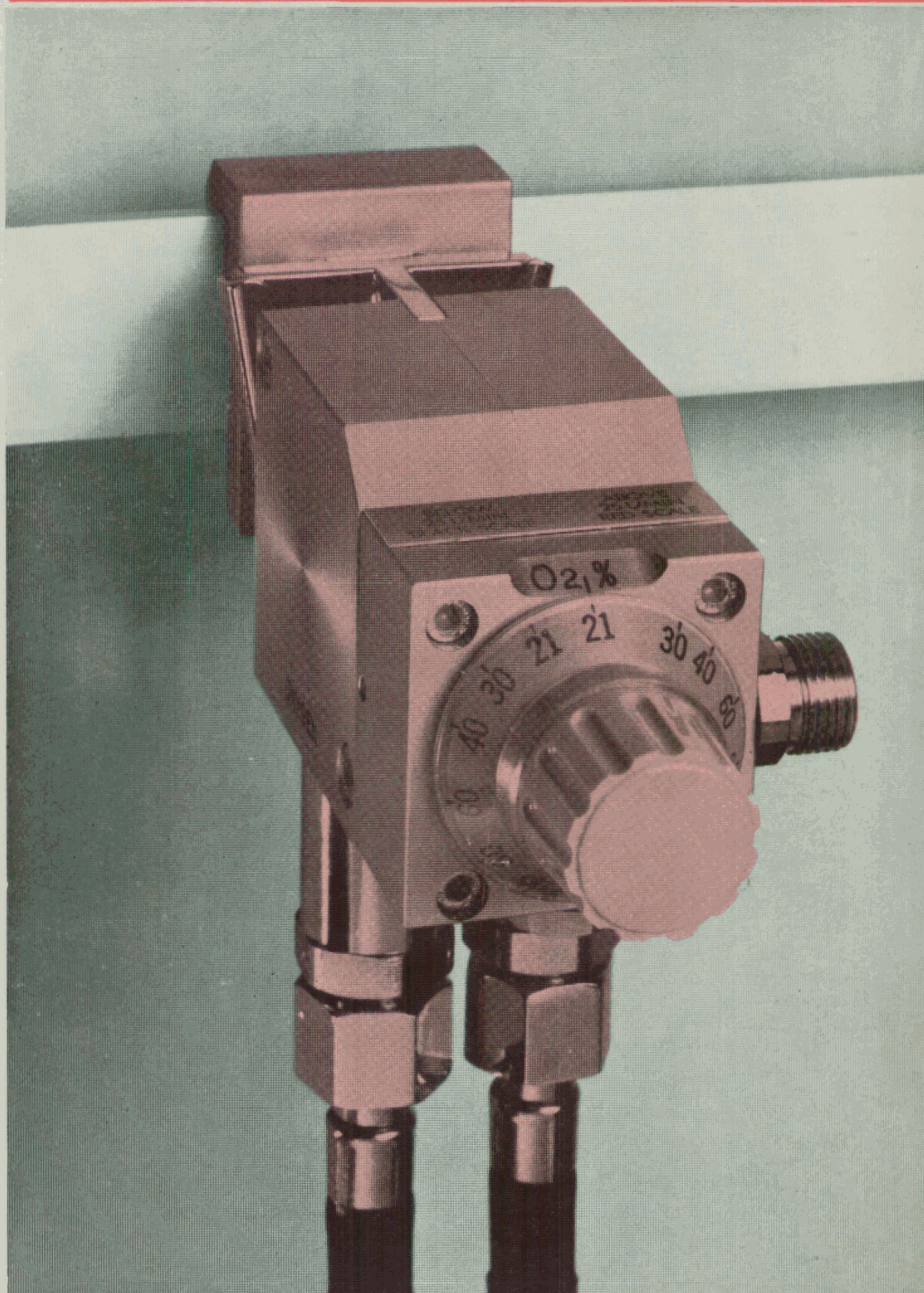
HE

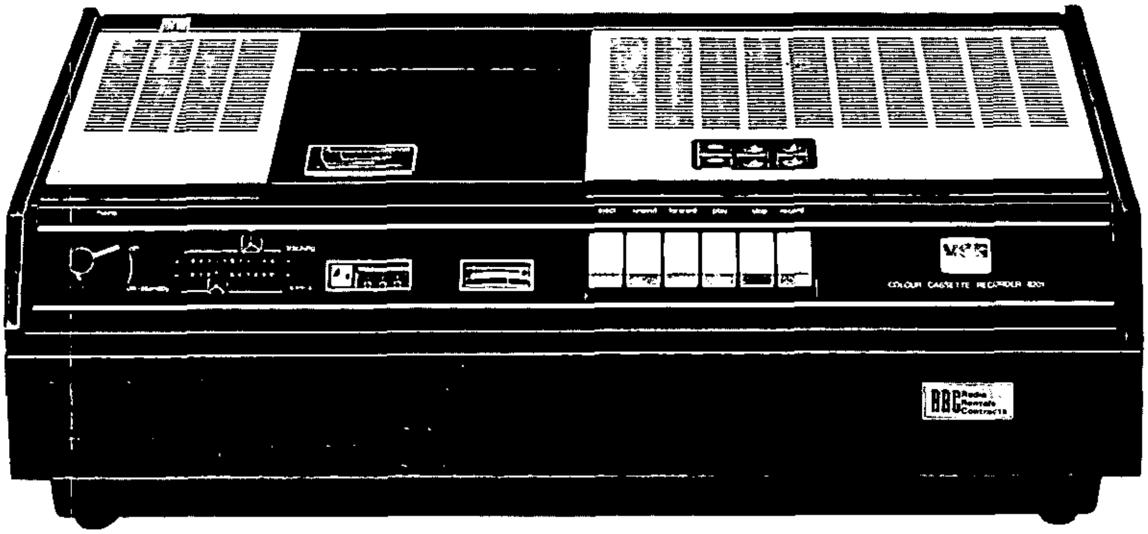
Hospital Engineering

APRIL 1975



Institute of Hospital Engineering

You need this like you need holes in the head



(The holes you see, hear and speak through)

We're not criticising your face as God fashioned it, but it does have limitations. Five of its fittings are designed to receive information (and store it if you've a faultless memory), only one to transmit – and that at audio level only.

So if you need to communicate effectively to one or many people; if you need to teach, train, demonstrate, inform, sell – you'll find this gives a remarkable extension of your own power to persuade and communicate. Let us tell you why.

What does it do?

It records and plays back at video level. It broadcasts. It broadcasts in colour or monochrome. It broadcasts from outside stations, pre-recorded tapes, your own tapes or your camera.

Sorry – it can't tap-dance.

Is it reliable?

The Radio Rentals Contracts V.C.R. Colour Video Cassette Recorder (bit of a mouthful – sorry about that) is one of the most reliable electronic teaching aids in existence. The Television unit is one of the famous Radio Rentals Baird range, used in over a million and a half homes.

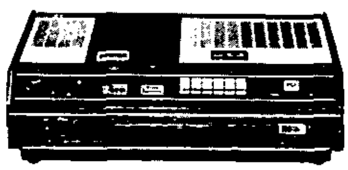
However, suppose anything ever does go wrong? We can echo the proud but practical boast of the American Civil War General, Bedford Forrest, and 'git thar fustest with the mostest', because we've over 1,000 service centres and the largest team of trained technicians in the business.

Does it cost the earth?

To purchase – the V.C.R. equipment is about £100 less than our nearest almost-competitor. To rent – it costs only about 50p a day.

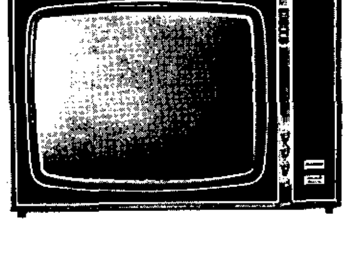
How about getting in touch?

Contact us now. Quote HE.2 We'll be delighted – what's more important, we're sure you will too.



The Radio Rentals Contracts V.C.R. Colour Video Cassette Recorder, as used by the B.B.C. – who know a thing or two about electronics.

Add that to this
(you've probably got one – if you haven't, we can rent you one – or any number) and you've got what we call Unit Video – but you can call it a donkey, because it'll do a lot of your drudgery and leave you to the business of business. Write in – it's truly worth your while.



RRC Radio Rentals Contracts Ltd.

Apex House, Twickenham Road, Feltham, Middx. Tel: 01-894 0991.

'Hospital Engineering'
is published ten times a year by
Peter Peregrinus Limited,
PO Box 8, Southgate House,
Stevenage, Herts. SG1 1HQ,
England
(PPL is a member of ESIP)

Individual copies cost
£1·10 (postage paid)

The annual subscription is £10·40

Average circulation per issue
(January - December 1974):
2169 (ABC)

Editor
David Mackin, B.Sc.

Graphics Manager
M. C. Partridge

Circulation Manager
R. C. Sutton, B.A.

All correspondence relating to the Journal should be addressed to:
'Hospital Engineering',
Peter Peregrinus Limited,
PO Box 8,
Southgate House,
Stevenage, Herts. SG1 1HQ,
England
Telephone: Stevenage 3311
(s.t.d. 0438 3311)

Advertisement Manager
Barry Weitz,
Advertisement Department,
Peter Peregrinus Limited,
Station House,
Nightingale Road,
Hitchin, Herts. SG5 1RJ
Telephone: Hitchin 53331
(s.t.d. 0462 53331)

©1975: Peter Peregrinus Limited

This publication is copyright under the Berne Convention and the International Copyright Convention. All rights reserved. Apart from any copying under the UK Copyright Act 1956, part 1, section 7, whereby a single copy of an article may be supplied, under conditions, for the purposes of research or private study, by a library of a class prescribed by the UK Board of Trade Regulations (Statutory Instruments, 1957, No. 868), no part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means without the prior permission of the copyright owners. Permission is, however, not required to copy abstracts of papers or articles on condition that a full reference to the source is shown

Multiple copying of the contents of the publication without permission is always illegal.

The Institute of Hospital Engineering,
20 Landport Terrace,
Southsea, Hants. PO1 2RG,
England
Telephone: Portsmouth 23186
(s.t.d. 0705 23186)

Secretary
J. E. Furness, V.R.D.

HE

Hospital Engineering

Incorporating 'The Hospital Engineer'

Vol. 29
April 1975

The Journal of The Institute of Hospital Engineering

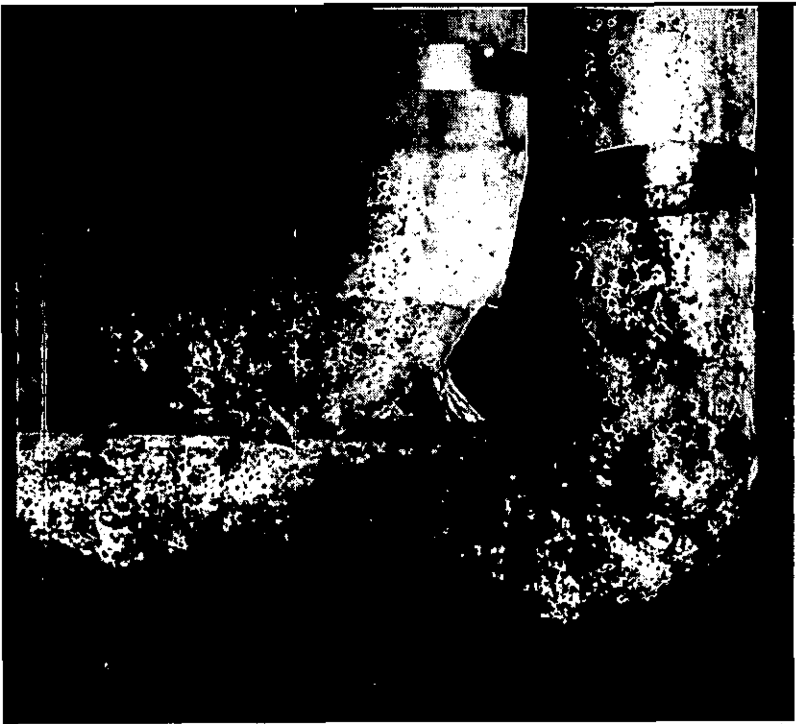
Contents

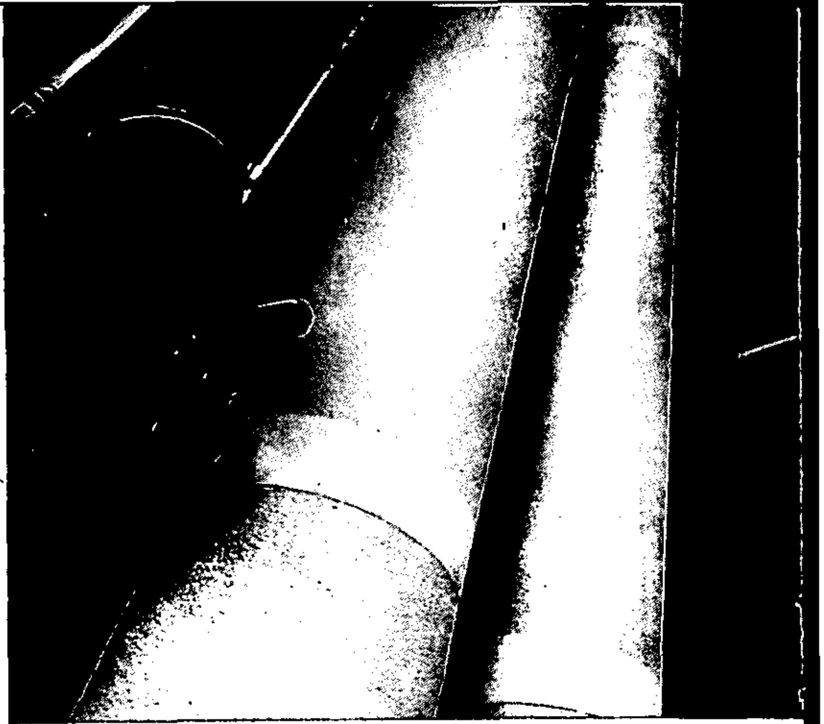
Special features

Departments

Front cover: The Medishield oxygen-air mixer for controlling oxygen and air mixtures for lung-ventilation and oxygen-therapy applications
(Photo: BOC Ltd).

Neither the Institute nor the Publisher is able to take any responsibility for the views expressed by contributors





You've got to face it.

Insulex facings make wet facing unnecessary and out of date.

Insulex facings make wet facing systems, and the skilled labour that they need, both unnecessary and out of date.

