the mid-1960's did any quantity of sophisticated biomedical equipment begin to be purchased. Hospitals were slow to understand the service needs of such equipment. The man who cut the grass or installed new electrical mains was the one to be called to fix allegedly inoperative electronic equipment. Of course, with no training, he seldom was able to do more than change a fuse.

Over the last ten years, US hospitals have begun to employ the staff required to maintain the ever-increasing amount of biomedical equipment they own. Today there are very few hospitals of 300 beds or more which don't have at least one full-time biomedical equipment technician (BMET). Most medium sized, and all large hospitals have a biomedical engineering department.

Organisation

As seen in *Figure 1* a committee on electrical safety is responsible for the hospital's biomedical programme, and reports directly to the administration. The head of the programme is typically a bio-engineer, and reporting to him might be four biomedical equipment technicians and one clerk/typist. In many hospitals, some of the BMET's report directly to the functional area of the

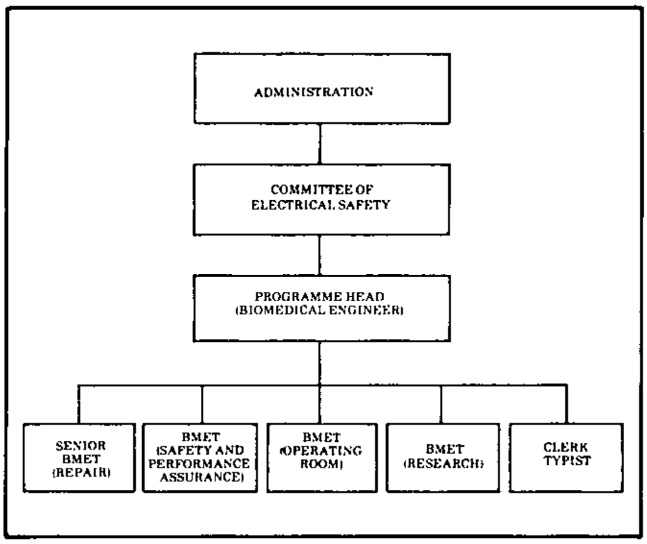


Figure 1: A typical Department of Bio-engineering in a USA hospital of 500 beds.

hospital in which they are assigned and report to the hospital's head biomedical engineer on a 'second boss' basis.

Committee on Electrical Safety

The Joint Commission on Accreditation of Hospitals, a non-governmental body that accredits hospitals in the USA, recommended in 1971 that an electrical safety committee be established in each hospital. Initially, the membership of this committee was comprised of an administrator, the directors of various departments, two other physicians, and an engineer. From the beginning, it was strongly recommended that the departments represented include nursing services, purchasing and housekeeping. More recently, the existence of this committee became mandatory before accreditation.

Page 33 of the current *JCAH Accreditation Manual for Hospitals* states, '*There shall be a multi-disciplinary hospital safety committee to adopt, implement, and monitor a comprehensive hospital-wide safety programme.*[1] *The programme shall contain requirements relating to the staffing, equipping, operation and maintenance of the hospital, which shall be designed to produce safe characteristics and practices and to eliminate, or reduce to the extent possible, hazards to patients, hospital staff, and visitors.*'

Further on, the *JCAH Manual* specifies, '*While its size and composition may vary with the individual facility, the committee shall be multi-disciplinary, having representation from the administration, the medical staff, nursing services, engineering and maintenance department, housekeeping and dietetic services. In-house specialists such as the radiation physicist, clinical engineer, or biomedical engineering technician should also participate at least in a consultative role.*'[2]

Listed briefly, the responsibilities of the safety committee are:

Generation of written policies;

Aid to the various departments in generating their own specific safety rules and practices;

Establishment of an incident reporting and investigating system;

Liaison with the infection control committee;

Generation and dissemination of safety related information to all employees;

Conductance of a hazards surveillance programme at specific intervals;

A periodic review of the effectiveness of the safety programme;

Familiarisation with all of the various governmental regulations applicable to the hospital;

Familiarisation with both governmental and non-governmental safety-oriented agencies;

Development of a reference library of pertinent documents and publications relating to all facets of hospital safety.

A very important function of the safety committee is to serve as the highly visible authority that enables the biomedical equipment technician to be unyielding in his rejection of various pieces of equipment not in compliance with the established hospital safety standards. With the safety committee as the enforcing agent, the biomedical engineering department is able to maintain a much more positive relationship with the other departments in the hospital than would be the case otherwise.

Duties of the Bioengineering Department

The tasks of a Department of Bioengineering are varied and critical to the satisfactory operation of the hospital:

Work with the hospital's medical staff, administration, and purchasing agents in the purchase of new equipment;

Repair biomedical equipment on site as required;

Conduct quarterly safety and performance assurance checks in accordance with written procedures and maintain written records of such checks;

Conduct monthly tests of conductive operating room floors and isolated power systems;

On a regular basis, conduct in-service education for personnel;

Review the energy requirements of the hospital with regard to conservation as well as ensure readiness of back-up systems in times of failure of the normal electrical supply;

Review all of the contracted services for cost effectiveness and ensure that adequate control procedures exist;

Participate in the hospital's capital equipment planning;

Periodically review the readiness of the hospital to an inspection by the Occupational Safety and Health Act team;

On an annual basis, give a thorough safety test of each of the electric beds;

On a monthly basis, check defibrillators for output energy and proper function;

Modify existing electronics equipment in accordance with the needs of the user;

Design and build electronic equipment needed by the hospital, but not available commercially at a reasonable price, according to required specifications.

Staffing of the Department of Bioengineering

Biomedical Engineer Education

The programme head is normally a biomedical engineer qualified to degree level. The university curriculum he followed to gain his degree of Bachelor of Biomedical Engineering may have included the following courses:

First Year: Principals of Chemistry (two courses), English Composition, Introductory Calculus (two courses), Introduction to Digital Computation, Introduction to Biology and either a Social Science or Humanities elective.

Second Year: General Physics (two courses), Discrete Systems Analysis, Intermediate Calculus, Principals of Physiology, Electric Networks, Linear Algebra and Applications and either Social Science or Humanities elective.

Third Year: Biomedical Electronics and Measurements (two courses), Engineering Mechanics, Mathematical Probability and Statistics, Mechanics of Biological Materials, Electronic Instruments and Devices, Real Time Measurement and Control of Heart Events and Electronic Circuits.

Fourth Year: Fluid Mechanics, Mechanics of Cellular Components, Information Organisation and Retrieval, Dynamics of Electro-Chemical Energy Conversion, Biomedical Transfer Processes, Material Science and Energy Technology and two Social Science or Humanities electives.

Some programme heads have a Master of Biomedical Engineering Degree. Their Bachelor's Degree is probably in Electrical Engineering. Occasionally, the programme head will have a Bachelor's Degree in Mechanical Engineering, Physics, or Engineering Science.

In America, people typically enter a university at 18, receive a Bachelor's Degree at 21 and a Master's Degree at 22 or 23.

Biomedical Equipment Technician Education

The education for biomedical equipment technicians (BMET's) is less extensive and less theoretical. The following programme leading to a degree of Associate of Science requires 2 years.

First Year: General Mathematics, General Physics, Introduction to Basic Electronics, Principals of Physiological Measurements, Medical Electronics, Medical Terminology, Fundamentals of Chemistry, and either a Social Science or Humanities elective.

Second Year: Electronic Instrumentation Components, Standards' Calibration and Maintenance, Specialised Physiological Monitoring, Principals of Semiconductor Devices, Neurological Measurement, Cardiac Physiology and Graphics, Ultrasonic Diagnostic Switching Circuits.

Certification

Currently, the majority of biomedical engineers in the USA are striving to be certified by a group called the Certification Commission, as Certified Clinical Engineers (CCE's). Likewise, biomedical equipment technicians (BMET's) are applying to the same Certification Commission to become Certified Biomedical Equipment Technicians (CBET's). Current members of the Certification Commission are American Association of Gynecological Laparascopists, American Association of Physicists in Medicine, American College of Chest Physicians, American Heart Association, American Society for Quality Control, Association for the Advancement of Medical Instrumentation, Clinical Engineering Association of New Jersey, Joint Commission on the Accreditation of Hospitals, Joint Materials and Devices Committee of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons, National Society of Professional Engineers, Office of Research and Development of the Indian Health Service, Pharmaceutical Manufacturers Association and the Society of Biomedical Equipment Technicians.

To become a CCE, one must have a Bachelor's Degree in Engineering or a related field. This requirement is waivered only when self-study and long experience have provided an equivalent education. A second requirement is three years or more of clinical engineering experience. Thirdly, at least one year must have been spent managing a biomedical engineering programme.

Lastly, a day-long oral and written exam must be satisfactorily completed.

The Association for the Advancement of Medical Instrumentation states: 'A biomedical equipment technician is an individual who is knowlegeable about the theory of operation, the underlying physiological principals, and the practical safe clinical application of biomedical equipment. His capabilities may include insulation, calibration, inspection, preventative maintenance, and repair of general biomedical and related technical equipment as well as operation or supervision of equipment control, safety and maintenance programmes and systems.'[3]

Many BMET's have a Bachelor of Arts Degree in Electrical Engineering or Electronics and learn the physiology and medical applications side of the business while on the job. For a BMET to be certified, he must have worked in a clinical environment for a minimum of 4 years. Currently, the Certification Commission certifies BMET's only in a general capacity.

