The Journal of the Institute of Hospital Engineering March 1981

HOSPITAL ENGINEERING

International Federation Issue

Spanish Association Third Discussion Meeting

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HOSPITAL ENGINEERING

The Journal of the Institute of Hospital Engineering

I.F.H.E. International Federation Issue No. 37

Contents

Volume 35 No. 2 March 1981

Front Cover:
Professor A. Bonnin (President) and Messrs Gras, Rovira and Alonso — The top table speakers at the Spanish Association's 3rd Discussion Meeting at Zaragoza on 6th November 1980 — see page 3.

Neither the Institute nor the Publisher is able to take any responsibility for views expressed by contributors. Editorial views are not necessarily shared by the Institute

Institute News

Royal Patronage

The Institute of Hospital Engineering is honoured to announce that His Royal Highness the Duke of Gloucester has agreed most kindly, to formally open the One-day Symposium the Institute is to hold in April as its contribution to the International Year for Disabled People.

The Symposium will be held at the Royal Festival Hall on Wednesday 29th April and the programme appears in this issue of the Journal.

Vinson R Oviatt

In the December issue, the new President of IFHE was introduced to members of the Institute. It is most unfortunate that the Christian name of Mr Oviatt was mis-printed. The correct version is *Vinson* and we regret any embarrassment or inconvenience that this error may have caused.

'What the Finniston Report should have said'

This is the subject of the 25th Graham Clarke Lecture by Sir Alex Smith, MA PhD, to be held on 26th March 1981 at 6.00pm at the Royal Aeronautical Society, 4 Hamilton Place, London W1.

Information and tickets are available from the CEI, 2 Little Smith Street, London SW1P 3DL.

MSc Degree for IHospE Fellow

Mr K. H. Bourne, a Fellow of the Institute, was one of ten men who were the first to be awarded the MSc in Energy Engineering of the University of Surrey.

The Degrees were conferred on them by the Chancellor of the University, HRH The Duke of Kent in Guildford Cathedral on 28 November 1980.

Launched by the University in 1978 to provide specialist education in energy management, the courses can be taken on a part-time or full-time basis. A booklet is available from the Faculty of Engineering, University of Surrey, Guildford, Surrey. Telephone (0483) 71281.

Design in Health Care

A half-day seminar, of interest to hospital engineers, is to be held at the King's Fund Centre, 126 Albert St, London NW1 on Tuesday 17 March 1981.

Arranged by the Design and Industries Association, the tickets, inclusive of lunch and tea cost £12. Items on the programme include *'Hospital Ergonomics — Fitting the Purpose'* and *'Engineering and the Patient'*.

Full details from Design & Industries Association, 17 Lawn Crescent, Kew Gardens, Surrey TW9 3NR. Tel: 01-940 4925.

7th International Congress of Hospital Engineering 9–15 May 1982 Amsterdam

Members may wish to make a note in their diaries of the IFHE 7th Congress, which will take place from 9–15 May 1982.

The event will be held in the International Congrescentrum RAI in Amsterdam, and a social programme is planned for guests accompanying delegates.

Further details can be obtained by writing to the Congress Secretariat, Organisatie Bureau Amsterdam BV, Europaplein 14, 1078 GZ Amsterdam.

North Western Branch

At the Branch meeting held on 20th January, 1981 the nominations for the Branch Committee for 1981/82 were approved.

The nominations are the same committee as last year with the exception of Mr A. Juliff who has resigned from Committee and in his place will be Mr E. A. Hately. The Committee also proposed and accepted that Mr A. Millington should again represent the branch on Council for the ensuing three years.

On Tuesday evening, 20th January, the branch held a meeting at St. Mary's Hospital, Manchester when a paper was given on 'Operating Theatre Engineering' by Messrs. N. Graham and D. Harker, Assistant Regional Engineers of the N.W. Regional Health Authority. Over 80 people attended the meeting including colleagues from the nursing profession i.e. Theatre Technicians. A very well presented and interesting paper was given which was appreciated both by the members and visitors which resulted in a lively period of question time, with interesting exchanges of points of view. In all, a very successful evening.

Interhospital 1981 Munich

Members intending to visit this conference, details of which were given in the December 1980 issue, will be interested to know that Pressplan Travel are offering a selection of packages. Prices start at £182 and full details can be obtained from Pressplan Travel Limited, 17 Verulam Road, St Albans, Tel: (0727) 33291.

Safety Seminars

On 1 January 1981 the new *Notification of Accidents and Dangerous Occurances 1980* regulations came into force.

The British Safety Council has produced an Accident, Mishap and Ill-health Record Book to enable employers to understand the requirements of the new regulations, and will be holding one-day seminars throughout the country.

Copies of the book can be obtained from the British Safety Council, 62-64 Chancellors Road, London W6 at £7, and for further information of course bookings, contact Mrs Helen Kelman on 01-741 1231.

Graduate Training Scheme

In order to help attract more good graduates into the Building Services profession, Science Research Council, University of Glasgow and several private companies and public bodies have combined to run a 2-year Graduate Training Scheme starting in the Autumn. The scheme, known as GAITES — Graduate Academic and Industrial Training in Engineering Services — is specifically for new graduate recruits to the profession and provides them with a co-ordinated blend of specialised academic education, practical training and professional experience.

The academic element, arranged in six 2-week blocks, provides a large degree of choice and is structured to provide graduates of Engineering and other science disciplines such as Physics, with the specialised knowledge pertaining to the Building Services profession. Organisations making use of the scheme are therefore able to widen their recruitment into the large pool of general engineering and selected science graduates.

The training and professional experience comprises a twelve week module of basic manufacturing skills followed by four 15-week and four 5-week modules covering all aspects of the profession. The trainee would normally take the majority of these modules in various departments of his own organisation but for modules covering other specialities he would go to other participating organisations. The training programme is fully monitored and has been approved by IMechE and IEE as satisfying their training requirements for corporate membership.

Companies and public bodies covering all aspects of the profession are invited to participate by putting trainees into the scheme and/or making available one or more training modules.

For more information please contact: Peter Robertson, Building Services Research Unit, 3 Lilybank Gardens, Glasgow G12 8RZ. Telephone 041-334 2269.

The Institute of Hospital Engineering Accommodating the Disabled A Symposium — Wednesday, 29th April, 1981

in support of

International Year of Disabled People

at The Royal Festival Hall, London

Although there have been quite significant changes in the public awareness of the problems of disabled people, there is still a lot more to do to break down the additional barriers that exist, which unnecessarily restrict the independence of the handicapped.

The Institute is pleased to sponsor this Symposium to bring together architects, engineers, surveyors and those who are responsible for preparing operational policies and briefs for buildings that are used by disabled people. The Symposium will be of interest to those working in the National Health Service, the designers of buildings, engineering services and those who have to maintain them.

10.00 Coffee

10.30 OFFICIAL OPENING by
HIS ROYAL HIGHNESS THE DUKE OF GLOUCESTER
CHAIRMAN for the day
KIT ASTON Esq JP BSc
Chairman, IYDP Central Committee

10.40 DISABLED PEOPLE IN THE COMMUNITY
Speaker: PETER LARGE Esq MBE
Chairman of Committee on Restrictions Against Disabled People (CORAD)

11.20 DISABLED PEOPLE — LEGISLATION AND ITS EFFECTIVENESS
Speaker: PETER MITCHELL Esq MA
Head of Research & Intelligence RADAR

12.00 ACCESS FOR THE DISABLED TO BUILDINGS
COMPARING CODES OF PRACTICE FOR THE DESIGN OF BUILDINGS
Speaker: GLYN STANTON Esq MSc DIPArch
Consultant Ergonomist, DHSS

12.45 LUNCH

14.00 DISABLED PEOPLE AND COMMUNICATION
Speaker: STEPHEN BRADSHAW Esq
Director, The Spinal Injuries Association

14.40 RESIDENTIAL CARE— NATIONALLY AND INTERNATIONALLY
Speaker: RONALD TRAVERS Esq
International Director
The Leonard Cheshire Foundation International

15.20 DESIGN OF BUILDINGS — CO-OPERATION AT INTERNATIONAL LEVEL
Speaker: C. WYCLIFFE NOBLE Esq OBE FRIBA
Consultant Architect, RADAR

16.15 CLOSE

To: The Secretary, The Institute of Hospital Engineering, 20 Landport Terrace, Southsea, PO1 2RG.

Please send to me .... ticket(s) for the ONE-DAY Symposium in support of INTERNATIONAL YEAR OF DISABLED PEOPLE to be held on Wednesday 29th April 1981.

I enclose £........... to cover cost at £24 each (includes Morning Coffee and Lunch). No fees will be returned for cancellations (in writing please) received after midday on Tuesday 23rd April 1981.

NAME (in capitals please)..

ADDRESS..

....

Position..

Letters to the Editor

The Engineer's Contribution to Assisting the Disabled

Dear Sir,
The January 1981 edition of *Hospital Engineering* outlined the programme for the National contribution to the International Year of Disabled People and quoted from Lord Snowdon's speech at the opening ceremony of the IYDP. 'What we have got to ensure is that anybody and everybody who is disabled in the world is given an equal opportunity, if feasibly possible, to enjoy their lives to the full, not as a favour nor exception, but as a normal dignified human right.'

I would like to draw attention to the contribution that individual engineers can make to assisting the disabled in their own local community.

Throughout the country there are some 75 Rehabilitation Engineering Movement Advisory Panels (REMAP) set-up under the auspices of the Royal Association for Disability and Rehabilitation. These are voluntary groups with the aim of providing aids for the disabled which are not commercially available.

It brings engineers with design and manufacturing capability together with Doctors, Nurses, Physiotherapists, Social Workers and Occupational Therapists, who refer to the panel particular problems for which there is no known aid available, or where the standard aid needs modifications for a particular patient.

The Berkshire Panel had its inaugural meeting just a year ago, so we are, to some extent, feeling our way, but since our formation we have completed, or have in hand some 25 projects covering an enormous variety of problems. Some examples of these include:

Two specially shaped chairs for a 10 year old — one for home and one for school;

special bath support, so that a mother could give her adolescent daughter a horizontal shower;

modifications to a tricycle, so that a blind spastic child could exercise at home;

a betting slip holder for a Bookies' single handed clerk;

special toilet aids;

a garden swing for a disabled youngster.

We have also carried out several small projects for the Geriatric Day Unit at a local hospital.

The range of projects cover aids to daily living, employment and recreation and are not generally very complicated or demanding in manufacturing ability, the usual practical engineer's resources on the garage work-bench are usually adequate.