Specifiers and contractors are realising that insulation panels laminated off site to decorative, decorable, vapour proof, rot resistant, washable Insulex facings save labour *and* delays–and produce a better result. And on top of all this give a Class 1 surface spread of flame to BS 476 Part 7.

Insulation contractors find that Insulex facings are easier to apply than wet systems and are more profitable.

We can give you examples from a wide range of applications, such as a moisture vapour barrier on 12,000 feet of low temperature pipeline at the Esso refinery at Fawley, or in the 11 acre cold store, at Stratford operated by Frigoscandia, where Insulex 360 was used as an insulation facing and vapour barrier, resistant to chemical attack. And insulation panel manufacturers are finding that Insulex makes better panels possible for less outlay.

INSULEX 310 at Addenbrookes Hospital, Cambridge

Take the example shown here. Insulex 310 reflective foil, one of the range of 13 Insulex facings, was used by contractors Kitsons Insulations in the upgrading of the hospital's out-patients department to provide for heat and energy conservation.

Sandwiched between 2″ of glass fibre and the perforated ceiling tile itself, Insulex 310 will be the perfect heat insulation material. It also offers vapour and dust barrier qualities–particularly important when you remember a hospital is a sterilized area.

Think what you could do with Insulex. Then write for the Insulex facings book.

Have the facts at your fingertips.

St. Regis Coating and Laminating Division, British Sisalkraft Limited
Knight Road, Strood, Rochester, Kent ME2 2AW Tel: (0634) 74171

SISALKRAFT

Hospital Engineering

Vol 29
April 1975

Sanitation in hospitals

by G. TUSON
C.Eng., M.I.Mech.E., M.I.P.H.E., F.I.Hosp.E.

The development of major hospitals has increased the complexity of sanitation problems, creating the need for a new appraisal of sanitation hazards and engineering solutions. The study group responsible for this work have, of necessity, posed questions relating to current practice in engineering and management terms. This article discusses a number of the many issues involved.

Clinical standards

The middle of the last century saw the emergence of two of our greatest innovators, both recognised today for their contributions to civilisation; Florence Nightingale for her contribution to the development of nursing and nursing care, and Isambard Kingdom Brunel for his civil-engineering works.

It is seldom realised that these two people made the greatest contribution to sanitation in hospitals in any era. Miss Nightingale published a booklet entitled *Notes on nursing* in 1859, which was described by Sir James Paget as 'the most valuable contribution to sanitary science in application to all medical institutions that I have ever read', the opening paragraph of which states 'It may seem a strange principle to enunciate as the very first requirements in a hospital that it should do the sick no harm. It is quite necessary, nevertheless, to lay down such a principle because the actual mortality in hospitals, especially those of large, crowded cities, is very much higher than any calculations founded on the mortality of the patient treated out of hospital would lead us to expect'.

Miss Nightingale's contribution to sanitary science was not based on a theoretical approach to that subject, but forged in the mud, squalor and disease at Scutari in the Crimea. The mortality of the Crimean disaster, 73% in six months from disease alone, was the ghastly fruit, not of war, but of the system which controlled the health administration of the British army.

The battles with the establishment which Florence Nightingale fought consequent to this were concerned with the application of sanitary science to hospitals. It has been described as a revolutionary thesis, that the high rate of mortality, then invariable in large hospitals, was preventable and unnecessary. Hospitals showed their appalling high death rate because they flouted the elementary principles of sanitary science. The answer to hospital mortality was neither prayer, nor self-sacrifice, but better ventilation, a higher standard of cleanliness, better drainage and better food.

In seeking solutions to hospital sanitary problems in the Crimea, Florence Nightingale was led, in later years, to become involved in the planning of hospitals based on sanitation concepts. Her influence was worldwide, extending to the development of drainage systems for the city of Calcutta.

Her attention to detail and statistical methods proved the undoing of those who opposed her. She was elected one of the first members of the statistical society and presented one of its first papers 'Miss Nightingale's scheme for uniform hospital statistics'.

Towards the end of the Crimean war the British government had become deeply concerned and embarrassed by the statistical reports of Miss Nightingale on the deplorable hospital facilities at Scutari. By January 1855 the condition of the troops had become a national scandal and a vote of censure was passed on the government. A committee of inquiry was set up and a sanitary commission sent to investigate the situation.

On the 16th February 1855, I. K. Brunel was asked if he could design an improved hospital for the government, which could be quickly built in England and shipped out for assembly to some predetermined site. By the 5th March, Brunel had planned his hospital of

---

Mr. Tuson is Chairman of the DHSS and Inter Regional Health Authorities Study Group in Public Health Engineering

This article is based on a paper presented by Mr. Tuson at a symposium, held at the Royal Society, organised by the Institute of Public Health Engineers

1000 beds, built of standard units, each consisting of two wards, each for 24 patients, completely self-contained, with nurses rooms, water closets, shower baths, vapour baths and outhouses. Each patient had 28 m^3 of air, and a large ventilation fan was included to force air into the wards to pressurise the wards and not to extract, as it was felt that it might draw smells from the water closets into the wards. As the water closets were a new apparatus to the troops, printed notices were attached to them explaining how to use them. It was also interesting to note that Brunel arranged for boxes of toilet paper to be supplied with the water closets. There were also fixed wash basins, invalid baths and a wooden trunk drainage system.

Each part of the prefabricated hospital was designed so that it could be carried by two men. Erection began at Renkioi on the 21st May and, by the 12th July, the hospital was ready to admit 300 patients. By the 4th December it was equipped with its full quota of 1000 beds. Before the end of the war, 1500 sick and wounded men passed through its wards, of whom only 50 died.

It is worthy of note that on completion of construction the hospital was completely watertight.

The speed at which Brunel acted verged on the incredible. As an object lesson to those of us who are involved in hospital design perhaps his own comments give an indication of his thinking at that time: 'I would only add to my instructions attention to closet floors by paving or other means so that water cannot lodge in it but it can be kept perfectly clean. If I have a monomania it is a belief in the efficiency of sweet air for invalids and the only point of my hospital I feel anxious about is this'.

It may be said that the Brunel Hospital was well ahead of its time of anything available in England. It was only following the severe outbreaks of cholera in the 1840s that mains drainage and Brunel's methods were slowly introduced.

The death rate in the UK did not fall decisively as a result of sanitary reform until after 1870. It is a fortuity of history that the only major research into hospital sanitation is being undertaken by the University which bears Brunel's name.

Problems

The absence of defined clinical standards which the engineer may use as guidelines to his work does not preclude the engineer from having an appreciation of the general standards required for sanitary areas, as the general rule is simply that these areas must not be a source of infection. The publication *Infection in hospitals* makes scant reference to sanitary systems.

One must ask the question: 'Why do eminent authors fail to recognise the problems associated with the most potentially infective system in a hospital, i.e. the drainage system?' I doubt the authors were unaware of the problem; they chose not to investigate it simply because the 'old-fashioned' drainage systems installed in hospital buildings over the years did, in fact, work. For, by and large, they were external systems where soil pipes were installed externally on the walls of the buildings and not internally as is the case in new designs. It is only in recent times that one has come across many major problems generated by faulty drainage systems in new hospitals.

The problems that have arisen from various causes are:

(*a*) the increase in the number of sanitary appliances per bed
(*b*) the design of modern sanitary appliances
(*c*) (i) architectural design based on planning requirements
 (ii) the increase in engineering-service requirements
 (iii) the design requirement that all pipework should be hidden in the structure
 (iv) the problems of co-ordination
 (v) the use of internal manholes
(*d*) the lack of expertise in design
(*e*) the use of CP 304.

On all new hospital-ward complexes, the provision of sanitary appliances is at a minimum of one per bed, rising to three per bed in maternity hospitals. The following statistics of new hospitals are interesting:

Hospital	Beds	Sanitary appliances
A	480	515
B	1119	1600
C	500	640
D	80	150
E (maternity)	80	293
F (maternity)	200	451

The prewar level was in the region of four beds to one appliance, although ten beds to one appliance is not unknown.

The increased scale of installation, coupled with economics of building, restricted site, dimensional co-ordination, work study and other statistical parameters, have an overall effect in reducing the area available for the installation of drainage services.

Sanitary-appliance design

The general principles of design of sanitary equipment have not changed dramatically over the years, although appliances have become more refined and aesthetically presentable. This study group has been concerned to evaluate the design of sanitary appliances and the general sanitation levels which they produce. Work has been carried out on various items of equipment, perhaps the most important being related to water closets.

The first work to determine infective hazard of water closets was carried out by Commander Darlow,[1] of the Microbiological Research Establishment at Porton in 1959. This work showed that the flushing of a washdown-type water closet could produce a bacterial aerosol. Further work carried out for the study group by one of its members S. W. B. Newsom of Papworth Hospital extended the work of Darlow, and supported by Darlow a paper was produced and published in *The Lancet*.[2] This indicated that if simple cleaning and maintenance of w.c.s was carried out there was little to suggest that they could be a source of infection, with the exception of problems generated by salmonella or such diseases that were present, but no evidence is available to incriminate the toilet with such infection. Work carried out by another member of the study group, C. L. Langshaw, to determine whether aerosols were generated by British Standard washdown w.c.s showed that on the test of 20 different w.c. pans all generated an aerosol in the flushing cycle. Eventually one was found (not complying with the British Standard) which had an excellent flushing capacity and did not generate an aerosol, but this went out of production owing to cost.

To date we are not aware of any washdown w.c. that does not generate an aerosol and would suggest that there is certainly room for improvement in their design.

As a matter of interest the Jennings pedestal vase of 1884 won the gold medal award at the Health Exhibition in 1884, being judged 'as perfect a sanitary closet as can be made'. In a test, it completely cleared with a 9-litre flush ten apples averaging 30 mm diameter, one flat sponge about 110 mm diameter, plumbers' 'smudge' coated over the pan and four pieces of paper adhered closely to the soil surface. I wonder how many of our modern closets would survive this stringent test.

The only alternative system is the vacuum type which generates positive suction, overcoming the aerosol and stranding problem. The study group is making observations on this possible solution.

Architectural design

The ever-increasing cost of building has, in recent times, caused architects to develop more compact designs based on planning requirements. In particular, the use of deep-core solutions to conserve space has also reduced or placed stringent requirements on access and accommodation for services. The increasing use of sanitary appliances and service requirements for them in this type of building has created many design problems.

Evaluation of two completed hospitals showed that, where staff were expected to work in deep-core situations, this created frustration and resentment, and on one project all deep-core rooms had to have walls removed which were fitted and replaced by louvred windows.

The situation became so serious that the Institute of Naval Medicine was consulted and it produced a report stating unequivocally that deep-core solutions should not be used where staff were expected to work for long periods.

An individual evaluation team also drew the same conclusion and stated that deep-core solutions were unsuitable for staff occupation (this should not be confused with open-plan concepts).

Deep-core plans create serious problems in the design of drainage systems.

Service requirements

The increase in engineering-service requirements for air-conditioning zone-controlled heating systems etc. has compounded the problem, in that the sanitary-drainage system, being based on a gravity flow, is inflexible and therefore its space requirements must be positively determined at a very early stage. Unfortunately past experience has shown that, unless this service is deliberately designed and installed under adequate supervision, problems are created.

Hidden pipework

That service pipework should be hidden within the structure and not exposed would be accepted by all who have an appreciation of aesthetics, but such a requirement again creates problems of access for maintenance and observation for leakage which, on a drainage system, can be serious.

Co-ordination

The problem of design for co-ordination has been dealt with in a previous article.[3]

The problem of co-ordination may be overcome by the use of preferred routes, each service having a distinct route over which other system designers may cross by permission. Owing to the size and inflexibility of the drainage services, the study group developed a solution based on two propositions:

(*a*) that, as drainage is a serious pollutant, the drainage system shall be designed to discharge from sanitary appliance to main drainage as quickly as possible

(*b*) that a preferred route shall be established to ensure as little interference from other services as possible, thus reducing co-ordination and access problems.

The solution has four elements related to branch soil pipes:

(*a*) all falls shall be 1:40

(*b*) no horizontal run of 100 mm soil pipe shall exceed 6 m

(*c*) access for maintenance shall be above floor and flood level

(*d*) the maximum pipe diameter allowed across corridor ceilings shall be 35 mm.

Internal manholes

I have to hand a copy of a letter to Florence Nightingale dated 3rd November 1863, concerning the old hospital in Winchester, pointing out the presence of a cesspit under the hospital. Deaths from typhoid had been attributed to the presence of this cesspit. On this evidence Miss Nightingale was pressing for a new hospital to be built outside the city.

The letter indicates a considerable battle by the writer and Miss Nightingale. The letter points out that, in 50 years prior to these deaths, there was no evidence that infection had been caused by the presence of the cesspit. Miss Nightingale was adamant and the new hospital was built on the outskirts of Winchester, on top of a hill, with external manholes. The total benefits of this decision are incalculable.

Recent designs of deep core and the high level of sanitary requirements had made the installation of internal manholes inevitable. One knows of new hospitals where manholes are installed down the centre of the ground-floor corridor when, for a little extra cost, they could quite easily have been placed outside the building. One begins to wonder in this age of technology whether we are becoming too complicated and creating problems and hazards which our forefathers eliminated.

Responsibility for design

The lack of expertise in the design of drainage systems is a result of the fragmentary approach to the design of buildings. Not all drainage systems are designed by public-health engineers. The drainage system has also suffered at the hands of contractors who have worked by rule-of-thumb method. As a result, the study group was commissioned to prepare a drainage-design guide. It is hoped this will be produced in 1975/76. This will, we hope, ensure that designers and installers will work to improved engineering methods.

Code of Practice 304

Since these problems were occurring on many other projects, the Chief Engineer at the Department of Health & Social Security set up the study group in 1967 to investigate public-health engineering problems in hospitals and, in particular, to study CP 304.

Preliminary studies of the code were carried out by Mr. Nye of the East Anglian Regional Health Authority on a test rig at Cambridge. The results of his work led to the view that CP 304 was inadequate for hospital work.

The first basic problem was to decide the form of standard test that should be applied to hospital-drainage installations. From experience gained on blockages around the country it was finally agreed that the standard test should be one sanitary towel and three paper towels, plus simulated faeces. The work at Cambridge indicated that a long-term study was required to determine new design criteria for hospital drainage systems.

Brunel University was commissioned in April 1974 to carry out a preliminary study to identify the presence of a problem and seek to quantify its range. This work was carried out between the months of May and September of this year. The result is a comprehensive document which clearly identifies the need for a new design method for drainage systems. Brunel is now commissioned to carry out a 3-year study to develop new design criteria and methods. The Brunel results confirmed exactly the results of the simple test rig at Cambridge.