Under consideration for implementation in 1978 is certification in any one or combination of four categories: BMET—G, General; BMET—CP, Cardio-Pulmonary; BMET—CL, Clinical Laboratory; BMET—NR, Nuclear Medicine and Radiology.

The more experienced BMET's tend to be assigned to repair functions and design and construction of simple instruments and switching boxes. The more junior BMET's spend most of their time on the safety and performance assurance programmes.

Equipping a Biomedical Engineering Department

Each BMET has his own tool kit, outlet tester, ECG simulator and thermometer.

The department will typically own two of each of the following:

leakage current meter, defibrillator tester, portable dual-trace storage oscilloscope, oxygen monitor, digital frequency counter, digital multi-meter, universal power supply, function generator, and a strobeoscope.

Biomedical engineering departments usually have one of each of the following items:

surgical analyser, pneumatic calibrator, conductivity tester, decade resistance box, bench type oscilloscope, isolated power test set, compression analyser, sound level meter, light meter, tachometer, water analysis instrument, humidity and temperature recorder.

The department normally purchases components, as well as high-failure-rate fabricated parts such as galvanometers and patient cables. In addition, the hospital may stock certain printed circuit boards and plug-in modules.

FOOTNOTES

1 *Accreditation Manual for Hospitals*, 1976 edition, copyright 1976 by Joint Commission on Accreditation of Hospitals, 875 No. Michigan Avenue, Chicago, Illinois, 60611, USA, p.33.

2 *Ibid.*

3 *BMET*, pamphlet distributed by the Society of Biomedical Equipment Technicians Association for the Advancement of Medical Instrumentation, 1901 N. Ft. Myer Drive, Suite 602, Arlington, Virginia 22209.

The author of this paper is Senior Principal Medical Officer of the Department of Health and Social Security.

Legionnaires' Disease

T GEFFEN FRCP

Introduction

The first recognised cases of Legionnaires Disease occurred in 1976 when a number of American ex-servicemen developed a pneumonic illness after attending a convention in Philadelphia. Outbreaks had, however, certainly occurred before then. It has some unusual epidemiological features, and as a result has attracted considerably more attention than its public health importance justifies.

At first the disease was only identified in patients suffering from its more severe manifestations, but it is now clear that exposure to the organism may result in anything from a severe, or even fatal, illness to minimal illness — or even infection without any known illness at all. Investigations leading to a definitive diagnosis are of course more likely to be carried out in very ill patients, and most such patients have a pneumonic illness sufficiently like other forms of pneumonia to make a definitive diagnosis of Legionnaires Disease impossible on the clinical features alone.

Confirmation of the diagnosis can be made by discovering the organism *Legionella pneumophila* in the sputum or, more frequently, by detection of a specific antibody in the blood of the patient.

Those patients who become seriously ill with pneumonia are more likely to be middle-aged or elderly men, are likely to be heavy smokers or drinkers, or to have had previous lung disease or other illnesses which make them less resistant to infection. Most of the deaths occur in such patients and in this group approximately one in ten will die. The disease is uncommon in young adults, and is very rare in children.

With the development of a specific test of past infection, it became possible to show that the organism had caused various outbreaks of pneumonic and other respiratory illness in the United States as far back as the 1940s. One cannot be certain that outbreaks had occurred earlier than this because it had not then been the custom to store specimens of blood for later investigation. *It* would be surprising if *Legionella pneumophila* had suddenly acquired the capacity to produce disease only 30 years ago.

The organism is difficult to grow on the commonly-used culture media, and it is therefore curious to find that in its normal habitat it apparently requires relatively simple conditions. It is widely distributed in nature, particularly in surface water and mud, which suggests that its nutritional requirements are not very complex. It grows best at a temperature of about 35°C, being inhibited or killed at temperatures above 45°C or below 20°C.

Infection is normally by the airborne route — though it is possible that it can be acquired in other ways. Such evidence as there is suggests that it is commonly conveyed in small droplets. Infection directly from person to person, if it occurs at all, must be very rare. Infection does not seem to occur from ingestion so that there is no known hazard from drinking water contaminated by the organism. The incubation period is between two and ten days, usually about five.

Its History

Proposals for the control and prevention of an infectious disease must be based on knowledge of its incidence and epidemiology. Outbreaks and sporadic cases have occurred in many parts of the world, particularly in the United States but also in Canada, Australia, Scandinavia, the United Kingdom and other parts of Europe and Israel.

Some of the patients found in England had acquired their infection while abroad. While some cases have occurred in outbreaks, apparently associated with a particular building, many others have occurred singly and separately.

It is difficult to say how frequent a disease is when many cases are mild and not fully investigated, and of which the more severe forms, until recently, would probably have been diagnosed simply as a typical pneumonia. Only in the last two or three years has there been an opportunity to try to assess the true incidence.

In 1979 there were some 125 known cases of Legionnaires Disease in England and Wales and the 1980 total was very similar. These numbers relate to people in whom the diagnosis had been confirmed on investigation. They must, however, considerably underestimate the total number of clinical cases of the disease as the tests are less likely to be performed on patients with mild or non-specific illness. One investigation carried out two or three years ago suggested that there might be up to eight times as many cases of the disease as had been positively diagnosed. If these figures can be applied to the whole country, and it is by no means certain that they can be, there might be as many as 1,000 cases of clinical Legionnaires Disease in England and Wales each year.

Although outbreaks of the disease, and particularly those associated with hospitals, have been given considerable publicity, the number of people involved in them has been small. There is evidence of the acquisition of the illness by patients in six different hospitals, although in one or two of these only a single patient was involved. The biggest episode is that which occurred in Kingston-upon-Thames in the first half of 1980 in which 10 people were affected.

In the other hospital episodes only one, two or three people were found to have been infected. Other small outbreaks affected four people who had been in a hotel, and six people who had lived in or worked in, or been very close to, a small area of West London. Although the Public Health Laboratory Service has been looking for evidence of other clusters of patients, so far none has been found.

Apart from these episodes in England and Wales, outbreaks have occurred involving holidaymakers from the United Kingdom who have been in overseas hotels. Of these the biggest example was that involving visitors to the Rio Park Hotel in Benidorm which involved 27 people during 1980.

Taking account of these known outbreaks, it is still clear that the majority of identified cases of Legionnaires Disease in this country have occurred singly and cannot be associated with a particular building.

The Causes

The organism itself, *Legionella pneumophila*, is normally found in surface water, creeks and damp soil; it is favoured by stagnant and lukewarm conditions. It is not difficult to see that it could find its way into water systems and flourish there in suitable conditions.

It was experience in the United States which first suggested that ventilation and humidification systems might play a part in outbreaks associated with buildings, and the findings there have been to some extent supported by investigations here. In some of the hospitals referred to previously, as well as in the hotel, the organism was found either in the cooling tower, in a ventilation system, tap outlet or some other such source. The same is true of the hotel in Benidorm. In other reported outbreaks there has been a suggestion, not fully confirmed, that the focus of infection could have been a building in the course of demolition.

It is still not clear why a relatively common and normally harmless organism should rarely cause illness in a very small proportion of those exposed to it. Blood tests suggest that 1% of the population has at some time been exposed to the organism — although obviously only a very small proportion of these individuals has suffered from any relevant significant illness. It is possible that the disease is truly a relatively new one, or at least that its incidence is becoming greater.

Possibly the increase in the provison of water-cooling and humidification systems has created a new, although still rare, epidemiological problem.

There is evidence to suggest that the organism develops better in association with certain green algae, although this is not a particularly helpful item of information in understanding the epidemiology of the disease. As with any infection, the size of the infecting dose, the route of infection and the resistance of the individual exposed — itself the result of many factors — must play a part in determining whether an exposed individual becomes ill or not.

Conclusion

Legionnaires Disease has attracted so much attention that it is necessary to put its significance into perspective. In addition to the reported 125 cases a year in England, there may be as many as 800 or 900 unrecognised cases. Among the 125 known cases there may have been 10 deaths but almost certainly the unrecognised cases — most of them much less severe — would have shown a much lower case-fatality-rate.

It is likely therefore that Legionnaires Disease has been responsible for more than 10, but far fewer than 100, deaths in a year. Against this there are over 50,000 deaths annually due to pneumonia in its various forms. Many of these deaths from pneumonia are merely the terminal event in elderly patients suffering from heart disease and other conditions; but it is still the case that, both as a cause of illness and of death, Legionnaires Disease is relatively a rarity.

It must also be realised that a proportion, possible as high as 10%, of patients being admitted to hospital develop some sort of infection while there. The great majority of these infections are of a very minor nature, although some are more serious. In this context again, while any case of illness acquired in hospital is much to be regretted, Legionnaires Disease must be one of the rarest of infections acquired as a result of a hospital stay.

This is not to say that efforts should not be made, where possible, to control environmental factors which appear to be contributing to Legionnaires Disease. But the fact remains that public interest greatly outweighs its significance as a public health problem.