Colleagues in the Service will know that I have been a strong advocate of the hospital engineer expanding his supporting role to the caring professions in the electronics field and in many parts of the Service these are providing an E.B.M.E. service through the Works Department. Well, to those who share the enthusiasm for this wider role — join your local REMAP group — you will find it an extremely stimulating and satisfying pastime.

For details of your local REMAP, I suggest that you contact the Head Occupational Therapists in the County Social Services Department, or The Royal Association for Disability and Rehabilitation, Thames House North, Millbank, London SW1 P4QG.

P. J. Tankard CEng, MIMechE, AMBIM, FIHospE
Area Works Officer
Berkshire Area Health Authority

Is there still steam?

Dear Sir,
A copy of HOSPITAL ENGINEERING for December 1980 was circulated by my office to announce the election of Mr Oviatt as President of the International Federation of Hospital Engineers. We are proud of him.

The article, 'Whittingham Hospital Power House Schemes', mentions reciprocating steam engines driving alternators. Are reciprocating steam engines easily available in England today?

J. O. Storry
Dean of Engineering
South Dakota State Univeristy, USA

As one who has spent much time working on steam railway engines I wish the answer was yes! I have heard of no new construction for years, but in this country we still have a dwindling number of reciprocating steam engines in regular use. Editor.

News from Member Countries

Spain

AEDIAH 3rd Discussion Meeting

Structure and Organisation of the Hospital Technical Maintenance Service

The Spanish Association of Hospital Engineering and Architecture held its 3rd discussion meeting in Zaragoza on 6 November 1980.

The topics, which attracted a good attendance included:

Perspective of organisation and development of the hospital technical maintenance service;

Maintenance services in the French Public Health by Pierre Gras;

Maintenance services in Insalud (Spanish Public Health);

Organisation of maintenance services at a university hospital of 1000 beds;

The maintenance organisation for a group of hospitals.

There then followed a discourse by M. Gras on the IFHE Council and an interesting colloquy on the organisation of hospital maintenance in the UK.

The conclusions, which affect the technical maintenance services in Spain were referred to the Central and Independent Authorities.

USA

Fire Protection Seminars

The National Fire Protection Association of America is holding one- and two-day seminars from March through to December.

Members who wish to attend can obtain full details from Judy Bolton, NFPA, 470 Atlantic Avenue, Boston, Mass 02210. Telephone (617) 482-8755.

Portuguese Association of Hospital Engineering

The APEH 2nd Intensive Course on Hospital Engineering took place in Lisbon between 12 January and 6 February.

The course involved, over a period of 4 weeks, $88^1/_2$ hours of theoretical lectures and 18 hours of visits to hospitals followed by debates.

Graduate university engineers attended the course, which is reported to have been a great success, and certificates were awarded after 6 hours of written, and 3 hours of oral, examinations.

The President of the Association, Eduardo Caetano, gave talks on the morphology and physiology of the hospital, and he was supported by some 19 other lecturers, each dealing with their respective disciplines.

1981 Programme

The main activities taking place in 1981 are:

7-10 April
First National Congress of Hospital Engineering, Architecture and Equipment.
Exhibition of hospital equipment.
The Faculty of Economy, Oporto.

26 June
Visit to hospital boiler house.
The District Hospital, Aveiro.

20 November
Energy Conservation.
Comissao Inter-Hospitalar do Porto.

Département du Génie Sanitaire de Biologie Médicale

(à la page 5)

Le Génie sanitaire de Biologie médicale doit être développé afin de répondre aux besoins dont un nombre croissant de notre personnel médical a ressenti la nécessité dupuis deux ans. Ces besoins exigent le développement et l'utilisation d'appareils électro-techniques à des fins médicales.

Le document explique en premier lieu les nombreux aspects des responsabilités du Département du Génie sanitaire bio-médical et donne les indications appropriées pour se servier au mieux de tous les instruments et installations.

L'auteur parle ensuite de l'importance de la coopération avec le personnel médical dont l'apport principal est de prendre note avec soin et précision de la totalité des observations et de les inscrire dans un registre réservé à cet effet. Il propose divers moyens de tenir ces registres.

Le personnel médical est de plus en plus confronté avec la difficulté de certains éléments au mécanisme compliqué dans le matériel de surveillance et contrôle et pour les diagnostics, aussi l'auteur donne-t-il quelques directives pour leur emploi.

La Régulation des Températures par Microprocesseurs

(à la page 8)

En 1977, un rapport signalait le gaspillage d'au moins 20% du combustible de chauffage utilisé par les Services de la Santé, en conséquence de la mauvaise conception des études, de l'entretien et du fonctionnement des systèmes de régulation. A l'époque, ce gaspillage se chiffrait en termes monétaires à quelque dix millions de livres sterling.

Il devint évident que des systèmes de régulation simplifiés réduiraient sensiblement les pertes et que des systèmes de commande des températures à microprocesseurs ayant leurs mémoires propres faciliteraient le travail de l'opérateur.

L'article présente ensuite une description détaillée du montage et des conditions de fonctionnement d'un prototype de dispositif de commande que le ministère de la Santé fournit actuellement aux Services de la Santé.

Les Économies d'Énergie au sein de la CEE

(à la page 12)

L'utilisation rationnelle de l'énergie occupe aujourd'hui une place prépondérante au sein de toute politique économique, industrielle ou de l'emploi. L'évolution vers une utilisation plus efficace des ressources pétrolières devra se faire à un rythme bien plus rapide qu'on n'avait prévu.

Les besoins énergétiques primaires de la CEE ont déjà subi une réduction de l'ordre de 10%; mais cette réduction découle essentiellement d'une diminution de la consommation énergétique en conséquence du ralentissement de la croissance économique. Le défi que nous devons maintenant affronter, c'est de savoir mettre à profit la tendance vers une utilisation rationnelle de l'énergie pour accroître la prospérité générale. Un investissement de ce genre pourrait alors représenter un moyen idéal d'introduire un modeste stimulant dans l'économie, sans toutefois gonfler l'inflation.

Jusqu'à présent, la Commission des Communautés européennes s'est concentrée sur la sélection des projets susceptibles de soutien. Or, l'étape suivante devra permettre la diffusion des connaissances techniques dans l'ensemble de la CEE et l'élaboration d'une orientation pour l'utilisation rationnelle de l'énergie dans les bâtiments.

Les Progrès de la Récupération des Calories en Blanchisserie

(à la page 15)

Les blanchisseries sont très consommatrices d'énergie et elles offrent par conséquent un champ d'application très large à la récupération des calories. Le présent exposé fait le résumé des essais et des développements réalisés à ce jour et constate qu'il est possible d'effectuer de substantielles économies.

Dans un premier temps, on a identifié les schémas d'utilisation énergétiques. Puis on a démontré, par des essais menés avec des échangeurs thermiques, des pompes à chaleur et des systèmes de commande perfectionnés, qu'on pouvait parvenir à des économies de vapeur de l'ordre de 18 à 20% — et cela uniquement par la récupération de la chaleur perdue, sans compter les économies réalisables à plus long terme grâce au perfectionnement des études de machine, à la récupération de la chaleur perdue dans les gaines d'évacuation des blanchisseries, etc.

The author of this paper is the President of the Belgian Hospital Federation.

The Biomedical Engineering Department

ING L. WULLAERT

Biomedical Engineering in the Technical Department must develop to meet the needs that a growing number of our medical workers have felt for about two years. These needs involve the development and use of electro-technical apparatuses for medical purposes.

The tasks of the Biomedical Engineering Department include:

Keeping the medical electro-technical instruments and installations necessary for some diagnostic and therapeutic needs, and for the support of life functions functioning perfectly and permanently, or maintaining the equipment in perfect order;

assisting the medical team with technical support in the execution of the diagnostic and therapeutic tasks, or to support life functions, whenever required;

carrying out quick and expert preparatory studies, and offering technical advice on the purchase of new medical/electro-technical instruments or installations;

modifying existing instruments or installations, or constructing medical/electro-technical instruments and installations, when required and if at all possible.

We try to realise the first objective through relative preventative maintenance, and through good management of all electro-technical instruments and installations.

The second objective is attained by:

- attaching some technicians to different departments of the hospital (e.g. Intensive Care and Operating Suites). There they can, in the real sense of the word, enter into the problems of the department, and thus provide help at the most suitable moment;
- drawing up and distributing clear instructions for use of equipment;
- co-operating in preparing and running training programmes;
- studying all kinds of documents and publications.

These two important objectives cannot be realised without ready and well-organised co-operation with medical workers. This co-operation includes, most of all, the quick passing of information about defects or problems, in as complete a form as possible. That is why we prefer a 'phone call when a problem arises, *and* simultaneous use of the Logbook. As everyone knows, the Log describes everything that happens on board a ship. In the course of time, we create a written record of every feature of the use of a piece of apparatus. This reveals any mistakes in construction, and gives warning of any potentially harmful defects. All Logbook pages relating to any piece of apparatus are numbered in sequence, and clearly identify the particular piece of equipment concerned where one book covers several apparatuses. It is not possible to lay down hard and fast rules about how many logbooks should be maintained in any one department. Sometimes, one will be perfectly appropriate for several different pieces of equipment. In another case, each piece of apparatus should have its own.

We find that the following points must be covered:

- The kind of apparatus, e.g. *pressure module;*
- the apparatus manufacturer, e.g. *Hewlett-Packard;*
- the typenumber or typename, e.g. *78205A;*
- the production number or serial number, e.g. *1330601148.*

After a description of the problem or user complaint, it is also useful to know who we can ask for further information. It is also necessary to mention:

- The department where the apparatus is used;
- the person who deals with it and who can provide the most information. Naturally the date of the entry is important.

Additionally, the typenumber and serial number must be recorded. All these should preferably be filled in by the same person.

At the foot of the page we note our findings, and the eventual outcome. The person who completes the exercise must sign, date and classify the logbook page, and number it.

We are glad that the BMED has, since it started 5 years ago, undergone a positive evolution, concerning its participants, the means available, and the places and the fields of action. In the beginning, we were busy monitoring, while we now also work on ultrasonic diagnostic apparatus and high frequency diathermy and coagulation units, infusion pumps and computerised arythmia detection apparatus. Briefly every piece of equipment with a medical application requires our attention. To face this large range of diverse technology, every engineer specialises in certain forms of equipment.

As an illustration, we give below some of the specialised areas:

- Infusion pumps;
- recorders;
- lung ventilators;
- medical gases;
- RX— apparatus;
- medical T.V.;
- pacemakers;
- oscilloscopes;
- ECG — EMG — ENG — EEG — measurements;
- digital technology;
- laboratory instruments;
- medical and surgical diathermy;
- ultrasonic diagnostic — apparatus;
- defibrillators;
- measurements and controls;
- pressure measurements.