The solution adopted by the study group referred to under co-ordination incorporates a factor of safety which, if applied to installations, will ensure a degree of certainty that the system will work. However, this was based on observation and not on any scientific data, and until such time as the work at Brunel shows otherwise, we feel it would be wise to adopt these recommendations. The test rig at Brunel University was constructed and consisted of 16 m of 100 mm diameter transparent pipe capable of adjustment and with provision for the introduction of two 135° bends. (Fig. 1) A range of

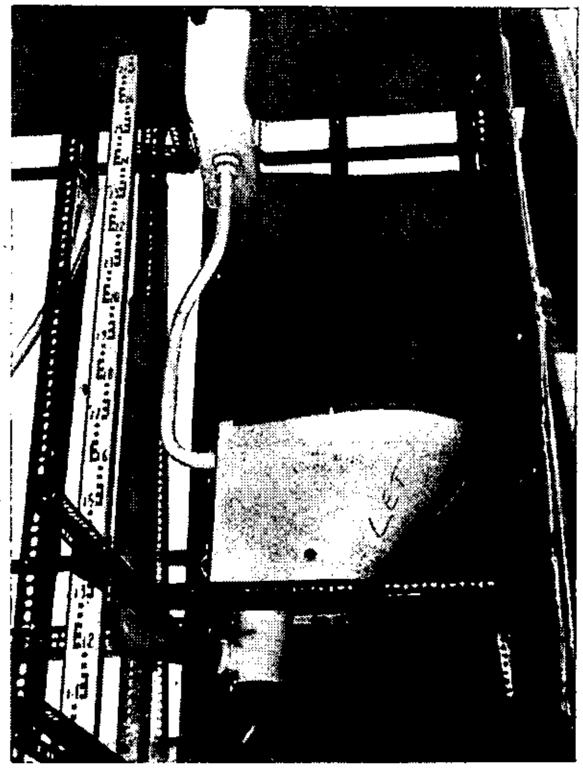


Fig. 2. Water-closet arrangement. Note position of vent pipe

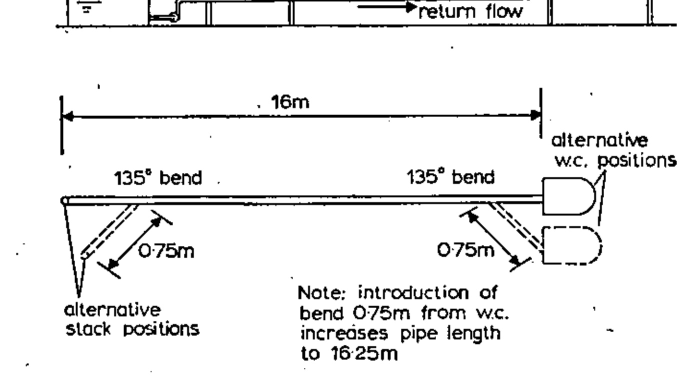


Fig. 1. Layout of test pipeline and support framework

material combinations based on sanitary towels, paper towels and simulated faeces was introduced into the pipe via a 9-litre flushing box-rim S-trap w.c. pan, with provision for venting the w.c. discharge. Five photo-electric sensors and lighting sources were mounted at 3·71 m intervals along the pipe, each sensor being connected to a separate pen recorder panel and the system was thus capable of providing average velocity results across four sections of the pipeline. The pen-recorder system is used to determine the velocity (Figs. 2–5).

The results from the paper readout were transferred to a computer programme and all results passed through the computer.

The conclusions that may be drawn from these initial tests are:

(*a*) The probability of a stoppage was dependent on the shape of the material assumed on entry to the waste pipe which is dependent on the w.c. action. It was found in tests that the w.c. action created a random pattern of discharge. The different items of waste material were ejected in a different mode on each discharge.

(*b*) The probability of a stoppage occurring was dependent on the velocity at which the solid entered the pipe section.

(*c*) Bends introduced in the pipeline, it was found, *could be correlated for gradient. In the further work,* the study of the influence of bends can be usefully extended.

(*d*) Self-clearing tests on 1:80, 1:90 and 1:100 grades

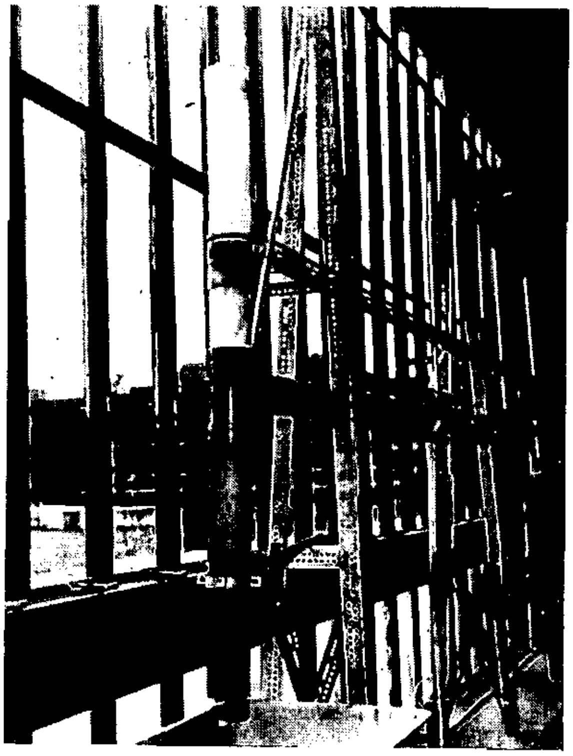


Fig. 3. Arrangement of vertical stack

show that these grades do not clear, but always have some deposited matter along their length. This *could become critical if stoppages were allowed to* dry out.

The work carried out by Brunel is not yet published or completed, but we feel that attention should be drawn

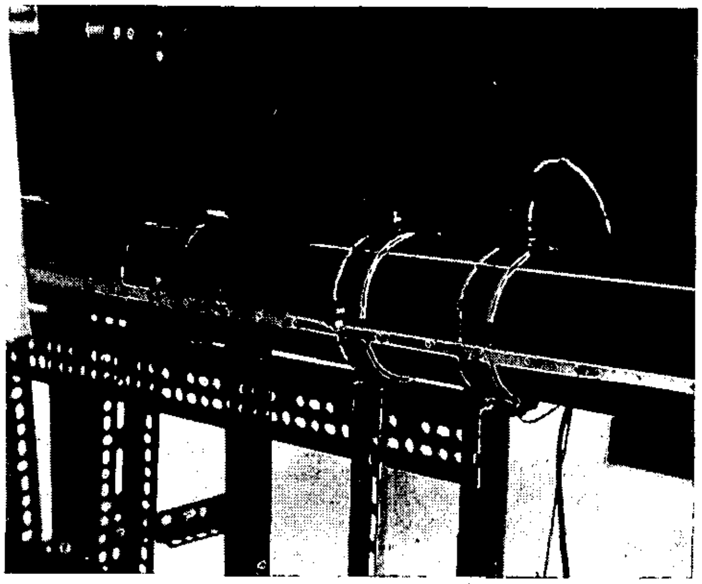


Fig. 4. Pipe connector, photoelectric sensor and light-source arrangement

to the problems that are being identified in CP 304 in relation to hospital installations.

One of the significant factors in the work at Brunel was the failure of the water closet to clear on each flush. The unit used had a 20% failure level. In fairness, no doubt the w.c. was not designed for the tests applied, but this corresponds to the levels of failure that one finds in hospital appliances.

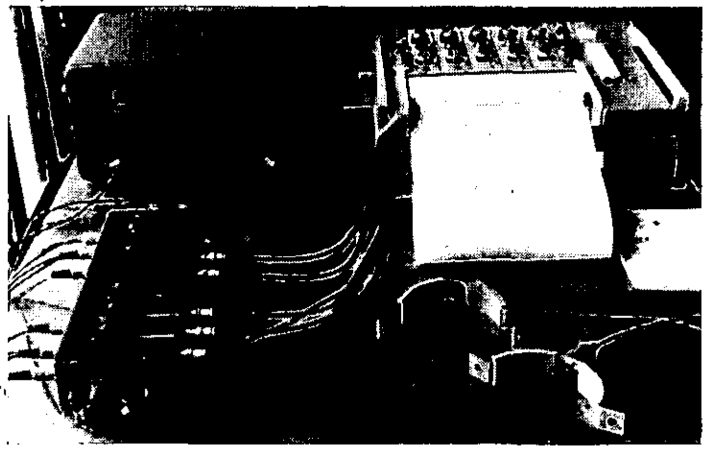


Fig. 5. Layout of velocity-recording instrumentation

Back row (left to right): 24 V light power supply and 10 V sensor supply, and H327 5-pen recorder

Front row (left to right): 5-channel output control box and sensor, and light source mounted on Marley 2-piece pipe clamp

The incidence of stranding indicated on falls of 1:80 and 1:90 is significant if considered in reliability terms. The question arises as to whether we should allow systems to be designed that are dependent upon a knock-on or 'push–pull' effect; that is the stranding of one discharge is cleared by the next. The question of reliability based on probabilistic terms is important and one can only say that in the hospital situation with the most dangerous service, that 100% reliability should be sought as the standard. This may be arguable. There can be no doubt that one stranding is sufficient to be the originator of a subsequent blockage and we feel that the importance of ensuring 100% reliability justifies the view that internal drainage should be designed to ensure that stranding does not occur on any discharge.

Reliability has two ingredients:

(*a*) safety

(*b*) availability.

First is the system safe to use? Is it safe as far as patients and staff are concerned? Is there a possibility of infection? Certainly a system cannot be said to be safe if it is continuously flooding or generally creating an infection hazard, and thus every endeavour must be made to ensure that as far as possible this probability is reduced to the minimum.

Secondly, the availability of equipment for use by staff or patient should be maximised. This means that quality must be applied to the purchase of equipment as well as the highest standard of reliability on the drainage system.

One of the most significant arguments made at the

Wessex Regional Health Authority in recent years was the request to the authority by the regional supplies officer that purchasing should be based on three elements:

(*a*) quality
(*b*) service
(*c*) price

in that order.

The Regional Health Authority agreed to this recommendation, which has meant that quality control has been of the greatest importance. From this it is apparent that looking at reliability in safety and availability terms derives the maintainability function. Reliability and maintainability are functions of quality, service and price.

It may be argued that to insist on quality is expensive in capital terms but there has long been a dichotomy between capital and revenue consequences, whereas we should be thinking rather in whole-life terms where capital and revenue are seen as one element.

We are facing change in so many ways, the most recent being the inflation which affects us all, not only in our private lives but in the work we have to do. It may be the time to ask pertinent questions. Can we afford to design obsolescence? Can we afford reduced capital costs at the expense of revenue? I suggest that we must see our designs as total-life concepts. If a building is to last 60 years then I suggest that the services installed within should be designed to do the same. To some extent this is impossible, as many engineering installations such as boilers have only a 15-year life expectancy, but sanitary installations are an exception.

The drainage system at Winchester Hospital, designed and built in the 1860s, has remained to this day. The manholes of Thomas Crapper are to be found in Westminster Abbey.

Drainage systems are known for their longevity, but one must question some more recent designs where new materials and new ideas are being thrust upon us by well meaning manufacturers. I do not mean this as a criticism, I simply ask: How long will 'O' ring or 'D' ring connections last without leak, or expansion? How reliable are expansion joints? The old fixed systems served us well in total-life terms. Will the new concepts do the same?

This fundamental service in a hospital must be considered as a whole-life installation and be costed in these terms, including whole-life reliability and maintainability.

Maintenance

It may be said that every line on a drawing has a maintenance consequence; that maintenance begins at that point in the design office. It is important therefore that the designer of drainage systems should understand the maintenance needs of his design and their cost consequences, and this should be part of his professional training.

It is said that maintenance costs of many installations lie between 8–15% of the capital cost per annum. From personal experience in the biomedical-engineering field the maintenance cost of some sophisticated equipment is certainly around 15% and one might say that with certain installations we are buying maintenance.

The complexity with which we are faced in our modern buildings represents a challenge to those of us who are concerned with design and installation, to produce systems that we can rely on, and that is the objective of the work of the study group.

Inter-disciplinary relationships

The public-health engineering service cannot be seen in isolation, but as an integral part of the building process, to be designed in association with all other services. The question of how professionally we associate in this work is one problem which needs discussion. The relationships between the various building professions has its impact on the success or otherwise of building projects and here I am thinking particularly of the architect/engineer relationship. Boundary battles, claims, counter claims, power bargaining and lobbying are, if not well known, certainly not unknown. I suggest that such situations are the result of the professions' failure to understand management concepts, and the type of management structure interdisciplinary relationships evolve. In a recent article entitled 'Principles of committee work' I deliberately ignored a new concept in management called the 'consensus' meeting primarily because those propounding this concept appeared to me as uncertain. Certainly those who were lecturing on this subject in the health service were both unsure and unclear.

I recently heard a senior administrative official lecturing on the subject of management say that he couldn't understand 'consensus'. Did it mean an 'old-pals act', the lowest common denominator, no contention, or if you don't agree you will be carpetted by the authority?

It is unfortunate that the word is used owing to the connotations that may be derived from it. The principles of the the accountability of various professions are reasonably clear; problems only arise when professions come together in co-ordination roles to reach a common objective.

There are two management methods which should be recognised:

(*a*) management by control
(*b*) management by co-ordination.

Management by control is a manager/subordinate role. Management by co-ordination is not a manager/subordinate situation: the 'I am in charge' syndrome has no place here. The architect is not in charge, nor is the engineer.

The management role is purely co-ordinative in an interdisciplinary situation. If the architect has a co-ordinative management role then he cannot direct other disciplines in their work, he may only persuade. The professions have equal responsibility and accountability in their professional capacities.

The problem of management by co-ordination is that the manager/subordinate attitude, if allowed to occur, destroys the discussions and free exchange of ideas. Old ideas die hard and the idea that an architect should present an engineer with a scheme asking for an engineering solution is typical of the old management by control method.

Management by co-ordination, however, means that the architect on receipt of a brief begins to co-ordinate meetings at that point—before pencil is applied to paper. This in no way devalues the architectural profession, but rather enhances it.

It has been proved on many management exercises that management by co-ordination always produces a better result than management by control.

As public-health engineering services are the first to be considered in a design and have an impact on all others, particularly in the co-ordination role, I am suggesting that co-ordination is more than drawing, it is a management attitude.