The extent to which expensive or time-consuming measures are justifiable to control the disease must be considered in this light.

For New Entrants

The author of this paper is the Assistant Area Engineer of the Leeds Area Health Authority (Teaching).

Boiler Fuels

Their Applications

J R FIELDING MIHE MIIM MBIM ACIBS DipIM MIPlantE

Introduction

During the last 7 years there has been anxiety over the supplies of oil fuel for our hospitals. Within the next 20 years our present anxiety will seem trivial when we may be faced with replacing oil-burning equipment on a vast scale, unless we prepare now by conserving and planning.

Primary fuel is a combination of one or more expensive raw materials, purchased to provide means of adequate, and no more than adequate standard of comfort and care.

We will consider the following categories of fuel and their conversion as a heat source:

Fuel Oil;
Fuel Gas;
Solid Fuel.

Of these forms of energy, each requires its own particular form of storage and delivery up to the process of heat exchange (burning).

Fuel Oil

Alarm about the world energy outlook has centred on oil; partly because oil is a uniquely convenient fuel, partly because it is in relatively short supply. It is said the world has enough oil to meet all its present energy needs for only 80 years.

Only a small part of the world's oil reserves are available in the form of oil-wells or holes in the ground. Most of our oil is locked up in shale and tar sand deposits which need to be mined. The USA possesses the largest of these reserves. The high-grade deposits are already near to being economically viable.

For example, the production of one million barrels of oil will produce something of the order of 500 million tons of waste sand.

Figure 1 shows the trend of world oil consumption between 1960 and 1978.

Additives for fuel oils have to be assessed in relation to all other factors, these factors can be divided into two main headings:

Improvers of the combustion process; specific remedies for various fouling and corrosion problems.

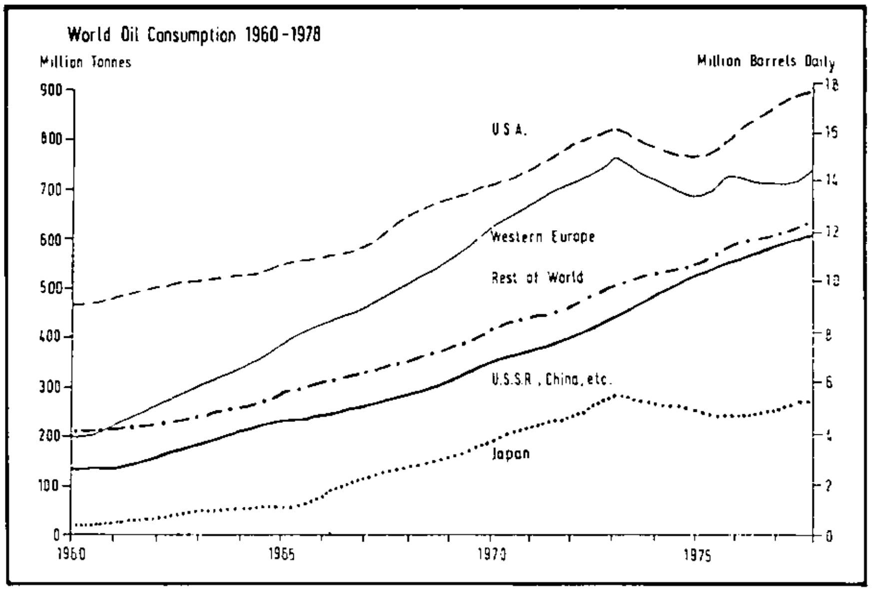
The extent of fuel savings that can be achieved by the use of these fuel additives depends on the plant in question. For a well-designed and carefully operated plant the benefits would be minimal.

In the case of fuel oils used for boilers and furnaces, the effect of the additive is to reduce soot and carbon formation so the amount of excess air necessary to suppress smoke to the legal limit is reduced. Of course other additives are available for the different reactions within fuel oils.

The characteristics of refining crude petroleum by distillation results in the lighter fractions. For example, paraffin, motor spirit, diesel oil and gas oil, are separated from the remaining residue of crude petroleum. This residue is then processed and blended to produce heavier fuel oil grades. The characteristics for analysis purposes are shown in *Figure 2*.

Storage Capacity: At least two weeks supply at full load consumption.

Figure 1



Properties	Class D (gas oil)	Class F (Medium oil)	Class G (Heavy oil)
Viscosity: Redwood No. 1. 100°C. Secs.	35	960	3500
Specific Gravity: 15.6°C	.83	.94	.96
Min. handling temp: °C	Ambient	30	45
Min. Storage temp: °C	Ambient	25	35
Calorific Value: Kj/kg. (Gross)	43,496	43,030	42,800
Carbon: % wt.	86	84.7	84.6
Sulphur: % wt.	.7	3.7	4.1
Atomising temp: °C	Ambient	82–104	116–127

Figure 2: Fuel Oil Characteristics

Storage tanks: B.S. 799/62; Identified for class of fuel, sited within a catch pit and have the following tank fittings:

Air vent; filling valve; drain valve; tank contents gauge; fuel outlet valve; overfilling alarm; fuel heater; access manhole.

Tanks should only be filled to 90% of their capacity to allow for expansion, tanks for 950 sec and 3,500 sec fuel should also be insulated.

Certain precautions require observing on delivery and storage of class 'C' and 'D' oils during cold weather. Below -7°C these oils may deposit wax, particularly on filters. In the case of class 'F' and 'G' oils, preheaters and trace heating are desirable to reduce viscosity for flow purposes, class 'G' oil solidifies at below 45°C.

Water and sludge which accumulates in the bottom of the tank, due to condensation and permissable water content of the oil, if not regularly drained off, will freeze and may cause blockage. At low temperature any sludge which has accumulated is likely to become more viscous and may carry over to the filter.

Atomisation

For fuel oils to be burnt completely and efficiently, it is essential that it must be admitted to the boiler furnace in the correct state and mixed with the appropriate amount of air to ensure complete combustion. The atomisation process, therefore, increases the surface area of the fuel so that each particle of fuel can make contact with its counterpart of oxygen (20%–25% excess air) at an elevated temperature instantaneously before ignition. *(See Figure 3)*

The three main methods of achieving atomisation are:

Pressure oil jet;
pressure air atomiser;
centrifugal or rotary atomiser.

Combustion process having now been attained *(Figure 3a)* can be expected to reach the temperatures illustrated in *Figure 4*.

Sulphur Corrosion

Fuel oils have a sulphur content and it is the sulphur corrosion in the flue gases that causes flues and chimneys to become vulnerable, although low temperature corrosion is more prevalent in modern boilers due to the high operating thermal efficiency at which the boilers operate. The furnace high temperature zone corrosion (535°C to 595°C) and low temperature zone corrosion (120°C to 180°C) should be avoided.

Combustion efficiency can now be measured by using a formula for stack losses *(Siegert Formula)*.

$$\text{stack losses \%} = \frac{K\,(t1 - t2)}{CO_2}$$

K = 0.21 Fuel Gas, 0.31 Fuel Oil, 0.34 Solid Fuel;
t1 = Stack temperature;
t2 = Air temperature, CO_2 Oil 12%, Gas 9%, Solid Fuel 13%.

The combustion efficiency is found by deducting the result of the formula from 100%. This, however, does not include losses known as 'moisture' and 'radiation loss'.

While the flue gas exit temperature should be maintained above 200°C, a rise in temperature of 10°C can represent a loss of 1% efficiency.

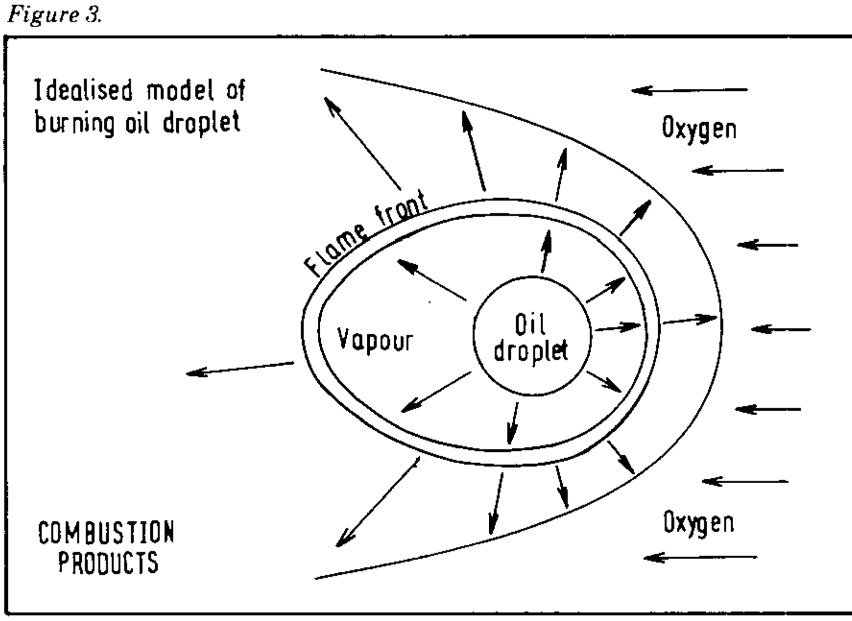
Moisture loss and radiation loss may be taken as 7% and 4% respectively.