At the same time, as well as concentrating on our own specialised field, we try to acquire a basic knowledge that allows every one of us to give first aid in any sudden problem. We are conscious of the fact that this cannot always be achieved, and that we often fail. However, the excellent co-operation of the medical staff always stimulates us to try again.

Some Suggestions for Users

Do know the apparatus you are working with;

is the method of working completely clear? Ask for an explanation;

are you not absolutely sure? You must ask again, instead of taking the risk of doing it wrongly;

don't be afraid — we consider it perfectly normal that you find the apparatus intricate, because this is exactly what it often is;

do follow the directions for connection of the apparatus to the patient as accurately as possible, because this is the weakest link in the chain. The most fantastic electro-cardiograph gives a worthless ECG when one electrode has a bad contact with the patient. The most beautiful and efficient pressuremeter will give completely useless results when there is air in the liquid pressure conduit line, or when the catheter is occluded or misplaced;

if a measuring installation works from more than one inter-connected apparatus, then one has to know how the connections must be linked, to get accurate results;

ask the technical department for the necessary explanation, if necessary with clear drawings;

if the results are not clearly shown on an oscilloscope or paper reel, check whether the connections are loose, or whether they have not been made at all. Do also check whether the Sensitivity, the Gain or the Amplititude adjustments have perhaps been left switched off, or whether the registration points are possibly out of calibration;

if your precautions and checks on the adjustments of the apparatus do not give the expected result, the technical department must be informed. Do not disconnect the apparatus yourself, or put it away, or connect it to another equipment. We do come *immediately*;

it is best for you, the user, to know for sure whether you have connected, manipulated and controlled the apparatus in the right way. It is also the best way to make use of it;

also for we technicians, we find in most cases that dealing with experienced users is the only way to know for sure whether the apparatus is effective or not;

while you are waiting for the technician, who will respond to your call immediately, fill in the Logbook page as completely and clearly as possible. This will eventually be checked with the head of the Biomedical Engineering Department.

Last Suggestion: Operate the apparatus you are working with in the same way as you operate your own hi-fi installation.

The author of this paper is the Senior Medical Engineer at East Birmingham Hospital.

Wide Area Paging at East Birmingham Hospital

R F G AUSTIN TEng MITE MIHospE

Various methods are used for locating staff in hospitals. This article attempts to outline the advantages of a U.H.F. (Ultra High Frequency) wide area tone and voice system, currently in use at East Birmingham Hospital.

Early Systems of Staff Location fall into three main categories:
(a) Electrical;
(b) Inductive Loop;
(c) Free Radiating V.H.F.

The Electrical System consists of a display of flashing coloured lamps, suspended from ward and corridor ceilings. A member of staff would be allocated a unique combination of colours, and would be required to telephone a control point when his particular combination started to flash. The main drawbacks are that only one member of staff can be contacted at a time, and only then whilst he was in sight of the display. Another problem is the inevitable failure of the bulbs!

Loop Systems have a continuous loop of inductive cable around the hospital complex; pocket receivers pick up signals from the loop, either tone only (Bleep), tone and voice, or occasionally two-way speech.

The problems associated with this system are usually shortness of range, large ferrous structures distorting the covered areas, and often the need for complex loops around remote buildings.

Free radiating systems have many advantages over the other two, staff can be quickly paged, and fewer 'grey' areas of doubtful coverage are found. Unfortunately, the VHF (27MHz) paging band most commonly used in Hospitals only allows speech to be used in emergencies (e.g. Cardiac Arrest) at the discretion of the Home Office which is the authority in charge of broadcasting in the UK.

Wide Area Paging is well worth considering, whether as a new site installation, or as a parallel to an existing on-site Paging System. As the name suggests the area covered by the system is larger than the on-site methods already mentioned, and has the advantage that it can legally be used (under Home Office licence) for speech. The actual area covered is determined by several factors:

Figure 1: The NEC II Radio Pager.

Base Transmitter Power and Aerial Height

Usually the application form to the Home Office will be completed by the supplier of the equipment, who will suggest power requirements and aerial height for approval.

Pager Sensitivity

Modern pagers, such as the NEC II (*Figure 1*) are extremely sensitive and will respond to the signal from the base transmitter, often at distances that cause the speech to be unintelligible. Thus, at extremes of range or in poor reception areas, the pager will be alerted but the staff member may have to telephone base to receive the message.

Geography

The aerial height should be at a maximum. Fortunately most hos-

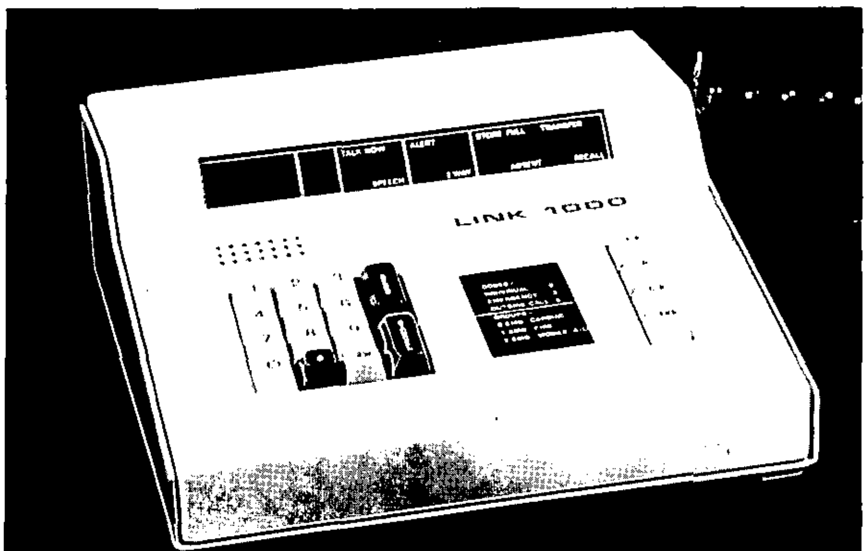


Figure 2: The LINK 1000 Keyboard Encoder.

pitals have multi-storey blocks where the aerial mast can be mounted (Typically 50–100 Feet in height). The greater the height of the site, the better, but if the site is particularly low in the surrounding terrain, then a land line can be used to the transmitter and aerial, located remotely on higher ground. Large hills tend to cause a 'Radio Shadow' to the pager, causing a reduction in the signal strength.

Signal Penetration

The strength of the signal is reduced as it passes through the dense concrete and steel of buildings, but using UHF this effect is minimised.

The base station comprises a Keyboard, the transmitter and its aerial. *Figure 2* shows the LINK 1000 Keyboard Encoder located in the telephone office at East Birmingham Hospital. This allows any one of 1000 individual Pagers, or any one of 30 Groups of 10 Pagers each to be called. *Figure 3* shows two Motorola Transmitters

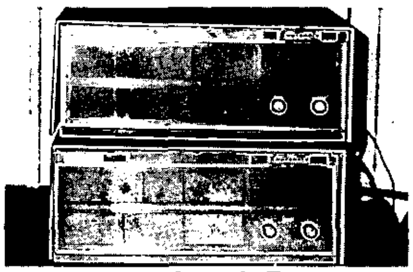


Figure 3: Two Motorola Transmitters.

(one used as a Stand-by) which are located as near to the aerials as possible to minimize feeder losses. In this instance, the transmitters are in a lift room directly below the aerial mast. Typical installation costs are £450 for the Keyboard Encoder, £900 for Transmitter, and £350–900 for aerial and installation.

There are numerous pagers available from various Manufacturers, with options for external aerials and earphones, etc. The NEC II pager used at East Birmingham Hospital also has the capability for Group-calling, where up to 30 Pagers can be called, all receiving the message simultaneously. This is particularly useful in Fire, Cardiac Arrest or major emergency situations. Typical cost for a Pager is £170 with charger and rechargeable cells.

In conclusion, the advantages to East Birmingham Hospital have been found to be numerous, but are mainly:

Faster response, due to voice message;
Less traffic to the telephone switchboard;
Greater freedom of movement, especially for on-call personnel, who can lead a normal social life, but can be contacted even when travelling;

One particular instance when the system proved useful was during a public transport strike in the area. Volunteer drivers were advised whilst on the road of the name and location of stranded nurses, thus saving time and petrol.

Future considerations include the possibility of a paging service for the General Practitioners in the District.

The author is a Superintending Engineer at the DHSS, London and he gave this paper at the Institute's Third Symposium on Hospital Energy Conservation at the Royal Festival Hall in October.

Microprocessor-based Temperature Control

I. MAHON CEng IEE

A report published in October 1977 by the Regional Engineers Association and the DHSS concluded that at least 20% of the fuel consumed by the Health Service for space heating (excluding warm air systems) was wasted due to the poor standard of design, maintenance and operation of the control systems. This represented an annual loss then of some £10m.

It was made clear that controls which would be simple for a user to set and operate could reduce this loss significantly. This simplicity can be achieved by using microprocessor-based heating controllers with an input keyboard and digital display, for example liquid crystal display (LCD) or light emitter diode display (LED), similar to a calculator with an alarm clock incorporated. The controller software could conceal any complexity from the operator. Even the initial settings, which the operator has to provide for the software to act upon, could be captured by bubble memories, or by memories whose state is retained during power failures by small on-board rechargeable batteries. On-board memories are cheap enough to cater for many zones, with optimum-start facilities for zones as required.