My plea is that architects and engineers study management by co-ordination to attain a right attitude to consensus and consequently a right attitude in our professional relationships. Since the solution of sanitation problems in hospitals is dependent on the participation of many professions, management by co-ordination is the only management tool suited to the task. It is easy to instruct, difficult to persuade, but demonstrably more worthwhile.

Conclusion

There is a general view that sanitation systems are nonscientific. The work of the study group and Brunel University shows that this is a fallacy and that solutions require a high level of statistical analysis and contributions from many disciplines. This is more important now than it has been in the past, with the increase in requirements and new problems such as crossinfection by drug-resistant organisms.

Acknowledgements

The study group is working on many problems in public-health engineering in association with the Department of the Environment, the Building Research Establishment, the Department of Health & Social Security Building Regulations Group, the Sanitary Appliances Group and Brunel University, and wishes to acknowledge the value of these associations in the task of ensuring that a hospital is a place which does the patient no harm.

References

1 Darlow, H. M.: *The Lancet*, 1959
2 Newsom, S. W. G.: *The Lancet*, 1972
Williams, R. E. O., Blowers, R., Garrod, L. P. and Shooter, R. A.: *Hospital Infection* (Lloyd Luke, 1966)
3 Tuson, G.: 'The role and relationship of the public health engineer in the National Health Service'. *Building Services Engineer*, 1972

Bleeps keep staff in touch

A new communications system at Claybury Hospital, Woodford Bridge, Essex, keeps all senior members of staff, wherever they are on the large site, in constant touch with the telephone operator. The system is a paging installation which permits the telephone operator to establish contact by producing a 'bleep' tone in their pocket-sized receivers, which may be followed by a speech message.

Claybury Hospital, for psychiatric patients, has a large main building and four large outlying wards. Originally built for 2300 patients, it now provides for 1500 patients. Under the hospital is a pattern of interconnecting subways, while the whole complex is sited in grounds of nearly 100 ha.

Anywhere on the site, at any time, staff members can be 'bleeped' and given a speech message by the telephone operator. 100 staff members can be equipped with receivers at present.

Before the Multitone system was installed it was expected that the receivers might not work in the subways or near the large amounts of steelwork incorporated in the buildings, but subsequent tests showed that there were only two blind spots in the whole site.

Electrical accessories for Warrington hospital

Walsall Conduits Ltd., West Bromwich, will supply all the nurse-call equipment and electrical accessories required for Phase A of the new general hospital now under construction at Warrington, Lancashire.

Installations

The main items to be supplied under a £20 000 contract placed by electrical and mechanical contractors Drake & Scull Ltd., are 270 nurse-call units, 30 000 m of 20 mm conduit, 4000 m of 25 mm conduit, 200 'Walrok' switches and associated 1 and 2-gang sockets, 3500 13 A plug tops, 300 telephone outlets and 200 spur units. Special items such as hoseproof switches and sockets for the operating theatres will also be supplied.

The nurse-call units will consist of hand sets in which an alarm button, 4-channel radio receiver, bed light switch and other facilities are mounted in a control unit that rests on the patient's pillow.

Fire-alarm contract

A £50 000 contract for upgrading the fire-alarm system in 51 buildings at Prudhoe Hospital, Newcastle-upon-Tyne, has been awarded to Balfour Kilpatrick Installations Ltd. by the Northern Regional Health Authority.

HE Technical news

Computer system at Kent & Canterbury Hospital

The Clinical Chemistry Department of the Kent & Canterbury Hospital, recently purchased a Pathlab computer system valued at over £46 000.

The system comprises a processor, 32K words of semiconductor store, visual display units, teletype, communications equipment, paper-tape facilities, and 9·6 million words of disc storage.

The system, which was installed during February 1975, is based on the development of Computer Technology's Modular One computers at Ninewells Hospital, Dundee. Other versions of the system are already installed at Dundee, Leeds General Infirmary and the London Hospital.

Uses

Initial applications will include the production of worksheets, storage of results for single and cumulative patient reports, and inquiry facilities. Expansion is planned, to incorporate haematology, online data acquisition in chemistry and haematology, and communication with an associate laboratory in Thanet.

HE Technical news

Public-health services

Hospital Hygienics are extending their public-health engineering services to include laboratory research and testing facilities.

The service is under the supervision of Rolf Payne, who for 14 years was a member of the Building Research Establishment at Watford, and for some years was responsible for research projects for the Department of Health & Social Security Building Group and the Building Research Establishment.

The facilities offered cover not only laboratory testing etc., but also include site investigations, surveys, underground pipe tracing, assessment of new products and systems in all public-health engineering areas.

Computer centre

A regional computer centre for the North East Thames Regional Health Authority is under construction at Harold Wood Hospital, Essex. The building, which will cost around £500 000, is expected to be completed by the middle of 1976 and comprises a computer room and associated ancillary facilities on the ground floor, with general administrative and related personnel accommodation on the first floor.

The Collins Melvin Ward Partnership, in association with the Regional Architect of the North East Thames Regional Health Authority, are the consultant architects for the building. The general contractor is A. E. Symes Ltd.

Redevelopment at Cumberland Infirmary

The new medical and surgical wards at Cumberland Infirmary, Carlisle, began admitting patients on the 10th February.

The 60 medical beds and 120 surgical beds (including six dental beds) are part of the £2·5 million first phase of redevelopment at Cumberland Infirmary. The other wards and departments will be opening in the near future. The two 30-bed medical wards are on the fourth floor and the four 30-bed surgical wards are on the second and third floors.

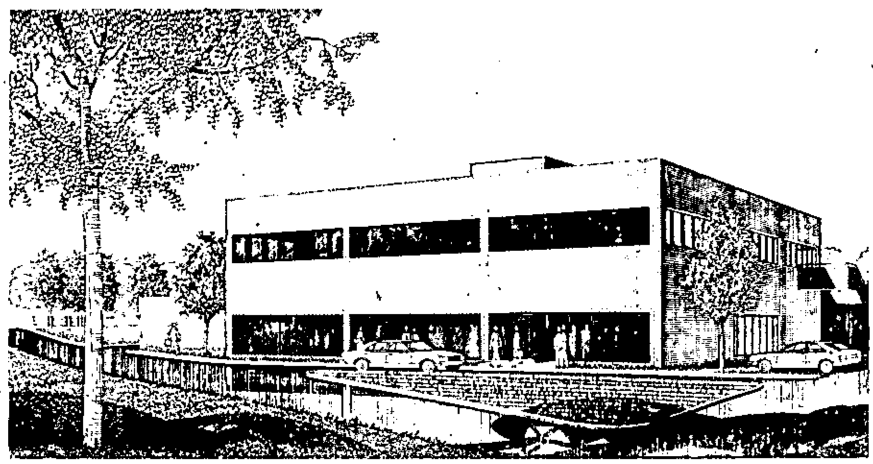
The accommodation on these three floors also includes consultants rooms, a medical secretaries office, a seminar room, an overnight stay room for relatives, an office for a nursing administrator and a room for domestic services.

Also included in the six storey ward block are three operating theatres, three X ray rooms, an ultrasonic room, a 54-bed children's unit, and a 10-bed intensive-therapy unit.

Meals service

A staff dining area and central kitchen are now operational. The central kitchen is providing a plated meals service, giving patients a daily choice of menu. It will eventually provide over 2000 meals a day.

Work started on the first phase in August 1971 and a foundation stone was laid by HRH Princess Anne at a ceremony in April 1972. HRH Princess Anne will officially open the new block on the 17th June 1975.



HOW TO REDUCE YOUR FIRE RISKS

Industry and commerce last year suffered fire losses reaching an estimated £237 million. To help organisations appreciate and reduce the risks of fire in their businesses, the Fire Protection Association has arranged three 1-day conferences at Chester, Basildon and Cardiff.

These follow the successes of similar conferences held in different parts of the country last year, and are aimed at those in industry and commerce who are involved in the day-to-day running of fire prevention, and for the insurance surveyors and fire-prevention officers who help and advise them. A special feature will be the screening of the latest FPA film entitled 'Flammable liquids—beware'.

Speakers will include representatives from the Factory Inspectorate, Fire Service, and the FPA. The conference will discuss:

New fire hazards: as technology progresses, fire hazards in processes and materials become more difficult to recognise. With this and the trend to larger undivided buildings, often of non-fire-resisting construction, the cost of any fire can be huge.

Building materials in fire: existing tests and terminology can be difficult to understand and can easily be applied in a misleading way.

Fire brigade reorganisation: how industry is affected, and how much is to be gained from closer contact with fire-prevention officers.

New legislation: how the Health & Safety at Work legislation and the Highly Flammable Liquids Regulations will affect practically every organisation.

Planning fire safety: The FPA shows how an organised system to identify and manage fire risks can be established.

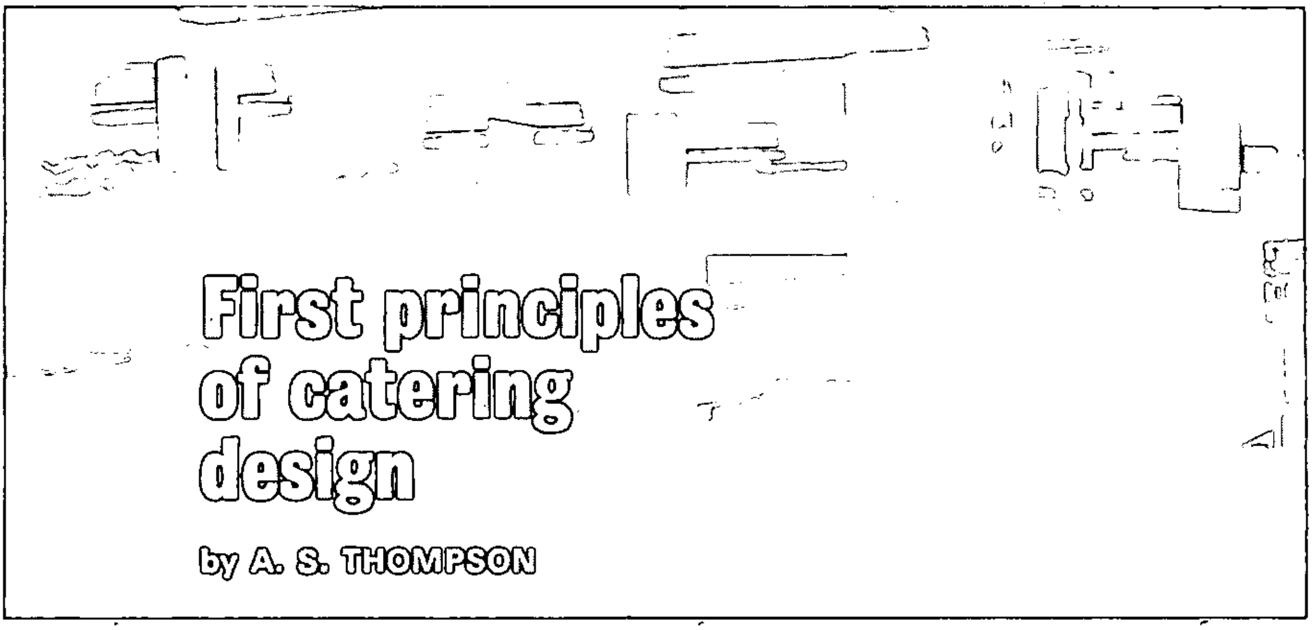
The three regional conferences are to be held at:

(*a*) Queens Hotel, City Road, Chester, on Thursday 10th April

(*b*) Essex Centre Hotel, Cranes Farm, Basildon, on Thursday 24th April

(*c*) Cardiff Centre Hotel, Cardiff, on Tuesday 20th May

The conference fee is £12·50 including lunch and refreshments. Multiple bookings qualify for a reduced inclusive rate of £10 per head. Applications should be made to the Secretary, Fire Protection Association, Aldermary House, Queen Street, London EC4N 1TJ.



First principles of catering design

by A. S. THOMPSON

Photo: Eaden Lilley & Co. Ltd.

When I was with the Health Service, I considered myself to be more fortunate than many of my colleagues because the hospital kitchens for which I was responsible were all well designed, adequately equipped and capable of producing the catering service they were required to provide.

You are forgiven for perhaps assuming that those kitchens were all sited in the new multimillion pound best-buy hospitals. They were, in fact, all built before the turn of the century, therefore allowing a succession of catering, engineering and building managers to eradicate the mistakes the original planners bequeathed to us over 100 years ago. A far cry from my 'lucky' colleagues who are bedevilled by purpose-built catering departments with kitchens that, in some cases, are incapable of providing the necessary service.

It is generally accepted that an efficient catering service is an integral part of any hospital; a high quality catering service is important for the well being, goodwill and morale of patients and staff in all types of hospitals. It should follow that, when a hospital is being planned, the food services required should be planned at the same time. However I suspect that what frequently happens is that the architect alone is asked to plan the catering department. Six weeks before it is to be opened the catering officer is appointed and complains, probably to the engineer, that he cannot possibly use the kitchen as planned and equipped. A month after it has been opened the customers start demanding different meals from those they were expected to eat. Six months later, a committee of inquiry is set up to discuss the catering policy—at least three years too late.

A possible solution which has been frequently discussed, but seldom adopted, is to reverse the planning procedure: consult the caterer in the first instance.

The planning and construction of new food-service facilities or the remodelling of old ones eventually becomes a problem with which most catering managers must work. They are not expected to be architects or engineers but must be able to discuss intelligently and interpret their needs, and help formulate the bases on which requests are made. They understand thoroughly the requirements of the situation, know cookery and efficient organisation and so should work actively with the architect and engineer on the detailed planning of the set-up from the earliest stages. The engineer can contribute invaluable information gained through training, experience, and observation. He knows particularly well the materials, construction, capacity, size and costs of the various pieces of equipment and their installation requirements.

I submit that the department should be designed around the menu, not as normally happens, the menu being modelled to suit the department.

How then do we formulate a menu for a catering department that will not open for possibly five years? I believe that the following checklist, although not exhaustive, should be of some use to the caterer when he commences to prepare his blueprint for the proposed catering department.

Forecast the future demand for the number of meals required

Number of inpatients

Hospital patients are usually served with 21 meals a week; breakfast, lunch and dinner, with a cup of tea or coffee in between.

Number of outpatients

Consider the provision of beverage and snackbar facilities.

Inpatient visitors

Catering for visitors has been sadly neglected in the past; it normally consists of a voluntary organisation, e.g. the League of Friends, supplying a partial service. Consideration should be given to the provision of a beverage and snackbar service or, possibly, the provision of main meal facilities available at a non-subsidised level.

Staff catering

The siting of staff dining rooms is important. People do not wish to walk far for meals and cups of coffee.