Fuel Gas

Natural gas, which is usually found in association with crude oil deposits, is now widely exploited in many parts of the world. Possible global reserves can be estimated at providing sufficient fuel for a little over 72 years.

Of course the North Sea is not our only source of methane gas. Recent projects between certain industries and the NCB have harnessed waste mine gas; one such site provides 9.5

Figure 3.



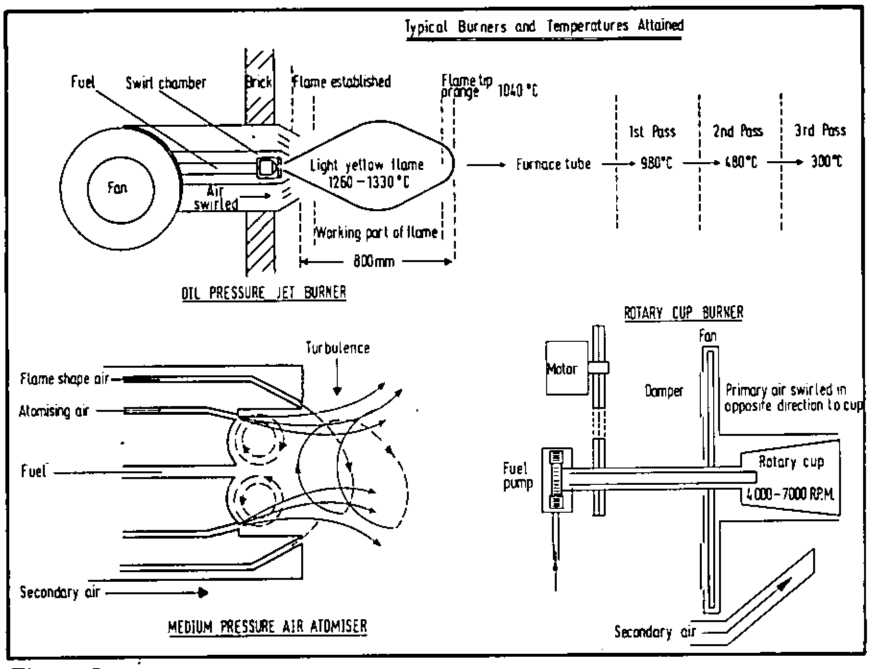


Figure 3a

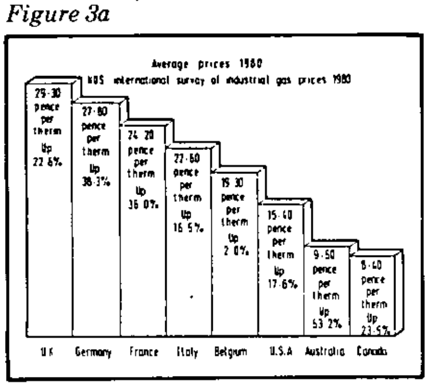


Figure 4

million therms of gas per year for an initial ten year period.

Despite the availability of gas on our door-step, the UK is still paying top world prices for gas. *Figure 4* shows average world prices of 1980 both for gas and other fuels.

The most common forms of gas are divided into two categories, non-liquified gas supplies as with Methane (Natural Gas), and Liquified Petroleum Gas as with Propane and Butane. *Figure 5* indicates their individual characteristics. Boiler fuel gases are hydrocarbon substances which are virtually sulphur free, they are colourless, odourless and non-toxic, but possess anaesthetic properties. A gas leak in a confined space would, however, lead to oxygen deficiency.

Storage

Customers obtaining Methane gas require no storage facilities as the gas is piped direct into premises for use. Where there is a high demand for gas, then a pressure-reducing system may be necessary which requires a secure and segregated area for such equipment.

Compact storage is possible with LPG because of the high ratio of gas volume to liquid volume. They are, therefore, stored in the liquid state and revert to gas for burning purposes when the pressure is reduced. Storage tanks should not be filled completely due to the high coeffecient of expansion in the liquid phase. Siting is also an important factor as the LPG vapour is heavier than air and may collect in undetected pockets, unless adequate ventilation is provided at low level.

Gas/air mixture is a flammable/explosive hazard, and must be treated accordingly.

Figure 5: Fuel Gas Characteristics

Properties (Gaseous)	Methane	Propane	Butane
Calorific Valve: J/cm^3 Gross	32	81	103
Specific Gravity	0.55	1.4–1.55	1.9–2.1
Wobbe index	1344	2075	2260
Max. Burning Velocity, m/sec.	0.34	0.42	0.42
Max. Flame Temp. (In Air): °C	1925	1930	1930
Approx. Ignition temperature: °C	700±50	465	400

Gas Burning

Due to the sophistication and sequence of operation on industrial burners, it is not intended within this context to cover the gas proving/safety sequence. Detailed information on burner sequencing is normally obtainable from burner manufacturers.

The quantity of heat that can be obtained from gas passing through a burner nozzle is effected by its calorific value and specific value. These are combined in a simple mathematical expression to give the *Wobbe Index*:

$$W = \frac{\text{calorific value}}{\sqrt{\text{Specific gravity}}}$$

The higher the *Wobbe Index*, the more heat is released, but this will also require more air to complete combustion.

Various types of burners are available to effect flame-retention and a stable flame without 'lift off' occurring. This phenomenon happens when the flow-rate of gas exceeds the burning velocity, the flame becomes detached from the burner and is carried downstream and extinguished. If the gas-flow rate is too slow the flame may travel back upstream inside the burner, this is termed 'light back'.

Fuel gas will only burn if its percentage gas/air mixer or aeration is within the upper and lower limits of combustion. The correct quantity of excess air for fuel gas has been found to be 5%–10%.

The combustion process now complete, the efficiency can be measured using the *Siegert Formula*. However, moisture losses can be taken as 11% while radiation losses are fairly constant at 4%.

Solid Fuel

We refer to solid fuel as coal or coke of which there are numerous types and groupings. The type of coal relates to its organic stage and the locality to which it is mined. The grouping relates to its burning properties, as with Bitumous coal. The following approximate analysis is shown in *Figure 6*.

Properties	Free-burning non-caking	Slightly caking	Medium caking	Strongly caking
Analysis: dry ash free	Gp.1	Gp.2	Gp.3	Gp.4
Carbon: %	79	82	83	87
Hydrogen: %	5.2	5.3	5.3	5
Volatiles: %	43	40	37	31
Calorific Valve: J/Kg	326000	338000	345000	357000
Moisture: %	14	8	5	3

Figure 6

Classification of coals are given low and high ranking, dependent upon carbon, C.V., Volatiles and moisture content.

Grading of coal is determined by size; cobbles, trebles, singles, fines etc., are some of the seven grades made available through the various size-screening processes.

The main characteristics of coal can be summarised into five headings:

Quantity of Volatile Matter;
quantity of ash and its fusion temperature;
inherent moisture;
caking properties;
size of coal.

Storage of coal should be near to its source of use to avoid additional handling. Undercover storage will avoid increase in moisture content although open situations on clean firm ground are acceptable. Quantity of stock should be less than 200 tonnes with a stack height not exceeding 8 metres.

The quantity of excess air required for solid fuel is greater than that required for fuel-oil and gas. Solid fuel requires 40% to 50% excess air. Too much excess air is wasteful, however, too great a restriction will result in partially burnt fuel, smoke and soot.

Proper balance of coal and air is obtainable by adjustment of coal feed and air dampers. Correct setting is indicated when sufficient coal is being fed to meet the heat demand together with a CO_2 reading of 13%.

Stack losses can be expected to be 9% if the flue gas temperature is retained at just above 200°C.

Sulphur content in solid fuel gives rise to problems of sulphur corrosion, precautions against minimum and maximum flue gas temperatures should be observed as already described under the Fuel Oil Classification. This is particularly important when such methods are adopted to combat smut emission.

Conclusion

Each type and grade of fuel and each type of fuel-burning equipment falls within its own specialist field. Each and every Engineer responsible for

Hospital Energy Questionnaire—Fuels

How Effective are you?

	Yes	No
1. Are you purchasing fuel at the most economical tariff?	☐	☐
2. Do you authorise payment of fuel purchased/delivered?	☐	☐
3. Is the quantity of fuel delivered ever checked?	☐	☐
4. Have you checked the quality of fuel recently?	☐	☐
5. Does your storage of fuel meet the required standards?	☐	☐
6. **Fuel Oil**		
a) Are tanks checked for water/sludge annually?	☐	☐
b) Do you allow settling time after delivery?	☐	☐
c) Are the correct temperatures and pressures to the burner unit being attained?	☐	☐
7. Does all your designed boiler instrumentation operate?	☐	☐
8. Is the instrumentation checked at least twice yearly?	☐	☐
9. Are meters for fuel oil, gas and coal in working order?	☐	☐
10. Are records kept of boiler-flue cleaning?	☐	☐
11. Do you see daily/weekly log reports?	☐	☐
12. Have you checked the combustion efficiency recently?	☐	☐
13. Is regular maintenance carried out on burners/stokers?	☐	☐
14. Do you know the present rate of blowdown?	☐	☐
15. Have you checked if the boiler working pressure can be reduced?	☐	☐
16. Is the hotwell temperature at its permissible highest?	☐	☐
17. Has insulation been well provided for on engineering plant?	☐	☐
18. Are you aware of heat output/unit of fuel?	☐	☐
19. Are the internal surfaces of boilers clean?	☐	☐
20. Is the boiler house in a clean and presentable manner?	☐	☐

If you only manage to score 19 out of 20 with a 'YES', then, unfortunately you have still to make improvements. The World fuel shortage has no room for half measures.

energy should be aware of the characteristics of both fuel and plant which they control.