To appreciate the complexity of the microprocessor software that is required to minimise the user's involvement, a common weather-compensated electronic control system as depicted by *Figure 1* needs to be examined first. To set up the system an operator has to relate water flow temperatures to the resulting room temperatures. He has to be familiar with a chart similar to the simplified version that *Figure 2* represents, and choose

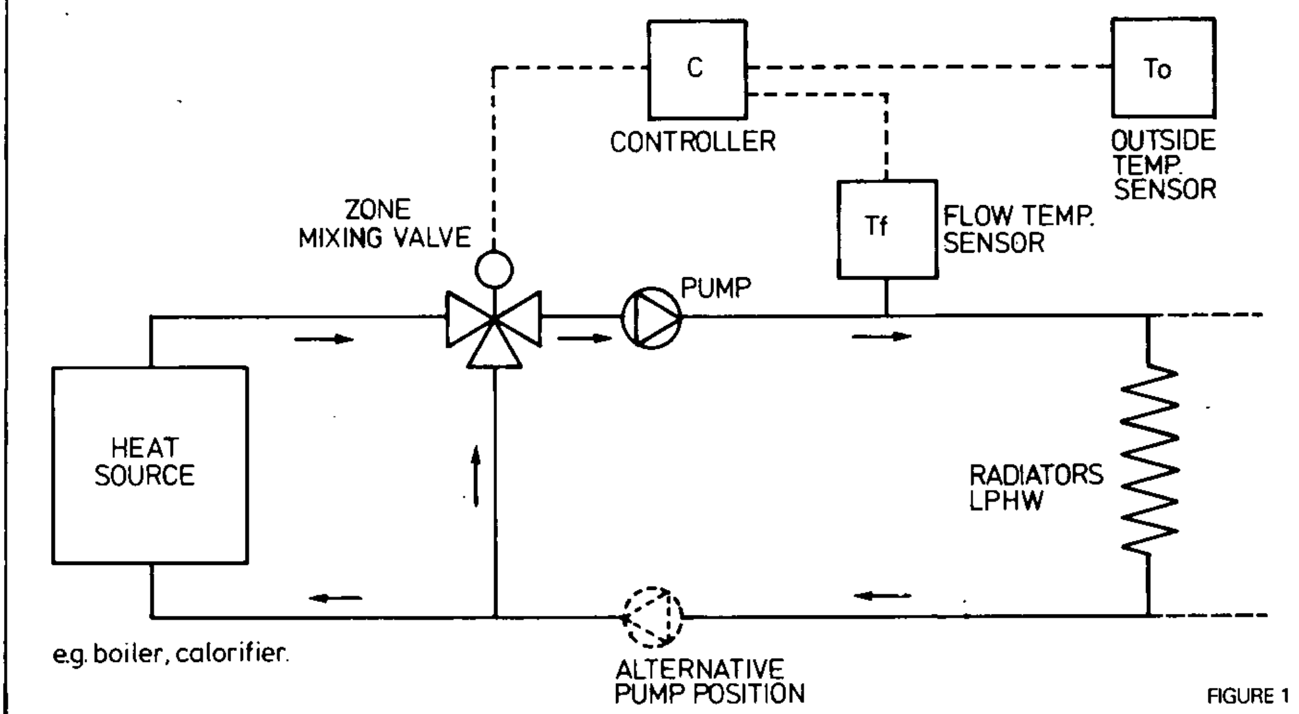


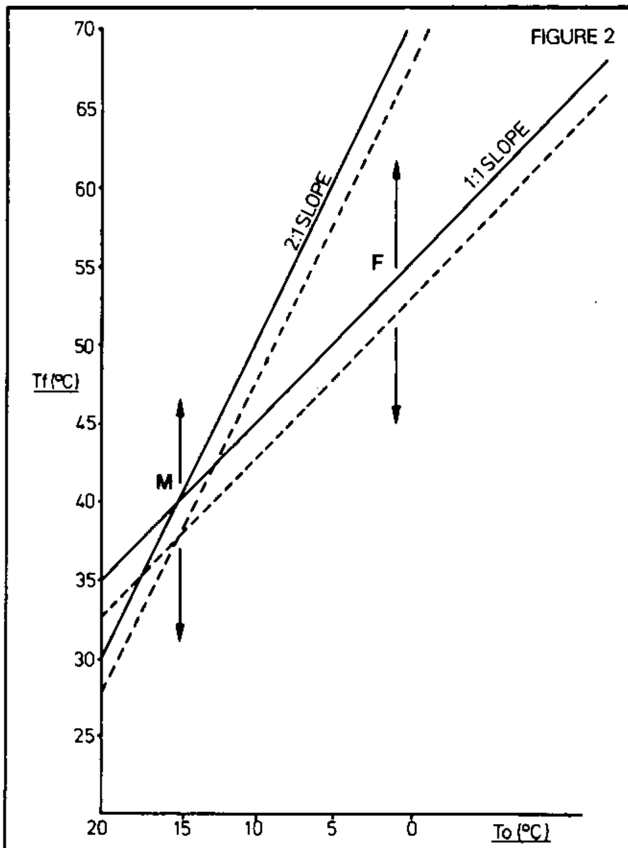
FIGURE 1

point M for mild weather conditions and point F for frosty weather conditions. To choose M he needs to have a knowledge of the radiator surface area in relation to the space to be heated; he also requires some knowledge of the heat loss through the building fabric. For a given radiator area and building U-factor, point M will need to increase with the space to be heated. A good knowledge of the building U-factor is even more important if he is to choose the optimum setting of point F. Potentiometers are generally used to set these points.

A microprocessor based temperature controller is available which caters for the M and F settings to be keyed-in simply on a pocket-calculator style keyboard and to be checked on a LED display. Besides compensating for outside temperature the software of this controller can be arranged to compensate for wind and sun influence, if the user requires it. Any settings that are keyed-in can be retained in the memory by an on-board rechargeable battery during power failures. The period of retention is usually far longer than the power outages experienced in hospitals: a month could be catered for. This controller can function as a three term controller i.e. with proportional, integral and derivative action. It could provide an analogue signal to 1 three-way valve in the type of system depicted in *Figure 1.* A good knowledge of the flow temperatures (Tf) that are appropriate to various outdoor temperatures (To) is still required. The controller does not make any automatic adjustment to improve the chosen settings.

At least one other microprocessor based temperature controller is designed to remove some of the guesswork or approximation from the initial selection of Tf to match To, i.e. the initial selection of points M & F. By utilising space or room temperature sensors instead of flow temperature sensors, Tr replaces Tf as shown in *Figure 3.* A pocket-calculator type key-board and LED display is still utilised. YES and NO push-buttons are included in the key-board and a numbered interrogation list is provided to enable the setting up of control parameters. Several zones can be controlled independently by proportional plus integral action and any of these zones can be set to provide optimum start facilities — in fact two optimum start facilities per day if required. Analogue

FIGURE 2



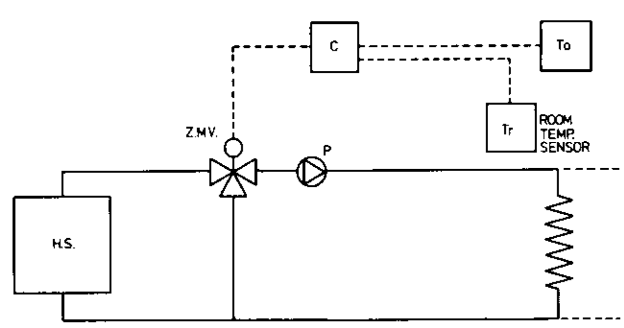


FIGURE 3

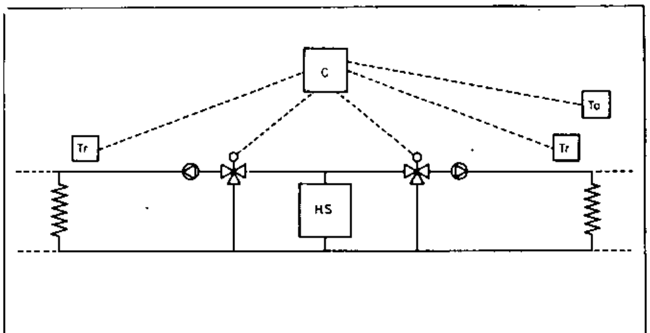


FIGURE 4

output is necessary to provide the two-term control; however the digital to analogue conversion is often done in hardware external to the controller for marketing reasons.

The keyboard input to all these microprocessor based temperature controllers provides simplicity but not at the expense of security. A password or authorised code has to be entered before a controller is receptive to any changes in the settings.

The software in microprocessor based optimum-start devices generally provides machine intelligence which optimises starting and stopping times to match building U-factors and thermal inertia after a learning period. This is often referred to as 'self-adaptive optimum start'. The information that is acquired may or may not be retained in the memory by on-board batteries in the event of power failure. The software generally provides frost protection during shut-down periods and facilities for different week-day and week-end start and stop times.

All the features that have been mentioned and many others can be provided in custom-built microprocessor based temperature controllers, however, specialised software tends to make this expensive. Many large centralised energy management systems could have their software adapted for these purposes; some have many of these facilities already programmed for use as required.

It has to be stated that an optimum-start device which is not based on a microprocessor is available which can provide compensation for building fabric loss utilising a thermal/mechanical system to vary the starting time. Space temperature changes result in a change in volume of liquid contained in the device and this varies a pre-set start-up time via a system of levers. The device is sited within the room or zone to be controlled in much the same way as a room thermostat. The initial choice of start-up time required to raise the space from frost-protection heating to the design condition may have to be changed manually as experience is gained, because the device is not self-adaptive.

There are a variety of microprocessor based temperature controllers, with software for one, two or three term control, with or without software for: modulating output, adaptive optimum start, controlling more than one zone, and with setting-up procedures varying from simple keying of a relatively few steps at the expense of extensive software, to keying with extensive interrogation lists but with minimum software requirements. Many combinations of these facilities can be imagined.

The DHSS seek to provide for the NHS a standardised local control unit with proportional control providing modulating analogue outputs for several building zones, each output being self-adaptive to the response of the building and solar and internal heat gains. *Figure 4* illustrates the requirement but only two zones are shown for clarity. The controller is to provide for any of the zones being set for optimum starting and stopping of the zone heating with the software being self-adaptive, i.e. learning the response of the building, and fine tuning its own performance to idealise energy input. The software is to cater for a whole 12 month period and include provision for leap-years, holidays, week-ends, extensions to the working day and frost protection during non-occupancy periods. The controller is to be set by a minimum number of dedicated push-buttons and LED number displays, and the software is to respond to an authorised access code only. Settings in the random access memory are to be retained during power failures using an on-board battery.

A prototype on-off controller with most of the above facilities is nearing completion and will soon undergo field trials. Subsequently the software will be adapted for proportional control and further field trials will be undertaken. *Figure 5* represents what the user will be confronted with. A description of typical setting procedures follows to demonstrate that the confrontation will not be onerous. The software may be developed during the field trials, so the final setting procedures may differ in a few respects.

After pressing the Access Code pushbuttons, or keys a dedicated key, labelled Zone Number is operated to gain access to any particular zone, which is then selected by pressing the appropriate one or two of ten numerically inscribed keys. Confirmation of the selection is displayed on two dedicated numeric LEDs.