Mr. Thompson was formerly Catering Manager with Exeter Health Care District, Exe Vale Hospital, Exeter, Devon.

On the other hand, the provision of main meals should be in one unit if possible; it is more economic than a number of dispersed units because of lowered staffing costs, simpler supervision, and centralised storage and preparation. Probably a 24 h service will be required to accommodate night staff, ambulance drivers, staff engaged on emergency theatre duties, etc. There is an increasing demand for the sale of alcohol, and therefore special storage and servery facilities might be required.

Special catering functions

Most hospitals have a degree of formal life, a management team with a requirement to entertain perhaps up to 20 or 30 guests in some formal state. The provision of such a service should be considered at this stage.

Decide the meal pattern

There are several important factors that will influence the eventual design of an acceptable meal pattern. It is therefore necessary to consider the following points.

Cost

Different minimum-catering-cost standards are issued by the Department of Health for the feeding of acute, psychiatric and long-stay patients.

Nutritional requirements

In some hospitals it is only necessary to provide a diet to maintain normal metabolism, e.g. psychiatric hospitals. However, in acute hospitals, therapeutic diets are also required to assist in healing, e.g. high-protein diets. The therapeutic diet may also be an integral part of the medical treatment, e.g. diabetic, low-fat and low-protein diets. A decision as to whether diets are to be prepared and cooked in the main kitchen or in a separate kitchen is needed.

Ethnical considerations

Religious, cultural and regional likes and dislikes will influence the design of the menu. For example, Hindu customers will not eat cow meat, and therefore there must be adequate alternatives to beef on the menu if it is known that a percentage of the potential customers will be of the Hindu faith.

Length of stay in hospital

The length of stay in hospital will determine the frequency of the menu cycle. In a maternity hospital with an average length of stay of seven days it will only be necessary to introduce a 2-week cycle. However, a long-stay hospital will require a minimum of a 4-week cycle if it is to avoid causing the patients to suffer from 'menu fatigue'.

Distance from kitchen to service points

As always, the biggest difficulty is to serve hot, freshly-cooked and nutritious meals at the patient's bedside. Ideally the food should be in front of the patient as quickly as possible; certainly a time lag of 10 min is the maximum that is acceptable. If a delay is unavoidable, special attention has to be paid to the menu items, i.e. omelettes will not 'travel', chips will lose their crispness etc.

Method of catering to provide required menus

Once the menus have been planned it is possible to decide the method of catering, the areas and equipment required and the layout. Methods of catering may be summarised thus:

(*a*) Traditional catering consisting of preparing and cooking fresh produce, utilising skilled staff.

(*b*) A greater use of convenience foods simplifies traditional catering. Prepeeled potatoes, commercially prepared and frozen vegetables, pudding mixes, soup mixes and a wide range of canned and other preserved foods can reduce the amount of costly work carried out in the kitchen.

(*c*) Cook/chill. The method of cooking food, chilling and reheating within 48–60 h is usually connected with the Régéthermic method of reheating in an infrared oven.

(*d*) Cook/freeze. Foods are prepared, cooked and frozen, either in a blast freezer or by using liquid nitrogen, during normal working hours, stored in frozen storage and then reheated at the point of service.

(*e*) New types of equipment may be used for any of these methods. Automatic cooking with automats and a conveyor-belt system lends itself particularly to the cook/freeze operation.
Tray meal systems and plated meals, utilising heat-store bases, are used in many hospitals, both old and new alike. The increasing use of convection ovens is of great value in reheating frozen foods, and are also satisfactory in a traditional kitchen.

(*f*) A mixture of various methods may be used. Traditional catering may be carried on through the day and the meals for the night staff utilise either cook/chill or cook/freeze methods.

Catering means moving large quantities of food from the delivery area through a variety of processes to the consumers' plate. The plan should be based on flowlines and not on static zones. This should be considered as an engineering project, the principles being basically the the same as those governing the design of an engineering workshop. They are that the food should be moved through the shortest possible distance between processes. There should be no obstruction or constriction to interfere with the flow of food. There should be no vertical separation, particularly between the cooking and serving processes. Such separation means greater capital provision, higher running costs and a lower quality of food.

At this stage of the planning operation the caterer should be able to submit a blueprint of the proposed catering operation to the technical experts. The blueprint will show the types of food to be processed, the frequency of processing, the types and capacity of equipment required and other salient points that perhaps the architect would not normally take into account.

I have tried to describe briefly how a caterer can help to design a hospital catering service. I acknowledge that my thoughts are not original ones, they have been frequently debated, nor do I see them as the panacea for all our planning problems. I do hope, however, that my submission will give food for thought to all those concerned with planning catering operations. After all, it really is just a question of eggs and chickens.

Lessons to be learned from Fairfield

by ALBERT LEESE

The fire at the Fairfield Old People's Home, Nottinghamshire, on the 15th December 1974 once again indicates that we never learn from past disasters.

The established procedure now is:

(*a*) We have the disaster.
(*b*) We have the expressions of horror.
(*c*) We have the cry 'Why did this happen again?'
(*d*) We have the inquiry.
(*e*) We have the report.
(*f*) Sometimes we have a revision or updating of means-of-escape legislation; then what happens afterwards? In a week or two the dust will have settled on the disaster, and we very soon see a return to the usual state of apathetic inactivity, and the level of complacency increases proportional to the time scale between the last and the next disaster. We had the Shelton disaster in 1968, the Coldharbour disaster in 1972, Fairfield in 1974. How many more disasters must happen before we tackle the basic problems?

Means-of-escape thinking in this country is based primarily on the supposition that people will be able to leave buildings under their own steam, but this concept as we have so often seen falls flat on its face when inmates of geriatric and psychiatric hospitals or homes are involved, who are bedridden or who are only ambulant with assistance.

Understanding

Clearly the fire resistance of a structure and the flame and smoke characteristics of a building and its contents are all very important factors, but the type of thinking in these special patient situations which even vaguely conceives of the building becoming involved in fire in the means-of-escape preplanning is quite alarming. The expectancy of infirm persons surviving in a fire situation where there is only the merest involvement of the contents of premises is a very doubtful one, but to contemplate the likelihood of survival in circumstances where there is serious fire involvement of the contents and the building is to betray a lamentable lack of understanding of the entire problem.

Year in and year out we read of countless numbers of incidents where people are killed in circumstances where the only combustible materials involved were an easy chair, a bed, or television set, etc., and these people died because supervision was inadequate or nonexistent.

Fire officers stipulate differing means of escape solutions for identical buildings because training, experience and thinking are biased by two basic preconceived notions: that people will generally be able to leave the building without assistance, and where this principle cannot be achieved that there will be the requisite trained supervision available to deal efficiently with the situation; each successive disaster reminds us that the latter factor is usually conspicuous by its absence. Proof of this also comes from the good fire record in acute hospitals where the standard and quality of supervision is high.

Expressions of horror and alarm by authority and the public, while natural in the circumstances, would seem very hollow against the background of apathy and inactivity. Relatives of old and infirm persons who would quite rightly raise hell if they thought that their loved ones were exposed to the likelihood of unqualified, inexperienced or untrained medical or nursing staff, seem quite unconcerned about exposing these same people to the risks inherent in inefficient or nonexistent fire-defence systems, or in the hands of staff who are unqualified, inexperienced, and often untrained in the sciences of fire prevention, protection and extinction.

The plain unvarnished facts basic in every geriatric and psychiatric situation where there exists a factor of patient infirmness or nonambulance are: if the fire-defence-system preplanning has not provided for the detection of the fire backed up by a trained attack to deal with the situation in the first seconds or minute of the outbreak, the certainty is that the system will fail, when at very best there will be serious injuries to patients, but much more likely the kind of fatal disaster we see too often repeated.

The British Fire Services Association and myself are on record for repeating time and again both in public and in writing to official sources that the level of fire-defence services in these high-life-risk situations could be improved by the setting up of a proper fire-defence structure, backed up by the requisite level and quality of staff.

There is, of course, never adequate financial resources available for these life-protection services, and yet the costs of such systems would be insignificant compared with the vast sums of money currently being poured out on the doubtful reorganisation of the health services and local government. One is forced to the conclusion that there appears something grievously wrong with a society which has lost its ability to identify and implement those priorities that would have the effect of saving lives.

Change in attitude

If there is not a drastic review of existing policies in official sources, or a rude awakening of the public's apathetic attitude to the risks patients in these situations are exposed to and the requisite pressure applied for appropriate urgent improvements, then we shall continue to see these disasters occurring with perhaps increasing regularity.

I am never surprised when these disasters occur; indeed, after more than 30 years experience and training as a professional fireman, fire-prevention officer and chief officer and, therefore, understanding the circumstances, my surprise is that these disasters do not happen much more frequently. Perhaps we shall need to experience a large-scale disaster with the magical figure of 100 or more killed before the problems receive the attention which successive tragedies quite clearly indicate they urgently merit.

Mr. Leese is the President of the British Fire Services Association, 86 London Road, Leicester

They have just completed a super operation at Guy's

No anaesthetic, no operating theatre and no pain. Just a matter of close co-operation between Guy's Planning Department, their Catering Officer and Stills.

Resulting in a new sophisticated catering system for the Nurses Home, as advanced as any in the world today. With kitchen and servery equipment to handle meals for 700 nurses. Every day. Efficiently, unobtrusively.

It is just typical of Guy's. For around 300 years they have always been among the acknowledged leaders in surgery. They know their catering equipment. And they know Stills.

By Appointment to Her Majesty The Queen Manufacturers of Kitchen Equipment W. M. Still & Sons Ltd. Hastings

W. M. Still & Sons Ltd., Catering Equipment Manufacturers, Fellows Road, Hastings, East Sussex. Tel: Hastings (0424) 43 2121.

Is standardisation the answer?

G. H. DAVIES, C.Eng., M.I.Mech.E., M.I.H.V.E., M.Inst.F.

For the engineer, building-services standardisation can aid design techniques; where the components that make up the pack that forms a building is limited then the total number of options is limited, and hence the question of proceeding to examine an unlimited number of alternatives is not possible. This may be considered as negative thinking, but is it? We all know of older hospitals that were built before the days of multidisciplinary planning teams, in which the finest medical care in the world is an everyday event, and, of course, it can be said that the same medical team with the latest equipment in a well designed hospital could do an equal and possibly a better job with less effort. However, if the emphasis is not to try and create standardised departments, but rather to standardise the individual rooms that make up that department and to rationalise the options so that when the units are put together the ultimate is not achieved, but an above average unit that meets the need of the patient and the medical team, and providing this is achieved in less time and consequentially with reduced costs then the exercise is justified.

The aims of a rationalised building technique should be to provide flexibility of design and use; building services should be adaptable so that, with a minimum of inconvenience, cost and time, the building of today can be adapted to meet the clinical needs of tomorrow, and can be extended as the department's workload increases, while at the same time improving the facilities for routine maintenance. After several years designing building services specifically for installation in an industrialised building system, experience has shown that the results are to improve the performance of design and construction techniques for hospital buildings. The building system is based on a structural grid system with a dimensional co-ordination using a modular grid of 100 mm and a planning grid of 600 mm, and utilises to a maximum factory-made components and dry construction methods.

Dry construction

By the use of prefabricated components in the building envelope its early enclosure is ensured, and thus the construction programme is not held in jeopardy by inclement weather to anywhere near the extent that it affects the traditional building construction.

Similarly dry construction is rapid and avoids the long drying-out time and heating costs normally expected. The engineering-services subcontractor benefits from the early enclosure of the building because he is able to make a start on his contract earlier than normal, and to spread his workload more evenly over the entire building contract. The programme can also be adhered to more easily. The engineering services are fully integrated into the structure and design of the building.

There are of course problems created by such a system for the design engineer. For example because the external cladding arrives directly from the factory in complete panels it is not possible for the inclusion of engineering services, and where services are essential a void has to be provided by adding a further internal plasterboard skin. This, of course, incurs a cost penalty and a reduction in floor area.

Service void

The dry-construction partitions consist of multilayer plasterboard sheets which are fixed to a central timber frame, thus forming a service void. The sequence of construction of a partition is to fix one side complete with service outlets, such as washbasins, medical-gas outlets, and to install all interconnecting pipework to the branch mains in the undercroft or ceiling void, and then conceal the services with the second side of the partition. However, problems arise where it is necessary to fix two outlets, such as two wash basins, so that they become back to back on a partition. Under such circumstances it is necessary accurately to cut holes in the second skin and to thread it over the piped terminals before fixing the second appliance and completing the engineering services.

Fig. 1. External cladding being positioned

A system such as this must never be allowed to stagnate, it must develop and, although not essential, a rationalised building construction greatly assists the introduction and use of the most powerful and exciting tool ever to be placed in the hands of the design engineer, a computer-aided design system. With it every member of the design team will be able to build up and develop a complete building image stored on tape within the computer. It will be interactive, so that alterations made

Mr. Davies, formerly with the Oxford Regional Health Authority, is now Area Engineer, Oxfordshire Area Health Authority (Teaching)

Fig. 2. Water services in a partition

to any single component can be examined to determine their effects on the entire design, and at the same time it will automatically generate the drawings, facilitate detailed design-cost estimating as the design proceeds so that abortive work due to the design exceeding the cost limits should never occur, and to prepare schedules and bills of quantity required for the contract.

From the brief for a proposed development it will be possible rapidly to undertake a vast number of evaluations in developing the building form, such as the minimum cut and fill to locate the building on a sloping site. The interaction of the orientation of the building, its glazing areas with daylight factors, solar gains, and heating and cooling loads, in fact every item that can be quantitively expressed, can be dealt with in this manner. With each member of the design team having the means to rapidly examine a number of alternative solutions before deciding on the optimum, design time is reduced and expenditure saved; if at the same time the layouts of the departments have been rationalised so that as near as possible package designs can be adopted then fuıther design savings will be achieved; and this is the direction in which we must proceed.

Institute news

WELSH BRANCH

At a meeting at Singleton Hospital, Swansea, on the 11th January, F. V. Waite, Area Works Officer, Mid Glamorgan Area Health Authority presented a paper entitled 'Power generation'. Mr. Waite began on an historical note going back to the time when supply authorities existed only in major towns. Hospitals at that time either generated their own electricity or went without.

Generation was by steam engines driving a d.c. generator, the exhaust from the steam engine being fed into calorifiers to provide heating and domestic hot water. The electrical demand was therefore matched to the heating and hot water load, 1 kW of power being produced for approximately 18 kg of steam. During the summer time when heating of the building was not required the exhaust steam would be released to the atmosphere.