We have briefly covered the main fuels and methods of combustion. If you are the Engineer responsible for the boilerhouse, then complete the questionnaire to see the extent of your control and understanding.

References

Boiler House Practice. D of E. R.T.C. Cardington.

Commissioning of Oil, Gas and Dual Fired Fuel Boilers. HTM 26 DHSS.

Where our fuels come from. K. A. D. Inglis, Energy Management. October 1979.

Oil Storage Tanks, Fuel Gases, Fuels. HSED DQ1-2. DHSS.

Guidance to Good Boilerhouse Practice and Management. R. F. Fletcher BA CEng. Hospital Engineering May 1979.

Industry Monitor. Chartered Institution of Building Services. December 1980 and January 1981.

The author is the Area Engineer of the Salford Area Health Authority and is a member of Council of the Institute of Hospital Engineering.

Equipment for the Disabled
A Works Contribution

AMOS MILLINGTON TEng(CEI) FIHospE

Introduction

It is a pity that, for engineers employed at either District or Unit level, the opportunities to design equipment for disabled or partially disabled are all too infrequent. Usually, such specialist equipment is readily available and only requires involvement by the engineers to determine the mechanical and electrical services necessary for that equipment to be commissioned.

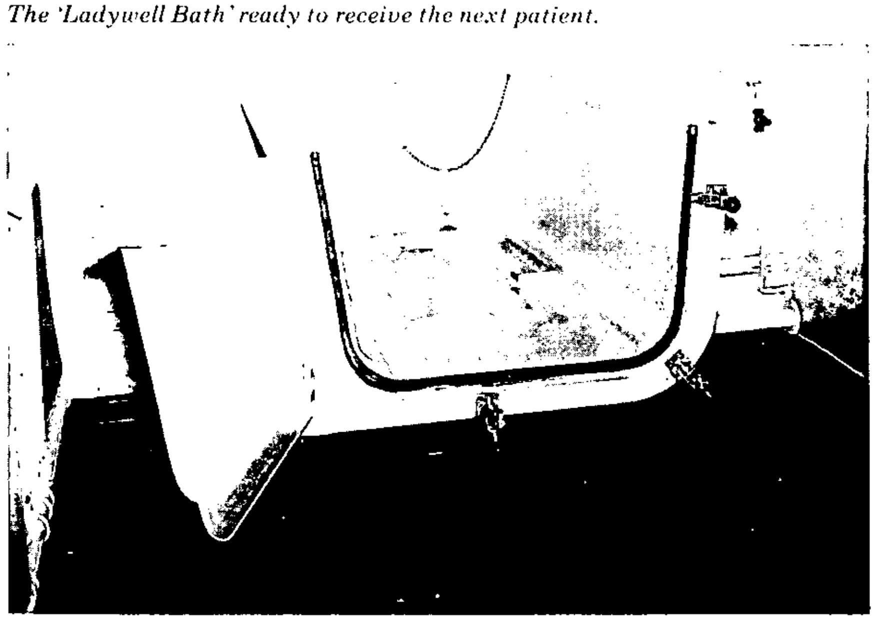
In more recent years, the needs of the disabled person have become an automatic consideration when designing public buildings, and manufacturers of equipment have modified and extended their range of products to cater for the person who, through infirmity or physical disablement, finds difficulty in using those everyday artefacts which the majority of us take for granted.

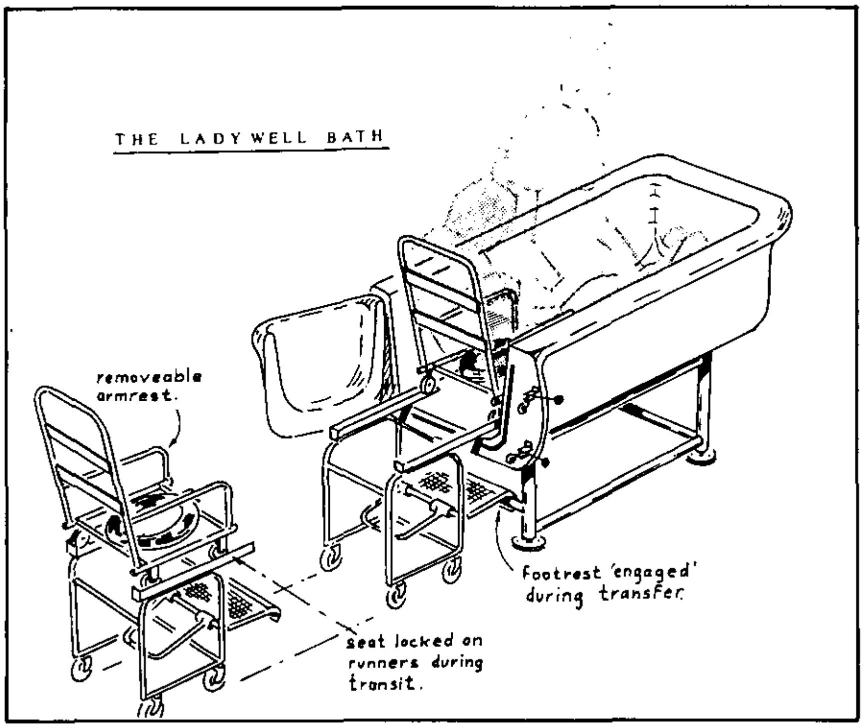
In the late 60's/early 70's, the range of such specialist products was limited and, in my own Area at that time, there was protracted discussions as to how best to cater for the bathing of geriatric patients in a new twenty-eight bed Geriatric Ward which was being built at Ladywell Hospital, Salford. Bathing geriatric patients using conventional methods had always been a difficult and arduous task because of:

Strain on nursing staff; and
fears and discomfort to the patients due to lifting etc.

Several novel methods, available from manufacturers, were considered but were rejected either because they involved complicated equipment or were of high capital cost.

The 'Ladywell Bath' ready to receive the next patient.





How to use the 'Ladywell' *bath.*

The Ladywell Bath

At the time when the new unit was being planned, a request was successfully made to the Region for an allocation to finance the design and fabrication of a purpose-built bath.

The height of an average chair seat proved to be an ideal height for nurses to execute long bathing sessions and, with this in mind, a sketch was prepared depicting an almost conventional bath but with a door at one end, and with the whole assembly mounted on a frame, so as to attain a bath bottom height of 500mm. Using a standard tubular frame sanitary chair as a model, a sketch was made detailing a chair which would transport the patient from ward to the bathroom. At the bath, the seat and backrest of the chair would separate from its base and transfer the patient into the bath, still seated. After closing the bath door, water could be admitted at the correct temperature.

To 'prove' the design, a company specialising in the manufacture of hospital furniture co-operated, and built a prototype of the special chair. By coincidence, an adjacent factory boasted a plastics division and they in turn produced the bath-shell from resin-bonded glass fibre.

Important details such as door seal, easily-operated door catches and other safety features were decided upon, and the actual bath and chair were built.

The temperature of water was thermostatically controlled through a locked mixing valve and a quick-response motorised valve was installed after the mixing valve to interrupt the water to the bath should it rise above a safe limit.

As the bath needed to be drained before the patient could be removed through the door, a larger than normal waste was incorporated. That part of the chair which would be partially immersed in the bath water was treated with a silicone-based varnish to minimise water carry over when withdrawn from the bath.

The bath proved successful and was adopted by the hospital furniture manufacturer as a standard in his range of products, being given the name *The Ladywell Bath*, after the hospital for which it was designed.

The advantage of this bathing aid was that, because the patient was held clear of the bath bottom and the chair afforded virtually total access to his body surface, proper bathing could be effected by the nursing staff, who in turn benefitted from the ergonomic considerations built into the design.