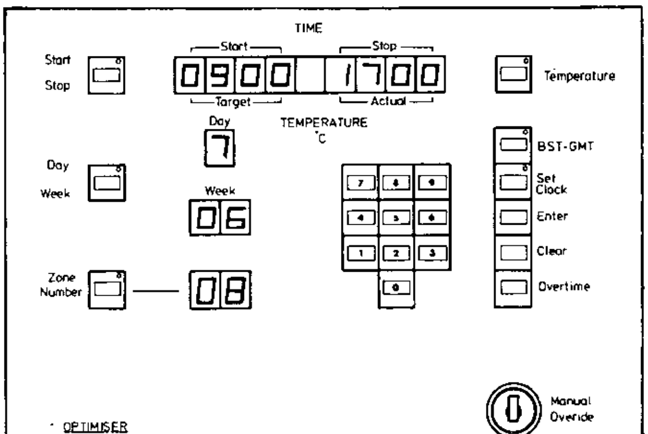


FIGURE 5

A push-button labelled Temperature is then pressed to display, on up to four LEDs, the target and actual room temperature (Tr) in °C pertaining in the selected zone, i.e. at a particular sensor stationed in that zone. The target room temperature can then be altered using the numeric keys; the LED display changes accordingly. This change is introduced into the program via the key labelled 'Entry' and keying errors can be erased using the Clear key.

For continuously occupied zones no further setting is necessary. If the outside temperature (To) needs to be checked this can be displayed by setting Zone Zero.

For a zone which is not continuously occupied, a starting time for the daily heating cycle can be set by keying in the Zone Number as previously described followed by pressing the Start/Stop key. The numeric keys are then used to feed in an hour and minute corresponding to the time of occupancy, which are displayed for checking on the same LEDs previously used for temperature setting and are entered into the program via the Entry key. The stopping time for the daily heating cycle is entered in a similar way. Thereafter automatic variation of these times to achieve optimum fuel economy is accomplished without further intervention by the user, thus providing self adaptive optimum start and stop facilities.

If the optimum start/stop facility is required for one or more zones the quartz clock within the controller has to be set to the correct time (this would normally have been done at the commissioning stage). It is achieved by first keying Set Clock, which results in a time of day being displayed on the four LEDs that also serve for optimum start time and target Tr display. Concurrently a day number, and an ISO week number are displayed in appropiately labelled LEDs. The numeric keys are then used to set the actual time of day, followed sequentially by the day, week, and year. The ISO week is used to facilitate access to the weekend program. The year is displayed on the two LEDs which also serve for the zone number and the correct year has to be set to cater for the extra leap-year day. After checking all these clock displays the Entry key is pressed to bring the clock to the correct time.

To prevent any further entries until the correct access code is used again, the Clear and Entry keys are operated sequentially. When any resetting is necessary sequential operation of the Entry key, the numeric keys appropriate to the authorised code and the Entry key again will make the controller receptive to new variables. Only variables that are to be changed need to be entered.

The Overtime key will be used on an ad-hoc basis to extend the stop time in a zone that is not continuously occupied. The current stop time will first be called up on the appropriate display and then Overtime will be keyed, followed by the changed stop time. On the day following the changed cycle, the program will revert to the normal stop time. It is possible that the software may be arranged for the Overtime mode to be programmed using an Access Code that differs from the normal code.

Omission of a daily heating cycle on a regular weekly basis (for example on Sundays) would be done individually for each of the zones affected by calling up the day of the week and the start and stop times, keying in a stop time that coincides with the start time and entering zero on the week display. In a similar way, omission of a daily heating cycle on an irregular basis (for example a Bank Holiday) can be keyed in any time prior to the date by calling up the particular day, week and year. Re-inclusion of a daily heating cycle on a regular basis would be provided by calling up the day of the week and by entering the appropriate start and stop times.

In the autumn when it is necessary to change from British Summer Time to Greenwich Mean Time the BST/GMT pushbutton is pressed, followed by the Entry key, which automatically retards the clock by one hour. In spring a similar procedure advances the clock by one hour in the BST mode.

Beside the 240V mains, the only input connections to the controller are from the temperature sensors via conventional 3-core cable, for the zero volt line, the +12V DC supply line and the signal line.

The only output connections from the controller are to the zone mixing valves. For the prototype controller with on-off output, zero volts represent the heat-off condition and 5V DC represents the heat-on condition. In the prototype installation the 5V DC operates a relay which switches the mains-operated zone mixing-valve. The controller could serve fifteen zones.

The base-emitter junction of a transistor, manufactured to close tolerance, provides the temperature dependant parameter for temperature sensing. The controller sends a reset pulse on the sensor signal line which initiates the charging of a capacitor at a rate determined by the temperature dependant base-emitter junction. The charging rate is related to the width of the reply pulse to the controller the width being inversely proportional to the temperature. A minimum pulse width of approximately 50msecs is equivalent to 30°C and a maximum width of 70msecs corresponds to -10°C. This should cover the range of indoor and outdoor temperatures that the device needs to recognise.

50msecs after sending the reset pulse the controller decrements a number at a known rate, the decrement ceasing at the end of the reply pulse, i.e. the number remaining is equivalent to the temperature pertaining. The controller software can operate on these numbers but a further routine converts the number for presentation to the user in °C on LED displays.

The software is arranged for 0.2°C to be represented by a single decrement of the number, a resolution which is well within the temperature setting available to the user i.e. 1°C. As the four LEDs that are available for start/stop times are also used for temperature display, the two least significant digits of the temperatures will always be zeros.

If Tra represents the actual room temperature and To the outside temperature, the normal control routine during occupancy of a zone is dependent on monitoring Tra-To. If the difference is less than a value programmed in the software, the zone valve is switched off (and vice versa) allowing for a switching differential which is set within the software for operational stability.

The self-adaptive routine for optimising energy consumption during occupancy of a zone is also dependent on monitoring Tra-To. With To increasing, if Tra-To increases at a rate greater than a value programmed in the software, this will be taken to signify excessive solar gain and the target room temperature (Trt) will be automatically lowered to prevent overheating. The rate of rise of Tra-To, the lowering of Trt and the time taken to reduce the rate of Tra-To, will be stored in the software. When this time is within a value programmed in the software, the response is stored as optimised action for use on the next occasion. The storage of this information in memory is retained during power failure by the on-board battery.

Similarly with To constant, if Tra-To increases at more than a chosen rate this will be taken to signify a significant change in internal heat gain and action will be taken, optimised and stored for use on the next occasion. In practical terms this facility may only be significant for small zones.

The self-adaptive routine for optimising the heating start time in zones that are not continuously occupied is dependent on monitoring To. The initial software contains arbitrary times for early switch-on (i.e. lead times) corresponding to various To values. If Trt is reached too soon the lead time is shortened and stored for use on the next occasion.

The basic controller dimensions, excluding the interfacing relays are 300 mm width x 200 mm height x 300 mm depth approximately. The 4k programmable read-only memory and the 2k random access memory required to carry out the functions that have been described, would be contained in the basic controller, no external memory banks being required.

In conclusion, microprocessor based devices have been available for some time for local temperature control or optimum starting of single-zones heating systems. Local control devices providing for multi-zone temperature control with optimum starting as required are being developed if they are not already available. The Department has arranged for the development of such a local controller with user settings as simple as possible and containing optimising routines for energy conservation in hospitals. The prototype controller provides an on-off output which could eventually be supplanted by proportional control. Subsequent to that further development on the averaging of several room temperatures to represent the zone temperature may be undertaken dependent on the savings that might accrue for the NHS.

The author is Principal Administrator, Directorate-General for Energy, Commission of the European Communities, and gave this paper to the Institute's Symposium on Energy Conservation last November.

Energy Saving in the EEC

ROBERT SHOTTON

General Economic Context

Today, productivity in the use of energy has become a central theme of economic, industrial and employment policies. The transition to greater energy-efficiency, and the substitution of oil by other fuels, which was expected to be a gradual process extending over more than a decade, is now required of us in as short a time as possible. Almost every day renders it more imperative for the Western industrialised world. The adaptability of our economies to changing circumstances has never been so critically tested in peace time.

It is a test which energy rich industrialised countries like Britain must also meet. True, they are able to contribute more easily to the Western world's effort to reduce oil imports by the development of indigenous resources. All the same, domestic energy-efficiency means a lengthening of the economic life of energy reserves developed at great cost and effort, while benefiting from the foreign exchange earnings from exports. It means limiting environmental disruption caused by the development and use of energy resources. It means increasing the international competitivity of the energy-intensive industries, like steel, paper and pulp and basic chemicals, for which energy costs are particularly important. Finally, it means that the energy equipment industry, particularly the nascent energy-efficiency industry, can reach out to export markets from a strong domestic base. The world market for advanced energy-using equipment in both the industrialised world and the Third World will be enormous during the next decades. The British engineering industry needs domestic market incentives to keep product development in line with best-practice in world markets.

Of course, valuable savings in energy consumption have been obtained since 1974 by the better management and more careful use of energy. They are estimated to amount to about 10% of primary energy requirements in the Community as a whole. But generally speaking, the associated investment has been modest, and has not implied any important changes in the basic structures of energy supply and use.

Regrettably, in fact, the 'non-use' of energy has been of greater importance: that is, lower energy requirements due to lower rates of economic growth. Above all, in the last year, most of the reduction in energy requirements must be attributed to lower standards of comfort and convenience for households in response to higher prices, and the fall in output in a number of important and energy-intensive industries.

The challenge must be to use a drive for energy-efficiency as a means of becoming more prosperous, not less prosperous. In future, we must rely less on good housekeeping or simply lower standards, and instead on a massive effort of investment in equipment, materials and processes, that fundamentally improves energy productivity. Indeed, as is recognised by the eighth plan for the French economy, recently adopted, investment in energy productivity is an ideal way to provide a moderate stimulus to the economy without aggravating inflationary pressures. Inflationary pressures will be relieved if households and firms can afford the energy they need despite rising fuel prices, because of investment in energy-efficiency. Purchasing power will be released as the result of greater efficiency. The reduction in the bill for energy imports should substantially outweigh any increase in imports of equipment and materials. A useful if not decisive contribution to employment will be made.

A means must therefore be found to facilitate this investment, despite a generally restrictive economic environment. Otherwise there is a risk that high energy prices, in a recession especially, will simply lock industry and households into inefficient consumption habits, for lack of resources to do otherwise. That is the task that governments throughout the European Community must face during the next six to nine months. I shall come back to this in my more detailed remarks on the Community's policy for energy saving.

However, it must also be recognised that such an effort of investment will not be without problems as well as benefits. It will impose an accelerated rate of change on the energy sector. For example, there will be a permanent slow-down in the rate of increase of demand for energy, particularly marked for oil products, and rapid change in the structure of the market for oil products. The introduction of heat distribution networks is expensive and competitive with established systems. A more widespread development of own supply by industry, hospitals and other large users requires a review of contractual relationships with public suppliers.