Eventually, hospital electrical loads outstripped steam demand and with the availability of local electricity supplies site generation by steam largely disappeared. For hospital-site generation, diesel-driven generators became popular. Some hospitals employed two electrical systems, the public a.c. supply and their own d.c. supply.

Mr. Waite then moved on to the electrical requirement of the more modern 500–600-bed hospital and the need to provide an alternative emergency supply of the order of one-sixth of the maximum demand of the hospital. In more recent times, owing to the disruption of hospital services by industrial action the DHSS now requires new hospitals to be able to generate 45% of their normal requirement.

Mr. Waite spoke at some length on parallel running with the National Grid and of arrangements with electricity boards, some of which impose penalties to offset loss of revenue. His experience was that peak-load topping with diesel sets was not worthwhile because of the complexity, cost and maintenance of control gear.

Looking to the future Mr. Waite said he could foresee the time when a small on-site nuclear or fusion generator would provide a hospital with all its power independent of other sources.

Following an interesting questions and answers period the Chairman warmly thanked Mr. Waite for his paper which had been of great interest to the members.

The following officers were nominated for 1975:

Chairman, R. G. Kensett; Vice-Chairman, W. Browning; Hon. Secretary, R. E. Long; Hon. Treasurer, B. V. Williams; Committee Members, T. Gleeson, A. Grundy, M. Gibbon; Welsh Council Member, P. Jackson; General Council Member, Mr. R. G. Kensett.

A lengthy discussion took place on works-staff training during which members pointed out difficulties being experienced in getting on to training courses. Some were being blocked at district level while in other cases reorganisation had meant loss of contact with appropriate departments.

Discussion took place on whether to proceed with arrangements for a Summer School during 1975, but after a review of the attempt to hold one in 1974 it was agreed not to hold a school this year but to proceed with the idea of holding one during 1976 and to publicise the intention as much as possible during 1975.

WEST OF SCOTLAND BRANCH

At the January meeting of the branch on the 30th January a paper on computer program for heat losses with environmental control was given by R. MacLauchlan of the Department of Environmental Engineering, Strathclyde University, Glasgow. Commencing by explaining formulas for air-to-air convective systems, and radiant systems, he then passed on to heat losses, environmental temperature, energy inputs, heat-flow paths, and finally thermal-comfort considerations.

After a short break for coffee Mr. Maclauchlan introduced J. Clark, who gave a short talk on how the program was built up and fed into the computer, then demonstrated this by showing a program concerned with a design for a small hospital/ward heating system.

An incentive bonus scheme for maintenance staff

by S. HENDERSON, T.Eng., M.I.Plant E., F.I.Hosp.E.

Sunderland Area Health Authority was to the forefront in introducing bonus schemes generally into its management techniques. The vigorous efforts of management, backed by progressive policies from the respective management committees, ensured that every effort was made to obtain the best possible conditions and rewards for the employees of the hospital management committees that form the authority. The financial incentive scheme for NHS maintenance staff prepared by the DHSS was introduced as a further extension to this policy, as a pilot scheme to be implemented over three phases.

Difficulties in implementation

While this was the first scheme to be introduced in the Northern Region, and one of the first in the country, in many respects it could not have received a more difficult baptism. With the impending reorganisation, the Sunderland Area and Cherry Knowle Hospital Management Committees were to merge to form the new Sunderland Authority and it was therefore sensible to negotiate the scheme collectively across both sets of employees. In practice, this proved extremely difficult as there were several anomalies in the respective conditions of contract, not only between the two separate groups, but also between the building and engineering disciplines in each group.

There was already a bonus scheme being operated for the building trades at one HMC and at the other a shift system was being worked for the engineering staff. The starting and finishing times were different as was the overtime commitment. The engineering staffs worked on a subgroup principle, while the building trades were managed centrally.

Although these difficulties did present considerable problems in the initial stages of implementation, they did not detract from the wisdom of the original decision, as the scheme made it possible to standardise the conditions for all the works departments staffs at a very early stage and thus avoid the build-up of frustration that might otherwise have existed. This has not always been possible with other disciplines who have amalgamated with reorganisation.

The initial reluctance of the staffs to co-operate with each other, the number of trades that were to be embraced in the scheme and the absence of an area works officer to decide on future works department organisational policy also hampered progress. With the increasing confidence in the scheme on the part of the men and their growing willingness to co-operate with each other, coupled with the endeavours of management to implement the scheme as quickly as possible, many of these problems have been overcome.

Introducing the scheme

As this was one of the pilot schemes being introduced, the DHSS naturally wished to guide the principles of application in the early stages. The Department's optimism, both locally around the negotiating table and in the guidance notes, on the progress through the various stages proved in the later discussions, when their direct presence ceased, something of a problem. However, it should be stated that, without their help with the initial talks in organising the training of planner estinators, and their basic understanding of the theory of the mechanics of the scheme, it would not have been possible to progress as quickly as we eventually have. The works study section at the Regional Health Authority was also keenly interested, as it was intended that all future schemes introduced in this region would be guided by this section and not by the DHSS.

Members of the organisation and methods staff attended and partook in the training courses for the planner–estimators and have since assisted in the negotiation, both at the working-group and steering-committee meetings. Their help with the planning and realisation of the financial implications have been of great value.

Mechanics of the scheme

The scheme itself is based on the principle of measured work and revolves around an NHS Standard Work Measurement Data Reference Manual which has been compiled by the DHSS over a number of years with the help of a firm of consultant engineers. This data manual contains a considerable number of standard times for elements of work and these can be built up so that individual times can be given for the great majority of hospital jobs. The manual is provided by the DHSS and the data is handled by planner-estimators.

As with all measured-work incentive schemes the opportunity for earning bonus is calculated by performance against a standard time. The yardstick is the relationship to the British Standard performance scale. In phase III, when the scheme is variable, this scale starts at no bonus for 75 BS1 reaching a bonus of one-third basic pay at 100 BS1 performance. The schemes

Mr. Henderson is with the Sunderland Area Health Authority, Cherry Knowle Hospital, Ryhope, Sunderland SR2 0NB

From the very old...

...to the very young.

Electric catering systems offer more than just appetite appeal.

The catering responsibilities of local government are increasing annually. Schools, hospitals and old people's homes are all demanding more from hard pressed staff and out-of-date kitchens.

For all local government catering decisions your Electricity Board representative can give you the latest information on equipment and techniques.

He can arrange for demonstrations on how new Electric Catering systems not only provide a better standard of food, but achieve a total cost reduction in space, labour and time. Ring your Electricity Board or the Electric Catering Centre direct on 01-836 7337.

ELECTRIC CATERING

London Electricity Board,
Mr. W. F. Griffiths, Telephone: 01-588 1280
South Eastern Electricity Board,
Mr. H. W. Dammarell, Telephone: 0273 739211
Southern Electricity Board,
Mr. J. E. Monk, Telephone: 0628 822166
South Western Electricity Board,
Mr. S. A. Radford, Telephone: 0272 26062
Eastern Electricity Board,
Mr. H. R. Casley, Telephone: 0473 55841

East Midlands Electricity Board,
Mr. R. Russell, Telephone: 0602 269711
Midlands Electricity Board,
Mr. G. H. Wood, Telephone: 021-422 4000
South Wales Electricity Board,
Mr. W. E. Carey, Telephone: 0222 792111
Merseyside and North Wales,
Mrs. J. M. Dittrich, Telephone: 0244 40133
Yorkshire Electricity Board,
Mr. E. Raynard, Telephone: 0532 892123

North Eastern Electricity Board,
Mr. R. W. Sture, Telephone: 0632 27520
North Western Electricity Board,
Mr. B. Longton, Telephone: 061-834 8161
South Scotland Electricity Board,
Miss E. J. Caldwell, Telephone: 041-637 7177
North Scotland Electricity Board,
Mr. R. C. Benzie, Telephone: 031-225 1361

USE ELECTRICITY WISELY

The Electricity Council, England and Wales.

currently being introduced in other areas are, I understand, 2-phase schemes but at Sunderland the criteria for advancement were as given in Table 1.

Table 1.

	Measured work %	Performance BS1	Bonus %
Lead into phase 1			5
Phase I	15	75	10
Phase II	40	85	15
Phase III	85	variable	

The formula for calculating the bonus payable in phase III for the respective bonus group is set out below:

$$\text{Overall Performance } L = \frac{FG+KJ+75H}{C+D}$$

Group calculation summary: Phase III

A Net attendance hours (k)
B Overtime hours (1)
C Total clock hours $(A+B)$
D Clock hour adjustment $(d\text{-}f)$
E Total standard hours (c)
F Elapsed hours on measured work $(d+e)$
G Performance on measured work $(\frac{E}{F}\times 100)$
H Total lost time (h)
J Elapsed hours on unmeasured work (g)
K Sample performance on unmeasured work

Note: (*a*) If K is *not less* than 65 BSI, then 75 is to be used.
(*b*) If K is *less* than 65 BSI, then the actual performance of the sample should be used for K.

In the guidance notes provided by the DHSS, it suggests that progress between the phases can be to the following time scale:
phase I–phase II: six weeks
phase II–phase III: six weeks.
Entry into phase III can only be attained when an 85%-measured-work condition has been achieved and the necessary organisation, procedure and control requirements are fully operational. At Sunderland, it was agreed in local negotiation that the bonus groups would progress together to the variable stage and as such the 85%-measured-work condition was to be the average taken over all of the bonus groups.

In the somewhat euphoric atmosphere of the early discussions, the six weeks between phase II and phase III became fixed in the minds of the men not as a target date for which to aim, but as a definite commitment.

In actual practice and with local circumstances taken into account, this was grossly unrealistic. With a combined workforce of approximately 120 men spread across nine different trades and split into 12 bonus groups, the scheme actually progressed along the following timetable and this was only achieved when management appointed additional planner estimators and improved the method of communication between them and the supervisors.

Lead in payments commenced:	10th December 1973
Phase I commenced:	20th May 1974 (23 weeks)
Phase II commenced:	1st July 1974 (6 weeks)
Phase III commenced:	28th October 1974 (17 weeks)

Measured/unmeasured work

Preplanned work can be premeasured and standard times applied prior to the job being issued. The same can also be done for the majority of routine maintenance repairs, particularly where studies are available. In undertaking some jobs, there will, however, be instances where additional work has to be done which has been omitted from the standard time calculation. This contingency is catered for in the scheme by having tradesmen write down any changes to work on the job card. On completion of the job, the card is handed back to the planner–estimator when the extra time factor is calculated and credited.

There are, of course, some jobs that cannot be premeasured, fault finding being a typical example. In these cases, the tradesman then carried out the work, recording all the steps taken on the form. This is then returned to the planner–estimator and the job is post-applicated in a similar manner to the changes to work procedure.

Planner–estimators

The hub of the scheme revolves around the planner–estimators. As the scheme initially requires a high degree of local knowledge and participation, these planner–estimators were selected from craftsmen on the shop floor who applied for the posts in response to internal advertisements.

There was no initial pruning and all applicants were given an aptitude test. This test was prepared, supervised and analysed by the DHSS. All applicants were then given a formal interview and selection was made taking account of the interview performance and aptitude-test results.

The number of planner–estimators selected was based on the norms suggested by the DHSS of one planner–estimator to 20 tradesmen. With training and experience, an estimator can estimate and provide measured work in all trades, although it was clearly necessary to initially obtain a balance across the disciplines, bearing in mind the numbers in each trade involved. The breakdown of planner–estimators originally appointed is set out in Table 2.

Table 2.

Men/trade (excluding foreman)	Planner–estimator	Note
17 Joiners	1	Although some of the trade groups have since withdrawn from the scheme it has been necessary to increase the establishment of planner–estimators by two
8 Bricklayers		
11 Plumbers	1	
26 Painters	2	
8 Wall washers		
6 Upholsterers		
8 Building labourers		
12 Electricians	2	
15 Fitters	1	
18 Semiskilled craftsmen		

Since the scheme has been running, flexibility among the planner–estimators has greatly increased, although I doubt whether complete integration will ever be achieved. If Sunderland can be taken as a guide, the continuance of the scheme will highlight whether there are sufficient planner-estimators and, if not, the basic discipline in which any additional staff should have been trained.

Training planner–estimators

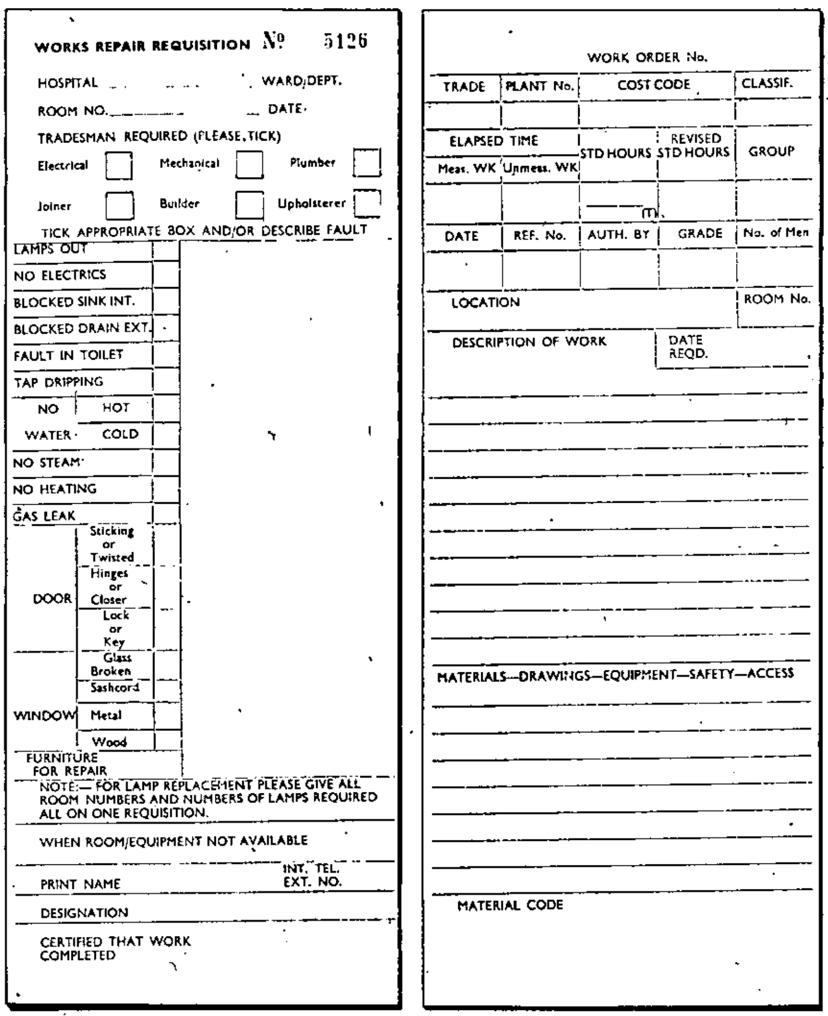
Formal training in the use of the data reference manual, the control information, general documentation and in the techniques of the role was given in the form of a full-time off-the-job course lasting three weeks. On completion, an examination was taken and a certificate issued to the successful candidates. It is a prerequisite that all candidates must pass the examination to be able to continue in the post. It then becomes a question of applying the theoretical knowledge gained, to a practical situation.