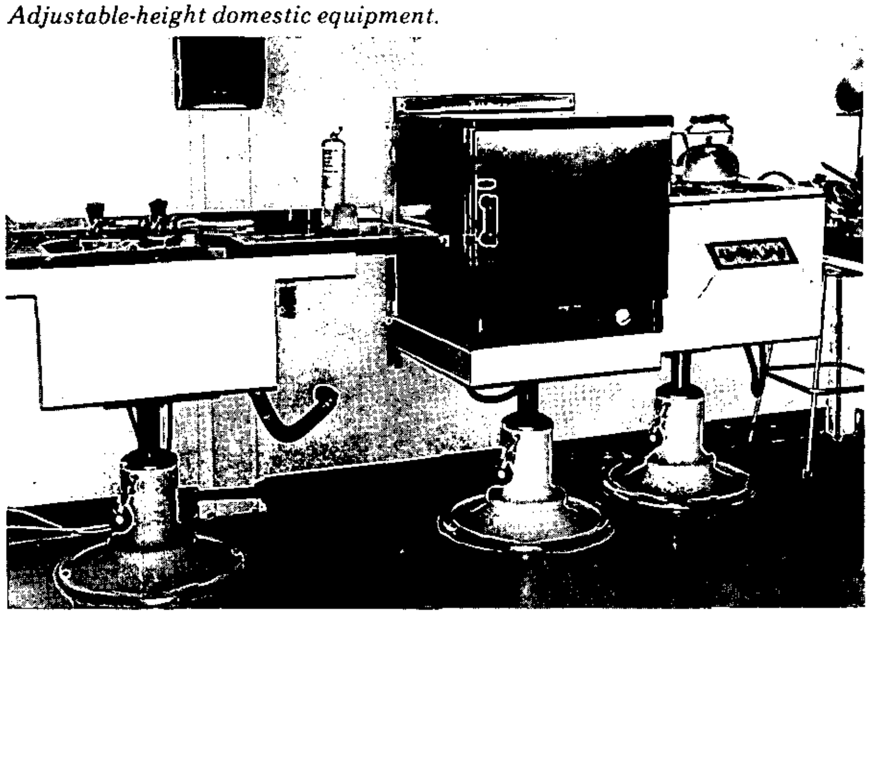
A disadvantage that has revealed itself over the years is that some patients feel uncomfortable at having to remain in the bath whilst the water is allowed to drain.

Other Aids

In 1972/73, a Geriatric Assessment Unit was built at Ladywell Hospital, Salford. This unit was designed to assess the suitability of those patients who could be discharged from hospital care but who, in their own environment, would have to care for themselves or could only expect limited help from their ageing, and perhaps infirm, spouse.

Part of the unit included a training area where patients became familiar once more with the normal household activities of cooking, washing, ironing etc.

Adjustable-height domestic equipment.



For some patients, the normal height of fixed domestic appliances was unsuitable, and specialist equipment was asked for whereby assessments could be made by the staff as to what alterations may be necessary at the patients' home to ensure that worktops, cookers, sinks etc., were at a height to suit the partially disabled person.

Four such appliances were requested for the inclusion in the unit, namely a stainless steel sink, cooker top, oven and ironing table. All units were designed 'in-house' and provided a novel diversion from the normal drawing board activity.

Which method to employ to raise and lower, safely and easily, the sink and cooker units was solved by observing the equipment used by any gent's hairdresser — an hydraulic plinth, one each for the sink, cooker top and oven.

The electric cooker top was a *Tricity* model with controls on a flexible conduit for remote mounting, but a commercial pattern of electric oven was chosen — domestic models, being rather tall, were not considered suitable for adaptation.

The three pieces of equipment were mounted on purpose-designed timber frames with suitable heatshields where necessary, the whole assemblies being bolted to purpose-made steel plates attached to the top of the pedestals on each hydraulic plinth.

To ensure stability, each assembly was located and ran in sliding door-track runners, attached vertically to the rear wall in the line of travel. The hydraulic plinths were of standard design as supplied to hairdressing salons. Final connections for piped services such as water and waste to the sink used flexible pipes.

Height adjustment of the ironing board was achieved merely by securing a ladder-type assembly to the walls, and by employing timber brackets on the ironing board itself, which would locate in the rungs of the ladder at any desired height.

These designs for the disabled and infirm may seem but a drop in the ocean when compared with what has been and is being developed by specialist departments and manufacturers, but hopefully it illustrates that a Works Department can make a useful and practical contribution to designing that 'one-off' item which may be needed in the care of the disabled person.

Product News

Monitoring instrument achieves energy savings

Energy Conservation engineers of the Hillingdon Area Health Authority are utilising a Servis Recorders SRB portable chart monitoring instrument to assist in the calculation of optimum heating systems operation in clinics and buildings under their jurisdiction.

By utilising the Servis instrument for short-term monitoring, the engineers can obtain a complete record of all heating systems activity while it is under the control of the optimiser or thermostats. If the activity does not correspond with their instruments, i.e. the buildings are being unnecessarily heated when closed or the boost period is insufficient prior to the clinic opening in the morning, the engineers can adjust the system control equipment based upon a known pattern of operation.

In this location, the instrument has been used to record the operation of the condensate pumping sets to enable an accurate estimate to be made of steam consumed in some isolated buildings where steam meters are not available.

In the clinic applications, the Servis instrument is actuated by a signal emitted from the boiler switch gear. When the boiler fires, the recorder is automatically actuated and the chart recording commences.

The signal causes a pendulum in the recorder to oscillate. Mounted on this pendulum is a circular, wax-coated chart in the instrument. Oscillation of the pendulum causes the chart marking to be in a heavier block configuration whereas, when the boiler is idle, the oscillation ceases and the chart marking becomes a thin, clearly distinguishable line.

Mr Paul Smith, *Hillingdon AHA Engineer, inspects the SRB instrument at the Laurel Lodge Clinic in Hillingdon.*

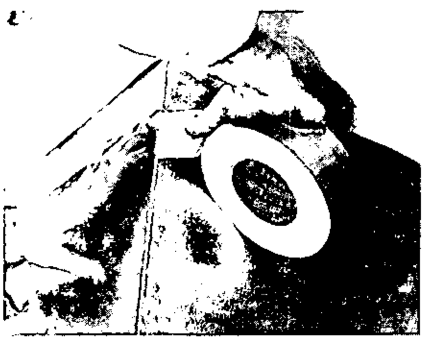
Being a totally portable unit weighing only $2^{1/2}$ kilos the Servis instrument is readily transported around the various clinics for the assessment work. And during the winter months, the recorder fulfills an additional activity in ensuring that systems operation is still correct and the settings have not changed.

Contact: Servis Recorders Limited, Northgate House, 19 London Road, Gloucester. Tel: 0242 45966.

Duct Sealing Tape

A silver-grey, polythene-coated cloth, self-adhesive tape is now available from Rotunda Limited for duct sealing at temperatures up to 100°C continuous. It is available for covering joints in hot-air and other ducts and for covering joins in insulating materials around ducts, typically in heating, ventilating and air-conditioning systems.

3120 duct sealing tape has a tacky, heat-resisting adhesive which will adhere strongly to almost any clean,



Rotunda duct-sealing tape

dry surface. The makers say it is resistant to water and to penetration by water vapour. The minimum recommended temperature for application is 10°C but lower temperatures will not harm the tape's performance once it has been applied.

Full technical information, samples and advice on specific applications are available from Industrial Sales Department, Rotunda Limited, Holland Street, Denton, Manchester M34 3GH. Tel: 061-336 4433.

Stabilised Uninterruptible Power Supply System

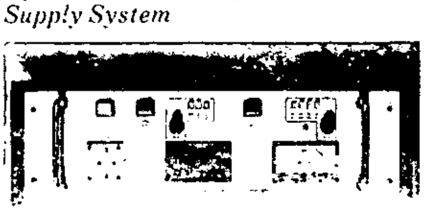
The Aplab 8854 is a 250VA uninterruptible power supply comprising a linear inverter and a battery charger with an electromagnetic automatic changeover relay. A static changeover switch, for effecting a breakless changeover of load, being available as an option.

This system provides a stabilised a.c. voltage at 50Hz or 60Hz: the frequency being selectable by slide switches. In an emergency condition whereby the mains fail, the Aplab 8854 will continue to supply the load since the inverter is driven by a permanently connected battery bank. A synchronisation facility is built-in to the system to enable the inverter output to be synchronised and phase-locked with line frequency, or any other signal with 3% of nominal frequency: sync. signal -1 to 20V a.c. r.m.s.

This facility is particularly important when synchronising with external equipment or with other inverters when providing a three-phase supply. The output power of the 8854 is 250VA maximum (400VA for ten seconds); if a greater power output is needed or a longer stand-by time required, the units can be connected in parallel.

Information from: Aplab (UK) Limited, Salford House, Welford, Northants. Tel: Welford (085 881) 696.

Aplab Uninterruptible Power Supply System



Blended Water Recirculation

A new electronic temperature controller is claimed to overcome the problems associated with conventional approaches to the accurate, economical and safe control of the temperature in blended water recirculating systems. Called the Mira 32 RM, the unit will maintain circulating temperature to within 2°C regardless of the level of draw offs, say the company, and employs an entirely new technology involving electronic temperature sensing and motorised control of hot and cold inlet supplies.

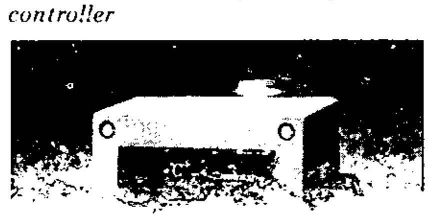
It is intended for use with a recirculating pump that will provide a minimum flow rate of 10 litres (2.5 gallons) per minute. An LED display on the controller housing gives a read-out of mixed water temperature accurate to within 0.5°C, thereby providing an easy and positive means of setting the circuit.

Its function is to break down high temperature water from a boiler to a safe showering or handwashing temperature and keep a circuit at that temperature in, for example, schools, hospitals, leisure facilities, factories or institutions. Other applications include the accurate control of the temperature of the recirculating water systems used in a variety of food, chemical, cosmetic and horticultural processes.