It also poses problems for sectors determining the conditions of energy use. The impact on the automobile industry is clear to see. I am convinced that the impact on the construction industry must be and will be equally profound. Clients will require much higher standards of design and of construction in future, and will insist on testing performance in operation, taking account of the degree to which design has successfully anticipated the way buildings are used. Heating, ventilation and cooling systems can no longer be overspecified to ensure satisfaction. Full use must be made of modern control technology, and the scope for heat recovery, storage and recycling. A major effort of renovation in existing buildings is also required.

Thus, in conclusion, the need for investment in change and renewal is a great opportunity for the construction industry and its related professions. The potential for employment creation is particularly large per pound invested. The import content is generally low, but can the industry convince both its clients and the government that investment in buildings will be cost-effective in practice? If it cannot, the risk is that investment will be privileged in other sectors of energy use, where industry is more responsive to the energy challenge.

There can be no theoretical answer to these questions. The demonstration through careful monitoring and reporting of designs and equipment must be the key to progress. It should be accompanied by an insistence from clients, public and private, that proven best-practice design and technology be employed, even if there is a modest premium in capital cost, provided that it is justified by the bottom-line. Given the importance of public purchasing in all our economies, the public sector has a clear duty to give the lead.

The Community's programme for energy saving

My opening remarks must be that the Community's programme for energy saving should not be, and cannot be a substitute for national programmes. Nor should the Community seek to impose a blueprint on Member States, which ignores their specific circumstances and social conditions. That being said, there are a number of areas where the Community dimension can make a useful contribution.

First, the Community dimension is valuable in wider international discussions on energy. The economic and financial weight of the Community is evident. Its political coordination despite many difficulties on the way, steadily improves. It is useful in these wider discussions to set general guidelines for the Community as a whole. The credibility of these guidelines in turn depends upon a regular review of Member States' energy programmes to assess the contribution that each can and is making to their achievement.

Thus, by a resolution agreed on 13 May 1980, the European Council adopted, in the field of energy saving:

— new medium-term objectives for the ratio between the rate of growth in primary energy consumption and economic growth, for the period up to 1990;

— commitment by all Member States to adopt, by the end of 1980, energy saving programmes with comparable effects;

— a basic programme for energy saving recommended to all Member States, which includes guidelines for energy pricing practices and a series of specific measures to support adaptation in each of the main sectors of energy use.

The Community believes that energy pricing should reflect world market conditions. However, it also believes that specific measures will be needed to accelerate adaptation by firms and households, not only in the form of information, advice, education and retraining, but also in the form of selected financial support, and some perfomance standards for buildings and equipment where appropriate. That is indeed the policy followed in countries like France and Germany for example, where selective assistance to investment is provided, though, as in Britain, in the context of strict macroeconomic policies.

In the near future, the Commission will be publishing a report describing the status of Member States' energy saving programmes with reference to the basic programme annexed to the Council's resolution.

Secondly, there are a number of direct actions the Community is presently empowered to take in support of energy investment. To begin with, there are a number of Community loan schemes that have a significant role in support of Member States' energy investment programmes. In 1979 for example, 46% of all Community loans, amounting to nearly £1 billion, went to energy projects. However, these loans were almost entirely in support of energy production, especially electricity generation and distribution, and in support of projects sponsored by public authorities or nationalised industries.

The Commission is therefore examining what proposals could be made to increase the share being lent to energy-efficiency, and to the private sector. Already, the European Investment Bank, which is the main channel for this finance, has begun to make global loans to financial intermediaries in Italy and in Ireland, for on-lending to industry for investment in energy-efficiency. A number of loans have also been made for district heating schemes.

In addition, the Commission runs programmes of financial support for demonstration projects and for research and development. Under the terms of the regulation for demonstration projects, financial support up to a maximum of 49% of the cost of a project demonstrating on a full-scale new equipment, products or processes saving significant quantities of energy can be made. A new application of techniques or processes already known can also be supported. These sums are repayable if the technology is judged a commercial success, but instrumentation and measurement costs are excluded from this requirement, though they may not exceed 75% of the financial support granted. Since 1979, the Commission has issued two calls for projects, and has agreed to support 113 projects with financial aid amounting to a total of some £30 million, representing a total investment of some £93 million. In the latest round of projects it was agreed to support the demonstration of a design for a low-energy hospital, sponsored by the DHSS, to the extent of some £637,000. There are also two projects demonstrating the use of sophisticated control systems for the internal environment of buildings, as well as demonstrations of the use of heat pumps in buildings. Other demonstrations cover a wide range of new techniques and processes in industry especially, including the use of heat wheels, heat pipes etc. A third call for projects is expected to be published in the Official Journal of the European Communities, at the beginning of 1981.

The research and development programme is, of course, designed to support development work prior to the demonstration stage, and is operated under a separate regulation. However, funds available to this programme have all been allocated to projects, and it is not thought that a new invitation to submit proposals will be made before 1983.

Up to now in the management of the demonstration programmes, attention has been focussed on the selection of projects for support. However, we are now preparing actively for the second, and perhaps more important phase of the work, which is to ensure the diffusion of knowledge about best-practice technology throughout the Community. Such an effort would draw upon national as well as Community programmes, as well as other properly documented demonstrations. A technology data bank is in the process of being set up at the Community's research centre at Ispra, Italy.

A third area of activity by the Community is in the area of legislative proposals or voluntary agreements with industry concerning the performance of energy-using equipment, and the information of purchasers of such equipment. This activity has a dual purpose: it can stimulate the more rapid introduction of related national measures, and it helps ensure that national legislation or agreements do not create barriers to the sale of efficient equipment within the European community. Examples of this activity are the directive on the performance of heat generators adopted in February 1978, a series of directives concerning the labelling of domestic appliances, and the use of a standard fuel consumption test for automobiles throughout the Community.

Apart from the directive on heat generators, there have been no binding proposals made at a Community level concerning energy consumption in buildings and heating systems. The diversity of technical language, the differences in the basic concepts employed in setting standards, and the lack of adequate information about the use of energy in buildings, have made this a particularly difficult sector for Community action. However, there is now a growing recognition of the need for a new generation of standards which relate to the performance of the building and its environmental systems as a whole, rather than individual components. This may provide the opportunity for a more convergent approach to legislation in the Community.

We have in particular asked the European Committee for Standardisation to examine with us, the issues involved in trying to set guidelines for the installation of heating, cooling and ventilation systems as a whole. Such guidelines would have to take account of the adaptability of systems to different requirements, and part-load operations, as well as their steady state functioning. Where heat pumps or solar collectors are installed, such guidelines need to examine the management of such equipment in relation to storage systems and conventional back-up systems. New, 'intelligent' controls are in an advanced stage of development.

Finally, the Commission can play a role in shaping the general climate of opinion in which national and Community action is determined. The Community provides a forum in which experts from the Member States can discuss sector policies concerning, for example, the development of district heat grids or energy saving in agriculture. This can be on the basis of reports sponsored by the Commission from external consultants, as well as the experience of national programmes.

Today, although many actions in energy policy are motivated essentially by energy policy considerations, energy policy is increasingly placed in the broader context of the Community's social, economic and industrial objectives. This is especially true of that part of energy investment which is the responsibility of the energy user rather than the energy producer. Thus, in a recent paper on energy and economic policy, the Commission has included the proposal that energy pricing and investment promotion should be discussed by the Economic and Financial Council as well as the Energy Council. Such a procedure would be able to take account more easily of the wider issues I raised at the beginning of my talk.

In preparation for such a discussion we have a major study nearing completion, to identify more closely, and in operational detail, the quickest and most cost-effective investment strategies to promote energy-efficiency. As I said earlier, important means of finance must be mobilised and properly deployed in this area. This must be done in a context of lowered expectations for economic growth, a generally restrictive macroeconomic environment and severe contraints on public expenditure. The squaring of that particular circle is one of the most important tasks for economic policy in the coming months. It is an essential, if not sufficient condition for future economic progress, and a return to acceptable levels of employment.

The author is a Superintending Engineer at the DHSS. He presented this paper at the Institute's Annual Conference at Seaton Burn in May last year.

Progress in Laundry Heat Recovery

V E SKEGG CEng MIMechE MIMarE MICIBS MInstR

Introduction

Hospital laundries are extremely heavy energy users, and the conventional washing process is one where large quantities of comparatively high grade energy are discharged to atmosphere or drain. Consequently the scope for heat recovery is great. The laundry is also an area where large quantities of high grade energy in the form of flash steam are commonly vented to atmosphere — in fact I would go as far as to state that, in many instances, the exact location of NHS laundries can be pinpointed by the discharge plume of waste steam which is issuing skywards.

The cost of energy has now reached the point where it is essential to ensure that the thermal performance of our laundry installations is improved to the economic limit. The objective of this paper is to provide a summary of prototype trials and other developments which have taken place within both the NHS and the commercial field, and to demonstrate that — despite the inherent difficulties — significant savings can be made in laundry energy consumption.

Pattern of Energy Usage

In order to make an assessment of the potential gain from the installation of heat recovery techniques in the laundry, it is first necessary to identify the pattern of energy usage in a typical NHS Laundry and the path of its ultimate disposal. A typical breakdown of the average workload of 1000 lbs dry weight by finishing process is:

Table 1

APPROXIMATE DISTRIBUTION OF ENERGY INPUT & DISCHARGE
BThU PER 100 LB OF DRY WEIGHT

Process	Heat Input	Heat Liberated Within Processing Area			Heat Discharge	
		(a) Radiation & Convection	(b) From Hot Fabric	(c) From Evaporated Water	(d) To Drain	(e) To Atmosphere
Washing	1,000,000	58,000	40,000		902,000	
Conditioning	574,000	53,000	38,000			483,000
Drying	362,000	29,000	4,000			329,000
Calendering	617,000	268,000	15,000	167,000		167,000
Pressing	261,000	180,000	3,000	78,000		
Total	2,814,000 (100%)	588,000	100,000	245,000	902,000 (32%)	979,000 (35%)
		Total 933,000 (33%)			Total 1,881,000 (67%)	

Large flatwork	500 lbs	50%
Small flatwork	150 lbs	15%
Tumble dry	200 lbs	20%
Presswork	150 lbs	15%
Total	1000 lbs	100%

The approximate distribution of the heat energy utilized both in the laundering operation and the finishing process is shown in *Table 1.* These figures are based on the use of batch washing machines, and exclude all flash steam or other losses associated with the engineering services.