One of the reasons for having a 'lead-in period' followed by a phased procedure before arriving at a variable condition is to permit the planner–estimators time to build up experience. The data reference manuals could not, at this relatively early stage of development in a practical situation, contain every element of every task, nor were there many studies available of jobs which had been given approved standard times. It was therefore necessary to carry out actual studies on particular jobs. Not only did this afford the opportunity for adding to the existing data, but it also gave the planner–estimators valuable experience. It had been agreed, at an early stage in the negotiations with the craftsmen, that this procedure would be allowed on the understanding that it was only the specific operations necessary to complete a job or task that were observed and not an actual job time.

A considerable number of studies were and are continuing to be undertaken, particularly in the trades where the information in the manual is lacking, a specific example being for upholsterers where there were no data at all.

Studies of planned-preventive-maintenance works

The guidance notes provided by the DHSS suggest that the planner–estimators should have at least 2-weeks backlog of work. In a practical day-to-day situation, this is impossible without a high level of preplanned jobs. Therefore, to maintain 85% plus measured work, planned preventive maintenance (p.p.m.) is essential.



a b

Fig. 1 Works repair requisition
a Front
b Reverse

Much work has been and still is being done, in studying this type of job. Before any times can be set, the precise limits of the task must be clearly defined. In this respect, every p.p.m. sequence has to be looked at and the exact work content clarified.

This is resulting in some revision of the p.p.m. manuals as phrases like 'replace as necessary' or 'adjust if required' are having to be rationalised into definitive terminology. A standard time cannot be given for a task that 'may' or 'may not' be done. This is obviously a tremendous task and cannot be completed overnight but preplanned work is the bread and butter of the scheme and, once a standard time has been calculated, it is constant for however many occasions the work is undertaken, provided that the auxiliary considerations are the same.

The role of the supervisor

In terms of this scheme, a supervisor can be a trade foreman, building supervisor or hospital or assistant hospital engineer, as he is the person responsible for specifying to the planner–estimators the work content, deciding priority, and approving quality.

In the majority of cases, where standard data are available and no study is required, the planner–estimator is able to produce a time from the information supplied by the supervisor. To achieve this, the description has to be explicit and detailed and, as without considerable checking this information could not be attained from the form of requisitioning system being used, a new requisitioning procedure had to be introduced.

New requisition system

The new system requires the originator to specify more clearly the precise needs, and obviously a great deal of education was necessary to instil this into hospital personnel. Meetings were arranged with heads of departments, senior nursing staff, ward sisters and charge nurses at which requisition was explained, as were the reasons behind its inception. These discussions were of tremendous value and brought to light several factors which had not initially been appreciated and, in consequence, although the new pads were introduced, they have subsequently been amended to cater more for the originators' needs.

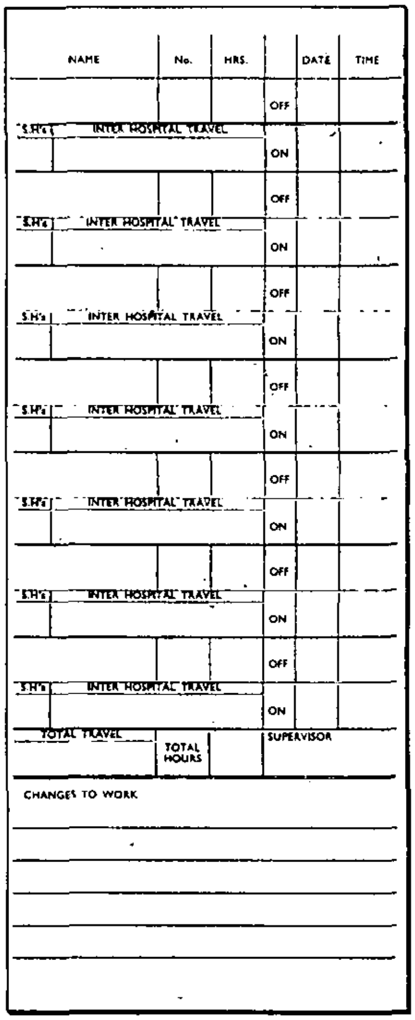
It was apparent from the onset that the number of people with authority to originate a request for a repair had to be restricted. This made education and appreciation of each person's problems easier to attain. With the progress of the system the standard of description for repairs has improved and with it the communication between works-department supervisors and requisition originators.

It was agreed that only heads of departments or recognised deputies or ward sisters and charge nurses would submit requests for repair.

Requisitioning procedure

The requisition pad is in triplicate (Fig. 1) with one copy being retained at source and two copies being sent to the works department, where they are segregated initially into building or engineering.

There are minor variations in the method of actually collecting and segregating the requests throughout the area to deal with individual problems, but this flexibility does not detract from the overall efficiency. Apart from replacement light bulbs, the system of one job, one requisition, applies. The requisitions are identical as far as the information on the front is concerned, but one of the copies has information on the back and is one of the two sent to the works department (Fig.2).



NAME	No.	HRS.		DATE	TIME
			OFF		
S.H's INTER HOSPITAL TRAVEL			ON		
			OFF		
S.H's INTER HOSPITAL TRAVEL			ON		
			OFF		
S.H's INTER HOSPITAL TRAVEL			ON		
			OFF		
S.H's INTER HOSPITAL TRAVEL			ON		
			OFF		
S.H's INTER HOSPITAL TRAVEL			ON		
			OFF		
S.H's INTER HOSPITAL TRAVEL			ON		
			OFF		
S.H's INTER HOSPITAL TRAVEL			ON		
TOTAL TRAVEL	TOTAL HOURS		SUPERVISOR		

CHANGES TO WORK

Fig. 2 Reverse side of work card (front side as Fig. 1b)

The supervisor then prepares a detailed description on a work card which has a duplicate (flimsy) copy as Fig. 1*b*. Where possible, this description is taken direct from the information contained on the requisition, but, if this is insufficient, by visiting the site and assessing the work. The work card and flimsy, together with a copy of the requisition (double-sided), are then passed to the planner–estimator to be timed.

Having arrived at a standard time, the planner–estimator retains the flimsy and returns the work card to the supervisor when the remaining copy of the requisition is attached. The supervisor then decides who shall carry out the job and what priority it should have and loads a planning board accordingly.

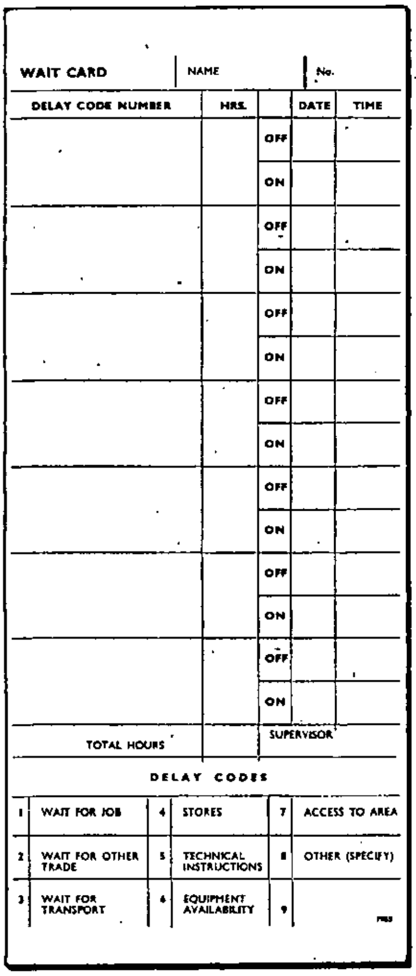
Planning boards

The tradesmen operate around a planning board, booking on to a job by entering the time on to the work card and moving it into the 'present-job' slot. The requisition is detached and taken to site for reference. On completion of the job, the tradesmen books off the card and puts it in a 'work-completed' box and then proceeds to his next job using the same method. By checking this board the supervisor can immediately tell where the workforce are currently employed.

The cycle is completed when the planner–estimator empties the box and matches the work card with the flimsy. The performance of actual time against standard time can then be assessed and the bonus performance calculated.

A number of these boards are strategically placed around the area and each have three sections as set out below. The name of each individual is listed down the left-hand side.

The three sections are:
(*a*) present job (*b*) next job (*c*) interrupted job
The interrupted job denotes work which is started but cannot be completed. Not being able to gain admittance or unavailability of spare parts are typical reasons for this.



WAIT CARD | NAME | No.

DELAY CODE NUMBER	HRS.		DATE	TIME
		OFF		
		ON		
		OFF		
		ON		
		OFF		
		ON		
		OFF		
		ON		
		OFF		
		ON		
		OFF		
		ON		
		OFF		
		ON		
TOTAL HOURS		SUPERVISOR		

DELAY CODES

1	WAIT FOR JOB	4	STORES	7	ACCESS TO AREA
2	WAIT FOR OTHER TRADE	5	TECHNICAL INSTRUCTIONS	8	OTHER (SPECIFY)
3	WAIT FOR TRANSPORT	6	EQUIPMENT AVAILABILITY	9	

Fig. 3 Delay card

Efficient utilisation of workforce

It would be a demonstrably inefficient use of labour if, after every small routine job, the tradesmen returned to the planning board for another card. It is therefore necessary for the supervisor to plan as far as possible each individual's work card. When there are several cards for minor repairs in one ward or department, these are grouped together by the supervisor before submission to the estimators and then retained as such in the planning board. The auxiliary time and travelling time are assessed collectively and not individually for each job as would be the case without grouping.

Delay card

In the event of not being able to proceed with a particular job, the tradesman books into a delay card and records in listed categories the reasons for delay. Doctors rounds are a typical example. This procedure ensures that the man is not penalised through no fault of his own and also enables management to identify areas of delay, and should these be caused by inefficiency in organisation; e.g. waiting for transport affords the opportunity to take corrective measures.

Auxiliary times

As well as the actual time required to physically undertake the job, additional allowances in the form of auxiliary time, are also included. This is built into every standard time and takes account of the following factors:
(*a*) travelling time (*b*) job preparation
(*c*) clearing up on completion
(*d*) shift-change allowances (*e*) planning
Additional time is also allowed for personal needs and this was set at 15%. It was also necessary to consider where the lunch break commenced and finished and it was agreed in negotiation that 5 min would be allowed before and 5 min after the break to return to the job. As it was not always possible to know which job this tradesman would be undertaking during this period, the allowance was converted to a percentage of the full day and as such was spread over each job. This brought the allowance for personal needs up to 17%.

Financial viability

It was accepted from the onset by all concerned that the scheme must be financially viable within certain constraints. The benefits of increased productivity and improved utilisation of the workforce had to be offset against the considerable additional expenditure that must be incurred. In accepting this principle, management has basically two alternatives:
(*a*) to continue with the existing workforce and undertake additional work
(*b*) to assume the volume of work is constant and therefore reduce the staffing levels and overtime commitment.

It is the policy at Sunderland to carry out as much work as possible with direct labour and hence the first alternative of undertaking additional work at the expense of contract labour appeared the more attractive. However, when the full implications were realised, including additional material/stores costs and the extra burden on transportation requirements, it had to be faced that the finance for these items was just not available and, as a policy, the second alternative was agreed upon.

In assessing the staffing-level requirements under alternative (*b*) it is a prerequisite to establish the performance level prior to the scheme. This was achieved on the building side from the existing bonus-scheme data but, on the engineering side, it was arrived at from field surveys. Untimed work was issued for

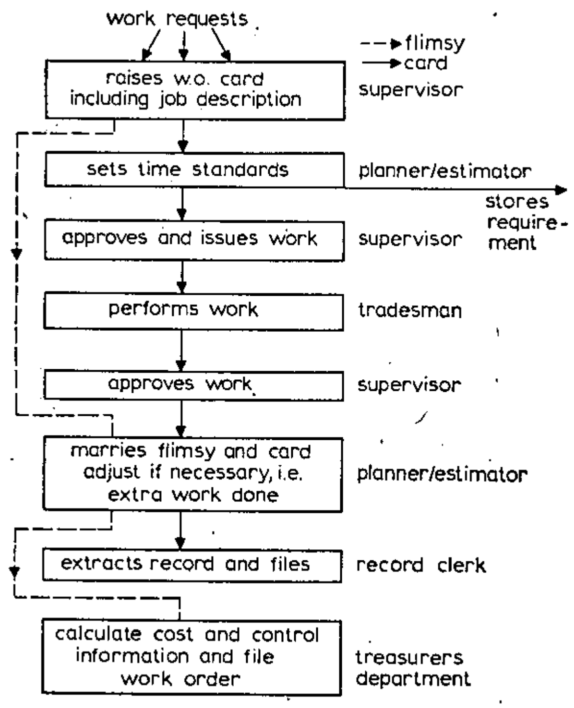


Fig. 4 Flow of a work order

which the tradesmen filled in a time on completion. This was then assessed against what would have been the standard time.

If this initial performance level is not gauged correctly, the 'planned' improvement that is anticipated is not accurate and hence the staffing levels will be incorrect.

Overtime must also be taken into consideration and the reasons for it fully appreciated. Basically, overtime can be categorised under the following three headings and if, as at Sunderland, there are no available data from which to determine accurately the overtime commitment under each heading, a reasoned judgement must be made and the amounts converted to full-time equivalents (f.t.e.).

(*a*) Essential: work which cannot be completed during normal hours.

(*b*) Necessary: work which must be undertaken to achieve laid-down programmes. Insufficient establishment or shortages of staff are typical causes.

(*c*) Casual: in these periods, work is found for staff.

In preparing any assessment of projected staffing levels, the overtime worked under category (*b*) must be considered as being 'part of the actual workforce'. Of the other categories, that under (*a*) will always have to be undertaken irrespective of a bonus scheme, while that under (*c*) can be stopped.

Holidays are also a separate entity and were taken account of by an allowance of 14% being made on top of the 'rounded off' staffing levels. The appropriate department head could then determine for himself how this allowance was allocated. Extra staff could be employed in specific trades, overtime could be worked during holiday periods or seasonal staff employed to cover the hours.