In all cases, the new controller is claimed to be more accurate and reliable, and to require less maintenance than the conventional methods used for providing recirculated blended water.

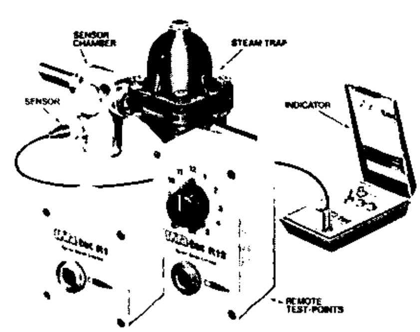
Details from: Walker Croswell & Co. Ltd., Whaddon Works, Cromwell Road, Cheltenham, Glos. Tel: 0242 27953.

Water recirculating temperature controller



Remote Reading for Steam Traps

The SPIRA—TEC Trap Failure Indicator has added a new dimension to steam trap checking. At the flick of a switch, the user can tell if a steam trap is passing steam or not, and has been further enhanced with a remote reading facility.



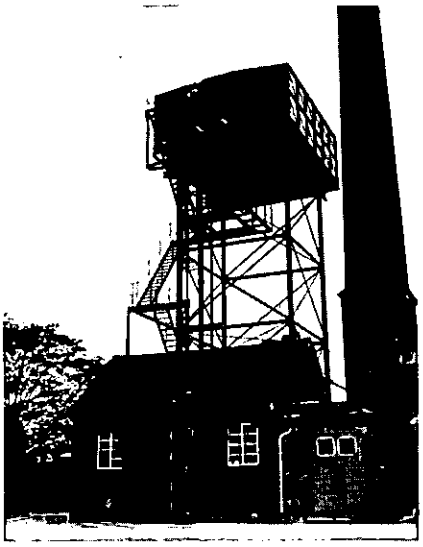
Trap Failure Indicator

If the sensor chamber is located in an inaccessible spot for checking, it can be permanently wired to a remote test point. There are two types of remote test point. 'Type R1' provides for one sensor chamber. 'Type R12' is a multiple test point which can be connected to a maximum of twelve sensor chambers through a selector switch.

Both types comply with BS 5490 and IEC Publication 529. They are completely protected to IP65 against hosing with water and the ingress of dirt.

Further details from: Spirax Sarco Ltd. Charlton House, Cheltenham, Glos. GL53 8ER. Tel: Cheltenham (0242) 21361.

storage tank at the Rush Green Hospital in Romford has been repaired, and put back into action at a fraction of the cost of replacement.



Braithwaite water storage tank at Rush Green Hospital

This tank, which gives the 397-bed hospital soft water throughout and vital standby supplies in the event of mains failure, was corroding and beginning to leak.

To treat the 50 ft. above-ground-level tank — measuring 20′ x 24′ x 8′ — Dee-Cee teams first mechanically wire brushed the roof, sides and floor to remove loose flaking scale and rust. Bitumastic coatings were then applied to the roof but the treatment to the main body of the tank which followed was more complex.

This was completed by the team using non-toxic and taint-free glass laminates and resins which were moulded into a completely new inner tank precisely following the contours of the damaged existing Braithwaite.

Repairs to the outer casing and feed inlets were also completed and the tank filled, and flushed entirely on two separate occasions, before being returned to service.

Full details from: Dee-Cee Contracts Ltd, 165a Upper Heath Lane, Dartford, Kent. Telephone Dartford (32) 72521.

Test Plugs

Binder Engineering, supplier of Twinlock Test Plugs and instruments for the heating, ventilating and air conditioning, industrial, chemical and processing industries, has published three application data sheets covering Twinlock Test Plugs which are complimentary to their six-page descriptive brochure.

The Twinlock Test Plug can be mounted on any pipe that will accept a 1/4 BSP access, where pressure does not exceed 500 p.s.i. (35 Bar) and within the temperature range of -30°C to 135°C. The Test Plug can assist in the accurate measurement of temperature, pressure and differential pressure in a pipe line as it brings the sensing probe into direct contact with the liquid or gas within the pipe. On removal of the sensing probe the Test Plug automatically seals itself.

The six-page brochure generally describes the plug design, specification and gauges available — the data sheets give chemical resistance, installation and detailed application data.

The information pack is available from: Binder Engineering Co. Ltd., 6 Beaumont Road, Banbury, Oxfordshire OX16 7RH. Telephone: Banbury (0295) 57404.

Hospital Demonstrates Fuel Saving Policy

A further order for a Comtro starved air incineration and waste heat recovery system, the third in recent months, has been won by Beverley Chemical Engineering.

The order, placed by the Greater Glasgow Health Board, is for a size A39 Comtro Unit fitted wth automatic loader and includes the waste heat boiler, control equipment, ductwork and fans and other ancillaries.

The unit, which will be installed at the Glasgow Victoria infirmary, is designed to incinerate 699 lbs of hospital waste per hour and will supply waste heat to a Thompson Cochran waste heat boiler which is designed to generate 3500 lbs of steam at 100 psig. The steam thus generated will supplement existing sources, produced from coal fired boilers. It will considerably reduce the Authority's bill for conventional prime fuel and clearly demonstrates the Authority's forward thinking energy policy.

Enquiries to: Beverley Chemical Engineering Limited, Billingshurst, West Sussex RH14 9SA. Telephone: (040 381) 2091. Telex: 87416.

Photo-Electric Alarm

A two-tone gong signal is the feature of a ready-to-fix and effective door alarm introduced by Londex Limited.

'Photoguard' uses the 'magic eye' principle, and gives a clearly audible signal whenever anyone breaks the light beam by passing through the doorway (or any opening up to three metres in width).

It can be installed either for security purposes, or simply to announce the fact that someone has come through a door or has entered a particular area. The gong can be sited remotely, and additional gongs can be fitted if required.

Photoguard comes boxed and ready to fix in position; only a 13A plug has to be fitted. The simple-to-fix parts are a small box (housing the gong, transformer, and the alarm's electrics) and the inconspicuous transmitter and receiver which are fixed on each side of the entrance.

This simplicity makes Photoguard ideal for any doorway or entrance in every kind of professional, commercial and industrial premises.

Photoguard costs £35 (plus VAT), which includes packing and postage, and is available direct from:

Londex Limited, PO Box 79, Oakfield Road, London SE20 8EW. Tel: 01-659 2424.

Fire Alarms to New Standards

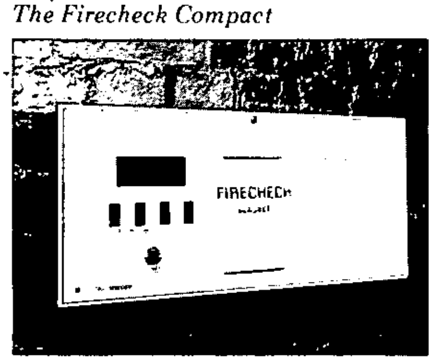
The new BS 5839 Code of Products for all new fire alarm systems, has been incorporated in Tann Synchrome's alarm and detection equipment. All firecheck control panels including the popular Compact model now meet this demanding new standard.

This new BS 5839 will be used by all fire services as the standard, and it is essential that all future systems are supplied with equipment which meets the requirements.

In addition to Firecheck a new exciting Modular range CMS 3000 also meeting BS 5839 is now available up to 96 way as standard.

For further information: Tann Synchrome Ltd, Station Road, Westbury, Wilts. Tel: 0373 822491.

The Firecheck Compact



CLASSIFIED ADVERTISEMENTS AND SITUATIONS VACANT

HAREFIELD HOSPITAL
Harefield, Middx.

Senior Engineer

Responsible for all major Engineering services at above hospital (377 beds). The post involves the maintenance and control of Electrical and Mechanical services for the hospital and the management and co-ordination of support staff. Minimum qualifications are an apprenticeship in Electrical or Mechanical Engineering and H.N.C. or equivalent DHSS approved qualifications. National Health Service experience would be helpful. Salary £6,822 – £7,896 plus London Weighting and bonus.

Application forms and job description available from Personnel Office, Harefield 3737 Ext. 628. CLosing date 22 June 1981.

Hillingdon AREA HEALTH AUTHORITY

Dudley Area Health Authority

SENIOR ENGINEER

required for

New District General Hospital

In 1982 the new Russells Hall Hospital will be opening in Dudley and we are now looking for a Senior Engineer (Male/Female) to manage the works department there. The hospital will initially comprise 407 beds and includes accident and emergency department, industrial zone and residential accommodation and plans for further developments are currently under discussion.

This post is ideal for the career minded engineer as it initially offers experience in being involved in the commissioning of the engineering plant and services and in scheduling for the setting up of planned preventive maintenance. After handover you will then take responsibility for the management of the works section at the hospital.

Salary Scale £6822 — £7896 per annum. Bonus and on-call allowances are payable after handover.

Applicants must hold an appropriate HNC or City and Guilds qualification having completed an apprenticeship or other practical training and have had five years relevant experience part of which should be in the Health Service or related environment.

Application forms and job descriptions are available from the Area Personnel Officer, Dudley Area Health Authority, Falcon House, The Minories, Dudley, West Midlands DY2 8PG, Tel. Dudley 56911 Ext. 204/219.