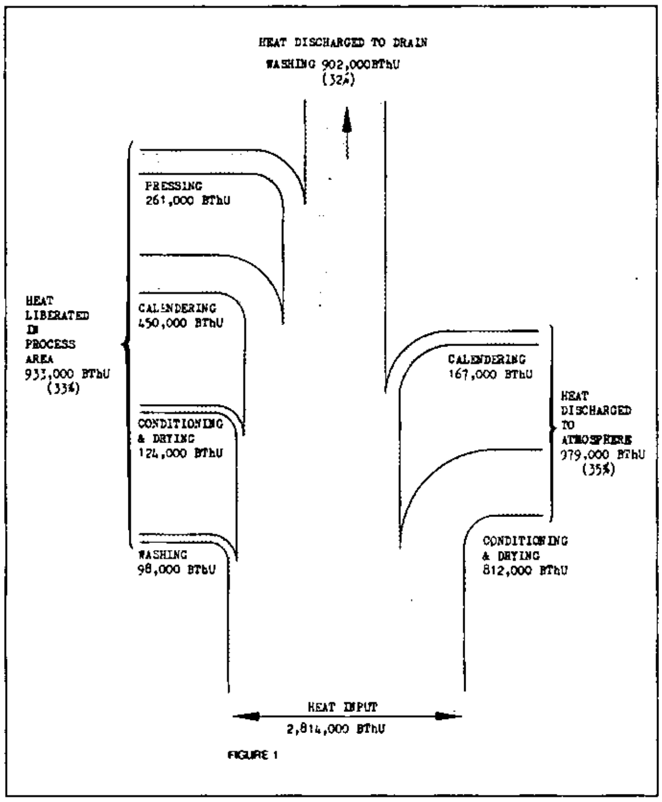


Figure 1 Sankey Diagram showing Pattern of Heat Liberation in Laundries.

The energy input of 2,814,000 BThU is equivalent to approximately 3,400 lbs of steam per 1,000 lbs dry weight, (steam conditions taken as 100 psi and 0.95 dryness fraction).

It will be observed that an approximate distribution of the disposal route of the heat energy used in the total laundry process is:

32% to drain (dirty wash liquor and rinse water);
35% to atmosphere (hot moisture laden air from tumblers and calenders);
33% into laundry process area (radiation and convection from machinery plus evaporation moisture in calender and press sections).

For ease of reference this pattern of usage is shown in the form of a Sankey diagram at *Figure 1.* The 32% of heat discharge to drain is medium grade — the average mix of rinse water and wash effluent normally lies within the range of 110°F to 120°F — and the 35% direct discharge to atmosphere from the tumbler driers and calender rolls although heavily moisture laden is of even higher thermal quality (150°F to 175°F). Clearly, from the viewpoints of heat transfer and ease of collection, these two sources of waste heat are more accessible than the 35% of heat and evaporated moisture which are liberated generally into the laundry process are, although the largest proportion of this release is concentrated in the calendering and pressing section. The least challenging of these waste heat sources engineering-wise is the tumble drier exhaust and I will therefore commence my detailed review with a brief survey of the progress of heat recovery in this particular sphere.

Tumble Driers

A number of prototype heat recovery installations have been made on both continuous and batch tumble drier machines utilising plate exchangers, thermal wheels and heat pipe recovery devices. There are important engineering constraints which must be reflected in the detailed design if these installations are to be successful. Firstly, tumbler performance is very susceptible to any 'fall-off' or diminuition in the air-flow rate. As a consequence, where any heat recovery device is fitted the fan speed and, possibly, the motor horsepower must be increased (or a larger fan fitted) to overcome the increased frictional resistance of the air circuit. Secondly, there is a considerable amount of fluff and fibres in the discharge air stream. It is imperative that specific precautions are taken against the fouling of heat transfer surfaces, and that provision is made for easy access so that thorough periodical cleaning can be carried out.

Ormskirk District General Hospital Laundry (Plate Exchanger)

The heat recovery installation at this laundry comprises an air-to-air plate type heat exchanger which serves 3 x 100 lb batch type tumbler driers. The individual machine exhausts discharge into a common delinting chamber where any entrained fluff and lint is removed by a filter screen — this process is assisted by an abrupt drop in the airflow velocity and an internal change in the direction of airflow. The hot humid air is extracted from this chamber by a separate fan and passed through the plate type heat exchanger before being discharged to atmosphere. The fresh air intake to the 3 tumblers is drawn through the heat exchanger so that it is in a preheated condition at entry to the machines. This engineering arrangement satisfies the basic requirements of avoiding lint deposition on the heat exchanger surfaces, and also avoids imposing excessive back pressure on the tumblers. Steam flow measurement has fallen from approximately 6,500 lbs/day to 4,500 lbs/day — equivalent to a saving of 30%. The steam flow charts are reproduced at *Figure 2.* The pay back period for the installation is estimated at 3 years.

Groby Road Hospital Laundry — Leicester (Thermal Wheels)

The installation comprises 3 x 130 lb Ortex batch tumblers operating in conjunction with a Schultess continuous tunnel washer. Each tumbler drier is fitted with a thermal wheel which has a corrugated aluminium media. As a result of the continuously rotating recuperator action, these heat recovery devices possess an inherent self-cleaning property — and lint which adheres to the discharge side inlet face is automatically removed by the reverse directional flow of the incoming air stream as the wheel traverses the inlet duct. The tumbler fan speed and motor ratings have been adjusted to compensate for

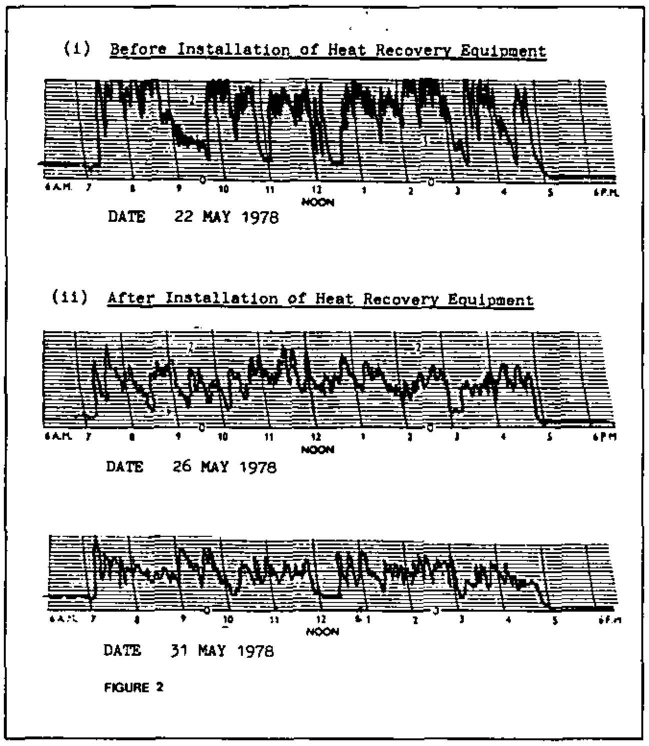


Figure 2 Steam Flow Meter Charts for Tumbler Driers fitted with Plate Heat Exchanger.

the increased frictional resistance. A detailed programme of tests were carried out by an independent research organisation, and the sensible heat recovery of the thermal wheels was established to lie between 80 and 85% dependent on whether the load was draw sheets (13 minute cycle) or top sheets (8 minutes cycle). The reduction in tumbler steam consumption with the wheel in operation averaged 14.5%. Whilst superficially this result is encouraging, it is for consideration whether the heat exchangers are achieving the optimum level of energy saving. Heat balance crosschecks were therefore produced from the test results for the wheel 'off' and 'in use' — these are set out in *Table 2.*

TABLE 2 — HEAT BALANCES BASED ON TEST RESULTS

	Top Sheets	% of Steam Input Draw Sheets
Wheel 'Off'		
Steam equivalent of Sensible Heat lost in Discharge Air	42.8	48.5
Steam equivalent of Latent Heat lost in Discharged Air	54.9	54.8
Casing Radiation & other Losses	2.3	-3.3
	100	100
Wheel 'On'	Top Sheets	% of Steam Input Draw Sheets
Steam equivalent of Sensible Heat lost in Discharge Air	7.0	9.3
Steam equivalent of Latent Heat lost in Discharge Air	62.2	57.7
Casing Radiation & other unquantified Losses	30.8	33.0
	100	100

The above analytical evidence discloses that the unquantified losses and casing radiation rose to approximately 31/33% of steam consumption when the wheel was in operation. This outcome is clear indication that heat exchanger performance is well below the optimum level. It is suspected that the wheel is entraining condensed moisture and returning it to the inlet air stream where it is being re-evaporated. This is a feasible hypothesis since the construction of the corrugated aluminium matrix is very similar to that of conventional high efficiency moisture eliminator plates. Unfortunately this cannot be proven directly from the test data as wet bulb readings were not taken. However, since the wheel has a sensible heat recovery of about 80%, it is possible to adjust the wheel 'off' heat balance figures to ascertain the reduction in steam consumption which would have been achieved if internal moisture transfer was not occuring. This adjustment is carried out in *Table 3* below.

TABLE 3 — ADJUSTED WHEEL 'OFF' HEAT BALANCE

	Top Sheets	% of Steam Input Draw Sheets
Steam equivalent of Sensible Heat lost in Discharged Air (80% Recovery)	8.6 (0.20 x 42.8)	9.7 (0.20 x 48.5)
Steam equivalent of Latent Heat lost in Discharge Air	54.9 (as previous)	54.8 (as previous)
Casing Radiation Losses (Estimated)	3.0	3.0
Sub Total	66.5	67.5
Reduction in Steam Consumption which should have been achieved	33.5	32.5
	100	100

The above assessment is based entirely on test data and indicates that the reduction in steam consumption should have been approximately 33%, which is of the same magnitude as the outcome from the less exhaustive tests on the Ormskirk plate heat exchanger — which yielded an estimated saving of 31%. The conclusion is that the thermal wheel is not a suitable heat transfer device for application where the exhaust air is heavily moisture laden, and/or approaches the dew point at its final discharge to atmosphere condition.

In conclusion, it should also be mentioned that direct air leakage past the wheel from exhaust to inlet duct was approximately 8% of the air in circuit. This constitutes a direct recirculation of moisture, and occurred because the pressure in the discharge section of the thermal wheel is greater than that prevailing on the inlet side. This machine design failure is undoubtedly a further contributory factor to the poor thermal performance. The manufacturer's response to our test results are awaited.

Heat Pipe Type Exchangers

The UKAEA Harwell has recently completed the development of a high-efficiency quick response heat pipe exchanger against a Department of Energy grant. This exchanger has now reached the field testing and proving stage. One prototype installation has been made on a Kamsin batch tumbler in a commercial laundry and a second on a Ortex 3 stage continuous tumbler at Ipswich Hospital laundry. These installations are now undergoing intensive testing and my information is limited to the initial trial runs.