For an informal discussion on the duties of the post please contact Mr J. Harding, Area Engineer, on Dudley 56911 Ext. 265.

Closing date for applications: July 10, 1981.

Senior Telecommunications Engineer (Medical Electronics)

Hong Kong £14,010 p.a. plus 25% gratuity

- Low tax area — maximum 15%
- Medical benefits
- Dental benefits
- Free passages
- Generous Annual Leave
- Subsidised accommodation
- Children education allowances
- Holiday visits for children

Applications are invited for appointment as Senior Telecommunications Engineer (Medical Electronics) in the Public Works Department of the Hong Kong Government. The successful candidate will, in consultation with senior staff of government hospitals and medical institutions, ensure the effective provisioning, performance and maintenance of a wide range of medical electronic equipment and systems.

Applicants must be corporate members of the Institution of Electrical Engineers or the Institution of Electronic and Radio Engineers with at least 8 years' professional experience in the procurement, specification and maintenance of medical electronic equipment and systems for groups of hospitals and medical institutions operated on a regional basis.

Appointment will be for an initial period of 3 years. The salary scale is from HK$13,430 to HK$15,230 per month (approximately £14,010 to £15,890 p.a.*).

For further information and application form, write to Hong Kong Government Office, 6 Grafton Street, London W1X 3LB, quoting reference PWD/STE(ME) at the top of your letter. Closing date for return of application forms:- 26 June 1981.

**Based on exchange rate of HK$11.50=£1.00*
This rate is subject to fluctuation.

Hong Kong Government

M	E	G	A	W	A	T	T	■	F	I	R	E	U	P
I	■	E	■	I	■	R	■	■	■	N	■	M	■	H
R	A	I	L	R	O	A	D	■	S	T	E	P	P	E
R	■	G	■	E	■	D	■	■	■	E	■	T	■	A
O	L	E	F	I	N	E	S	■	O	R	E	Y	E	S
R	■	R	■	N	■	S	■	R	■	N	■	B	■	A
■	■	■	■	■	I	N	S	U	L	A	T	I	O	N
A	■	E	■	T	■	U	■	N	■	L	■	N	■	T
C	O	M	B	U	S	T	I	O	N	■	■	■	■	■
T	■	I	■	R	■	S	■	U	■	C	■	M	■	A
I	N	T	U	N	E	■	S	T	E	A	M	E	R	S
V	■	T	■	I	■	■	■	D	■	L	■	T	■	I
A	V	I	A	T	E	■	E	F	F	L	U	E	N	T
T	■	N	■	O	■	■	■	I	■	M	■	R	■	I
E	N	G	I	N	E	■	S	T	R	E	S	S	E	S

Solution to the Crossword which appeared in May Issue

H.E.M.E.C.

THE INTERNATIONAL FEDERATION OF HOSPITAL ENGINEERING

I.F.H.E.

SECOND INTERNATIONAL SEMINAR FOR SENIOR HOSPITAL ENGINEERS

FOCUS ON APPROPRIATE TECHNOLOGY

18th APRIL – 7th MAY, 1982

ORGANISED BY THE
INSTITUTE OF HOSPITAL ENGINEERING

AT THE HOSPITAL ESTATE MANAGEMENT AND ENGINEERING CENTRE
FALFIELD, NEAR BRISTOL, ENGLAND.

FOCUS ON APPROPRIATE TECHNOLOGY

As a consequence of the successful first International Seminar in 1979, the Institute of Hospital Engineering has been invited by the I.F.H.E. to organise a further Seminar for Senior Hospital Engineers in 1982. The theme will again be the application of APPROPRIATE TECHNOLOGY to health care facilities.

The seminar is designed for senior graduate engineers with significant management responsibilities, who are employed by State or National Government to plan or co-ordinate health service facilities or who are responsible for the management of services in health care facilities. It will provide an opportunity for delegates from various countries to meet and exchange ideas and experiences in a structural programme of lectures and projects.

Candidates must be officially recommended and sponsored by their own Government or by their employer.

The seminar will be conducted in English. A really good command of both spoken and written English is therefore essential if full benefits are to be realised.

VENUE The seminar will be held at the Hospital Estate Management and Engineering Centre, Falfield, near Bristol, England. Residential accommodation being provided in single study bedrooms.

PROGRAMME

Within the overall theme of the seminar the following topics will be discussed:-

- Problems of organisation
- Problems of meeting demand
- Problems of standards and design data
- Managing the maintenance function
- Planning for special care groups
- Controlling the internal environment
- Systematic approach to design and commissioning
- Preserving the environment for the community
- Advances in technology
- Advances in specialist medical requirements

There will be an extensive programme of project work and visits to illustrate the lectures, a fully detailed timetable of which will be sent to all successful applicants.

The main speakers and tutors have considerable expertise in the fields of planning, design, operation and maintenance of health care facilities. They will generally be available to help any delegate with an individual technical problem. Delegates will also have the opportunity to present contributions.

FEE

The composite fee for the seminar will be £1200 and this will include the cost of accommodation and meals at the Centre and of official visits. Delegates or their sponsors will be responsible for the cost of travelling to the Centre. Any personal expenditure will be the responsibility of the delegate.

APPLICATION

Those wishing to attend the seminar should complete and return the attached application form as soon as possible, the final date for receipt being 1st February, 1982.

The declaration by the sponsoring Authority stating that the candidate has been certified medically fit and free from any infectious disease must be duly signed. Each application should be accompanied by a deposit of £300 made payable to the Institute of Hospital Engineering in sterling.

In the event of an application being unsuccessful the deposit will be returned in full, in all other instances the deposit is non-returnable. Successful candidates will be notified and the full fee must be received within one month of the date of notification. No place can be reserved for more than one month unless the full fee has been received.

JOINING INSTRUCTIONS

These will be sent to each successful candidate by 1st March, 1982.

Some comments on the First International Seminar held in 1979 reprinted from the December 1979 and March 1980 International Federation issues of Hospital Engineering.

From Sweden

'We had a great variety of papers, from briefing through the whole planning process to commissioning and evaluation. In the project work we could use and test our theoretical and practical knowledge. The seminar is going to be of great value for my future work within the Swedish Planning Rationalization Institute of the Health Service.'

NILS-OLOF EINARSSON
The Swedish Planning and Rationalization
Institute of the Health and Social Services,
Fack, S-10250 Stockholm, Sweden.

The three group photographs were taken during the First International Seminar in 1979 and show some of the delegates at work during the various stages of their projects.

From Pakistan

'The seminar on Hospital Engineering was a resounding success as far as the under developed countries are concerned. Most of the under developed nations have little know-how about this technology and would like to utilise their strained finances economically so that proper utilisation can be made of their limited resources.'

SHER MOHAMMAD
Engineering Advisor (Health), Pakistan.

From Nigeria

'The seminar programmes were interesting, challenging, comprehensive and detailed. I commend it to all Hospital Engineers worldwide, especially those in the continent of Africa.'

S. ADE MUSA.
Principal Maintenance Superintendent,
Vaccine Production Laboratory,
Yaba-Lagos, Nigeria.

From Denmark

'The Danish Hospital Institute would like to congratulate you on the successful arrangements and hopes that a second International Seminar for Hospital Engineers will become a reality.'

NIELS TINGLEV CHRISTENSEN
Hospital Engineer,
Danish Hospital Institute.

Focus on Appropriate Technology

18th APRIL –
7th MAY,
1982

APPLICATION FORM
FOR SECOND INTERNATIONAL SEMINAR FOR SENIOR HOSPITAL ENGINEERS

18th APRIL – 7th MAY, 1982

TO BE COMPLETED IN BLOCK CAPITALS AND RETURNED WITH THE APPROPRIATE REMITTANCE TO THE SECRETARY, THE INSTITUTE OF HOSPITAL ENGINEERING, 20 LANDPORT TERRACE, SOUTHSEA, HAMPSHIRE, PO1 2RG, ENGLAND, NOT LATER THAN 1st FEBRUARY, 1982.

PART A to be completed by the candidate.

1. FULL NAME (Please include title and underline the name by which you normally prefer to be addressed) ....
   ....
2. NATIONALITY ....
3. DATE OF BIRTH ....
4. EDUCATION (Brief details and qualifications) ....
   ....
   ....
   ....
5. PROFESSIONAL QUALIFICATIONS ....
   ....
   ....
   ....
   ....
6. EMPLOYING AUTHORITY AND OFFICE HELD ....
   ....
   ....

7. FULL ADDRESS FOR CORRESPONDENCE ....

....

....

....

....

....

8. NAME AND FULL ADDRESS OF PERSON TO BE NOTIFIED IN AN EMERGENCY ....

....

....

....

....

....

Signature of Candidate

PART B to be completed by the sponsoring Authority on behalf of the candidate.

I certify that:-

a) To the best of my knowledge and belief the information given by the candidate on this application is correct.

b) I have examined the medical certificate produced by the candidate, which states that he is medically fit and free from any infectious disease.

c) The candidate has a knowledge of spoken and written English sufficient to enable him to follow the seminar.

I nominate the candidate on behalf of ....

....

Signed .... Date ....

Position ....

Address ....

....