The Kamsin tumbler in the commercial laundry has two fan assisted outlets which are coupled together prior to discharging to atmosphere. As a consequence of this configuration a separate heat exchanger has been fitted in each outlet duct. The fan speeds have been increased by

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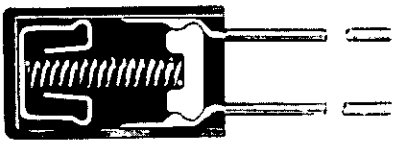
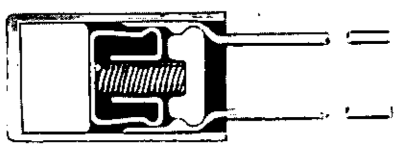
Product News

Thermal Safety

A device designed specifically for the protection of motors and transformers provides one-time protection against excessive temperatures by opening the electrical circuit and halting the current supply. Its flat profile and rectangular construction makes the M & TP particularly suitable for insertion into motor and transformer windings.





A choice of twelve temperature ratings is available, from 66°C to 152°C. The device is rated up to 3 amps at 240 volts AC and carries UL AND CSA certification.

3M UK Limited, 3M House, POB 1, Bracknell, Berks. Tel: 0344 58510.

Saving Fuel Costs

The steam trap is 'common' because it is found anywhere in a plant using steam for heating or process and its well known function is to retain the useful steam and release the condensate for re-use in the boiler. Traps happen to be placed in odd corners and at uncomfortable heights, and so long as they don't show external signs of malfunction — like leaking steam or dripping water — they will be presumed to be working effectively. Sight glasses, the traditional indicators, quickly prove ineffective due to clouding or even steam stratifying below a layer of water. So here we are with a tight little group of components ripe for attention.

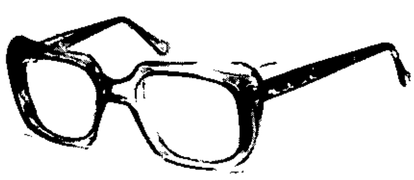
Plant Energy Surveys Limited, of Warley have equipped themselves with ultrasonic equipment which tells them if a trap is doing its job or passing steam before its energy has been used. After they have traced, logged and labelled every steam trap in the system they give the plant engineer a report. He can then replace, repair or ignore their recommendations as he pleases.

P.E.S. charge £100.00 for the first day's survey and £80.00 thereafter (costs at going to press). They reckon to cover 70 to 100 traps in a day, depending on accessibility. It may sound like a tough payment until one hears that G.K.N. saved £290.00 per week in steam generation costs after only 1 day's survey.

Enquiries to: Plant Energy Surveys Limited, 90 Edgbaston Road, Smethwick, Warley, West Midlands B66 4LE. Tel: 021-565 1843.

Safety Spectacle

The M38 is fitted with clear polycarbonate lenses which have a scratch resistant coating for increased life and are also available fitted with green anti glare coated polycarbonate lenses.



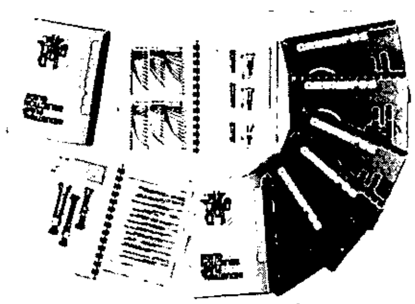
The sidearms have a wire insert and can be adjusted without the use of heat and crystal clear sideshields offer good vision with maximum protection, and is also supplied with clear toughened glass lenses.

Manufactured by: Solar Safety Limited, Kingsley Works, Walmgate Road, Perivale, Greenford, Middlesex UB6 7LG. Tel: 01-988 3366.

Brochures

Pumps

Grundfos Pumps have released the second in their series of pump reference manuals, which is aimed at assisting plant and building services engineers to select the correct size and type of pump for a given application.



The booklet has been produced on similar lines as the highly successful 'Heating Pump Guide' but covers a different range of applications, like boiler feed, general service and booster pumps, together with electro submersible and deep well pumps.

Grundfos Pumps Ltd., Grovebury Road, Leighton Buzzard, Beds. Tel: Leighton Buzzard 374876.

Process Control

The latest issue of 'Kent Review', quarterly magazine of Brown Boveri Kent, features articles on new additions to the Kent P4000 integrated process control and instrumentation system, pipeline surge control valves, a new high performance pH meter, a new Clearspan multi-point chart recorder, as well as other information on new products and applications in the field of process control, measurement and metering.

Brown Boveri Kent Linited, Biscot Road, Luton, Bedfordshire, LU3 1AL. Tel: 0582 21151.

Powercentre

A 10-page, 4-colour brochure describing the new Powercentre series of generating sets from Petbow Ltd is available on request. Based on a modular concept, the new range of generators features an electronic control system incorporating CMOS digital control technology.

Petbow Ltd., Sandwich, Kent. Tel: 0304 613311.

Heating & Air-conditioning

F. H. Biddle Limited have issued a handy pocket-size brochure. Using a series of 'tagged' sheet within a wallet folder. Its nine sections include Fan Convectors, Natural Convectors, Industrial Heaters, Coils, Air Handling Units, Fan Coil Units, Small Packaged Air Conditioners, Chillers and one for equipment such as heat recovery systems and ductwork noise attenuators.

F. H. Biddle Ltd., Newtown Road, Nuneaton, Warwickshire CV11 4HP. Tel: 0682 348233.

Differential Digital Thermometer

Binder Engineering has published a technical leaflet describing their new Model C 200 Differential Digital Electronic Thermometer. The battery powered Model C 200 is a highly accurate digital portable instrument for measuring single point, two points and differential temperature. Range is -50 to +150°C and resolution 0.1°C. Measuring 135 x 90 x 45 mm it weighs only 500 grams. A copy of the C 200 data sheet is available on request.

Further information from Binder Engineering Ltd, 6 Beaumont Rd, Banbury OX16 7RH. Tel: Banbury 57404.

Call Unit Mini Handset

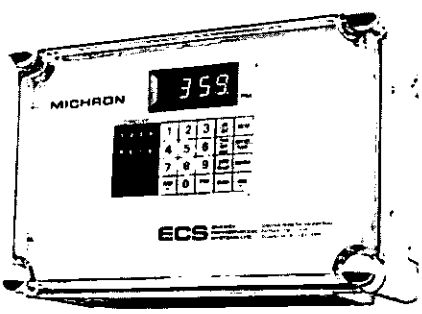
A lightweight miniature handset, rigidly moulded in brown and orange, is now available for use with hospital nurse call systems.

Designed and marketed by Static Systems Group, the unit is claimed to be compatible with existing systems. It comes either as a mini hand set or patient call push, and as an introduction to the unit, the manufacturers are offering the call push for half price — on receipt of a cheque for £3.74.

For further details: Static Systems Group Ltd, Heath Mill Road, Wombourne, Wolverhampton. Tel: Wombourne 895551.

Microprocessor Time Control

A versatile microprocessor-based time controller, now available in the UK, can be used to switch up to 8 operations (or circuits) on independent time programs which are entered by means of a simple keyboard operation. At its simplest, it will repeat ON/OFF operations at the same time every day on a 24 hour cycle.



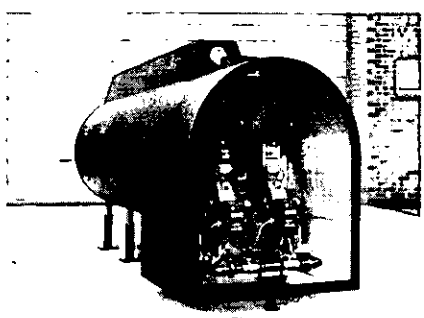
The system can be used to control heating plant and water heaters, and to ensure that other loads are switched off outside normal working hours and at weekends, with a power switching capacity of 8 amp per circuit (resistive) and a power consumption of 6 watts.

For further information: Paul Coleman, ECS Energy Conservation Systems Ltd., Gresham House, Twickenham Road, Feltham, Middx. Tel: 01-894 5511 ext. 305.

Weather Proof Water Heater

A fully insulated and weather-proofed water heater has recently been introduced by Beaumont.

Designed to be installed outside, for example on flat roof areas, it enables domestic and process hot water demands to be met by a completely automatic plant, even where a boiler room is not available or space is at a premium.



The Beaumont uses a simple heat-exchanger principle which transfers heat directly into the water only as and when it is used, thus eliminating the expensive and wasteful storage of large volumes of hot water. Fourteen basic combinations are offered. These range from 100 gallon to 500 gallon storage with heating capacities from 150,000 Btu/h to 1,250,000 Btu/h.

Contact: Beaumont (UK) Limited, Romsey Industrial Estate, Greatbridge Road, Romsey, Hampshire.

Curing pipe leaks

When a pipeline is under pressure, even a minor leak is a serious problem. Stopping leaks, especially in continuous process industries, demands both skill and technical knowledge. For fifty years Furmanite Engineering Ltd have been providing an extensive leak sealing service with the use of a special sealing compound which 'cures' leaks even though the pipeline concerned remains at full pressure and temperature.

The process involves forming an injection moulding around the failed gasket. The gap between the flanges is first fitted with a peripheral seal, then a compound is injected through adaptors fitted to the bolts, which thus fills all the grooves and pits in the face of the joint. Machining on site allows flanges to be resurfaced without interfering with the integrity of the pressure system.

Further information from: Peter Chinn, BAHCO TOOLS LTD., Beaumont Road, Banbury, Oxon. Tel: Banbury (0295) 57461.

Self-contained Blowpipe Set

Startfire is a small, compact, self-contained micro-blowpipe system incorporating a standard butane gas cylinder and a rechargeable oxygen cylinder.

When completely charged for use the unit weighs 8.5 kg, and the equipment supplied as standard includes a C. S. Milne micro blowpipe incorporating gas/oxygen control valves and interchangeable nozzles. Using the specially prepared adaptor hose, the cylinder can be recharged from a standard oxygen cylinder in a few minutes with the minimum of fuss.

For information: C. S. Milne Limited, Peckleton Common, Earl Shilton, Leicester LE9 7RG. Tel: 045-57 2471.

Cable Locator

The twin-coil search antenna principle incorporated in the Electrolocation GPR 404 is claimed to allow the receiver to pinpoint the position of buried cables and pipes very accurately even in 'congested' areas on manufacturing sites or in the highway. Separate peak signals are detectable over each service, unlike the broad signal received with a single-coil instrument.

Other advantages of the twin-coil system includes the elimination of interference from transformers or overhead cables, a push-button depth estimation facility, and the use of radio signals re-radiated from buried metallic services to provide an additional method of detection.

Electrolocation Ltd., 129 South Liberty Lane, Bristol BS3 2SZ. Tel: 0272 634383.

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