As part of the statement on financial viability, the essential overtime is estimated and taken into consideration. Emergencies, however, could not be catered for.

While it is too early to predict whether our calculations have been basically correct in choosing the second alternative as the policy for which to aim, because of the commitment given that any reductions in staff will be through natural wastage, it is clear that the financial constraints which prohibited the first of the alternatives will have to be borne until the desired levels are reached.

Hospital and assistant hospital engineers' involvement

While, under the terms of the scheme, trade supervisors are paid a fixed allowance which under phase III amounts to 25%, hospital and assistant hospital engineers are bound by PTB circular 286, as are building supervisors and deputies. This circular attempts to define clearly the extent of any allowance (as distinct from bonus) which can be paid to PTB staff, but, as with most circulars, leaves some room for interpretation on local negotiation.

The circular specifies that two allowances of 15% each can be paid per bonus scheme and this means that discussion is centred around the definition of what constitutes a scheme.

At Sunderland, account was taken of the following factors:

(*a*) Geography: the area is fairly widespread with a total of 15 hospitals.

(*b*) Engineering management: the area is divided into four sub-groups with hospital and assistant engineers at each.

(*c*) Engineers' involvement: There are no trade foremen and all of the engineers are involved with supervisory duties and job specification.

(*d*) Actual workforce: the total number of men employed across the nine trades.

It would clearly not be right to give details in this article of what the eventual settlement was, except to say that while it is incumbent upon management to strive for the highest possible level of efficiency, there is also a responsibility to ensure that, in improving the utilisation of the workforce, the additional supervisory burdens that automatically fall on the engineering management are also recognised and are rewarded in satisfactory financial terms. This has been done at Sunderland and the scheme is now running reasonably smoothly across the engineering disciplines involved.

Management/man participation

The strong trade-union ties which have been built up at Sunderland, while in no way minimising the problems, did ensure that negotiations were discussed in a frank and open exchange of views and aided the spirit of conciliation.

From the very beginning, full discussions were held with trade-union officials, shop stewards and the total work force at which DHSS representatives were present to outline broadly the basis of the scheme. Once agreement in principle had been reached with the full-time union officials, the majority of the subsequent discussions were held on a local basis. The culmination of this phase of the talks was the formation of two committees to run the scheme.

These and their functions are set out below:

Steering committee

This is a management group formed to discuss policy and consisting of representatives from administration, finance, and works departments.

Working-group committee

This consists of management and men. The management have the same representatives as in the steering committee, with the men having a representative from each trade from each HMC.

While the numbers attending the working-group committee do on occasions prove cumbersome, it was felt that, until all staff had gained confidence in the scheme and in each other as representatives, these should be persevered with. Once the scheme is running fluently, the present frequency of fortnightly meetings for both committees could be extended and their purpose confined to discussing general procedural points and queries over job times.

Formation of bonus group

The formation of the bonus pay groups was essentially a matter for local negotiation, bearing in mind the guidance given by the DHSS which suggested an optimum number of 15 per group. The scheme is designed to ensure that motivation stems from the shop floor and bonus groups formed with substantially less than 15 men could produce a situation of supervisors' favourites or a marked effect on the group by a person having a genuine off day. At Sunderland the average is seven per bonus group, and present performances, both from the men's point of view in earning a high bonus, and from the management-control aspect, have been encouraging.

Disputes procedure

It is obviously necessary to have laid down, a procedure to be followed in the event of disagreements over job times and at Sunderland the system is as follows:

(*a*) The job is queried by the man concerned with his supervisor. The supervisor will arrange for the planner–estimator to recalculate the standard time and, where necessary, to visit the job site. Meanwhile the man must proceed with the job.

(*b*) If satisfaction is then not reached, the appropriate shop steward is advised of all details and further discussions take place.

(*c*) If the matter is still not resolved, it is referred to the working group committee.

While there have been general disagreements over job times, to date these have always been resolved at shop-floor level with the first stage only of the procedure.

Appreciation courses

At Sunderland, it has proven beneficial to hold a regular series of short talks, usually given by the Work Study Officers of the regional health authority to all grades of staff including supervisors. It is crucial, particularly at the early stages, that all concerned completely understand the system and, more important, their part in it. These talks helped considerably with this and we were able to discuss particular problems with individuals and study in detail the effect of actual cases of incorrect procedure.

Conclusion

The scheme is in its infancy, and as such it would be unwise to make either wild claims on its merits or definite statements as to its financial viability until further information becomes available, but in conclusion certain observations can be made.

The scheme that is being implemented at Sunderland has now been agreed at national level by the DHSS and Unions and it is only a matter of time before increasing demands are made for its widespread introduction. The only thing management has to fear is that its own deficiencies in organisational ability will be highlighted. But is it not time that management ceased to neglect its responsibilities for planning, budgetary control and efficient utilisation of the work force and adopted a professional approach in discharging these duties?

I am in favour of bonus schemes provided that they can be fully controlled in the aspects mentioned above. This scheme gives management the tools for that degree of control.

Despite the initial trepidation of the men over job times, present indications are that with a little conscientious effort they are without difficulty able to achieve relatively high bonus performances. Management has, however, to ensure that, while it is influenced by the scheme, it is not dictated to by it.

One of the principles of the scheme is an active central data bank at the DHSS to correlate studies carried out at area level, and approve them for issue nationally. When this is in operation it will prove beneficial and time-saving and should avoid duplication of work.

Without an increase in the establishment of planner–estimators a delayed entry into phase III would have resulted. It was also apparent from an early stage that, for smooth running at shop-floor level, the supervisors and estimators need to be in close proximity. This permits the easy and regular communication which is necessary, particularly in the early stages.

As the standard job times build up, and the number of completed studies increase, the peak at which the planner–estimators are now working should smooth out. This will offer the opportunity of utilising their talents for planning capital or minor capital work being being undertaken by direct labour.

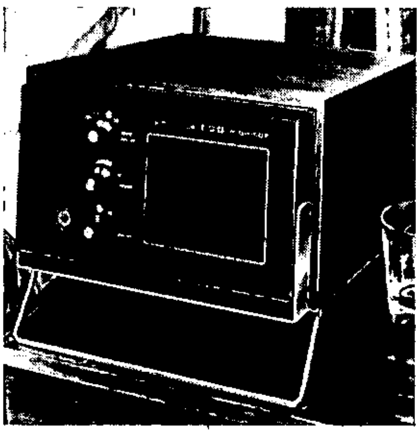
Acknowledgments

I would like to thank the Area Administrator, J. Swarbrick, for his help and guidance and the Regional Engineer, Col. A. P. Smith, for the interest he has shown in this article and in the scheme generally.

HE Product news

E.C.G. HORIZONTAL MONITOR

The Cambridge e.c.g. monitor is designed as a bedside unit to meet DHSS safety recommendations. The unit is fitted with a minimum of controls and features an automatic display-brightness control, an adjustable 'bleep' tone and a visible flashing light with each q.r.s. The monitor has a frequency response from 1 to 35 Hz, and a noise level of



less than 3 μV r.m.s., referred to an input at 100 Hz bandwidth. It has an input impedance of greater than 20 MΩ differential and greater than 10 MΩ to earth. The unit measures 183 × 280 × 328 mm, weighs 9·9 kg and operates from a 110–120 v or 220–240 v, 50–60 Hz single-phase supply.

Cambridge Medical Instruments Ltd., Histon Road, Cambridge CB3 3JA.

AUDIBLE TEMPERATURE ALARM

The BGM excess-temperature alarm automatically gives an audible warning when a prescribed temperature level is exceeded. To meet current UK legislation, the alarm is factory-set to actuate if a temperature of 20°C is exceeded, but the design facilitates changes in temperature settings with the aid of a special key. The alarm includes a battery-operated electronic amplifier and the unit requires no external connections. An impact-adhesive backing plate is provided to secure the unit in a suitable location. Measuring 100 × 75 × 50 cm, the alarm costs £3.

BGM Engineering Ltd., 22 Arnside Road, Waterlooville, Hants. PO7 7UP.

ELECTRONIC HUMIDIFIER

The Vapac electronic steam humidifier is designed to supply controlled quantities of steam for air-conditioning systems. Designed as a wall-mounted cabinet, the system is fitted with an internal-electrode cylinder boiler, supplied with cold water through a regulating valve. Steam is generated by passing an electric current through the water in the boiler by means of electrodes inserted into the cylinder and this is discharged through a top-mounted steam-outlet connection. Electronically operated overflow protection shuts off the water supply should high-level conditions occur in the electrode cylinder. Controls on the front allow manual operation of the water feed and drain valves. The boiler current is indicated by meter and lamps show the valve positions and indicate when cylinder cleaning is required.

Eaton-Williams Group, Station Road, Edenbridge, Kent.

FLAME-RETARDANT COATINGS

The Oakote series of vinyl-solution coatings is designed to protect polyurethane and polyethylene foam from absorption of fluids and to act as a flame-retardant barrier. The coatings conform to BS 4735 for flame retardancy and are available in any British Standard colour. The coatings are spray-applied to form a breathable film that allows air to escape as the foam is compressed. The principal difference between the different coatings in the series is in their degree of short- and long-term flexibility.

Baron Yemm Developments Ltd., 25 Woodford Road, Watford, Herts.

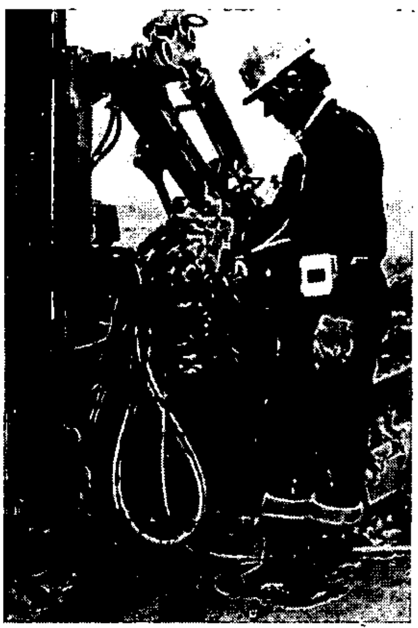
VANDAL-RESISTANT LIGHTING

The CL66 3-hour emergency lighting unit is contained in a toughened case and is suitable for installation in areas where damage from vandalism might occur. It is self-contained with a nickel-cadmium secondary battery, has a 13 W lamp and measures 59 cm × 14 cm × 11.5 cm.

Security Lighting Ltd., 56 Godstone Road, Kenley, Surrey, CR0 4RQ.

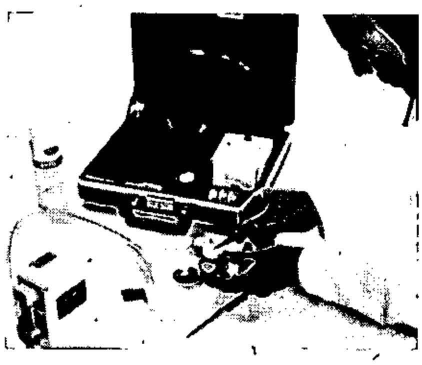
DUST-SAMPLING KIT

Supplied in a heavy-duty black briefcase, the A0 dust-sampling kit includes a Rotheroe & Mitchell L2C personal pocket dust sampler, a battery charger, a selection of filter



papers, an aerosol fixative for holding dust samples to filter papers, a screwdriver for adjusting the air flowrate, a pair of tweezers and containers for sending samples to a laboratory for analysis. The dust sampler measures 119 × 57 × 94 mm and weighs 1·14 kg. It has an adjustable air flow rate of 0·5–3·0 1/min and its rechargeable batteries will run for shifts of up to 8 h. The kit retails at £220.

A0 Safety International, Radlett Road, Watford, Herts. WD2 4LJ.



LAUNDRY EQUIPMENT SPECIAL OFFERS

UNUSED STOCK CLEARANCE:

		(List Price)	Special Offer
10 lb. capacity	406 Miele Washing Machine	(£446)	£380
22 lb. capacity	110 Miele Washing Machine	(£988)	£775
26 lb. capacity	112AS Miele Washing Machine	(£1479)	£950
16 lb. capacity	WZ11 Miele Hydro Extractor	(£327)	£295
25 lb. capacity	236 Miele Tumbler Dryer	(£883)	£650
33½" roller	850C Miele (coin-op) Ironer	(£284)	£225
65" roller	316 Miele (electric) Ironer	(£1081)	£900
69" roller	175 Miele (steam) Ironer	(£2052)	£1450
69" roller	175 Miele (electric) Ironer	(£2052)	£1450

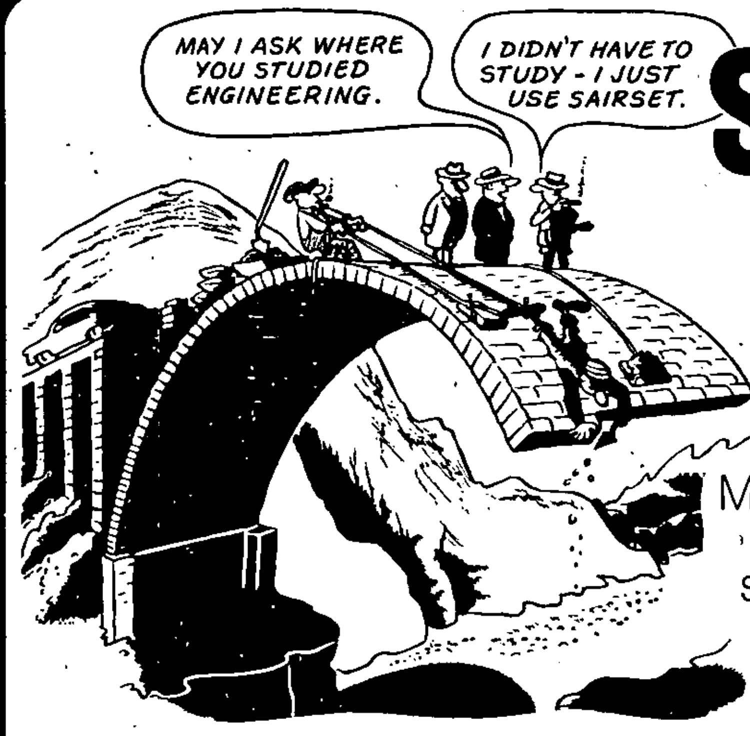
Surfaced damaged, guaranteed working order:

10 lb. capacity	406 Miele Washing Machine (240v. or 415v.)	£350
22 lb. capacity	110 Miele Washing Machine	£700
26 lb. capacity	145 Miele Tumbler Dryer	£400
55" roller	140 Miele Ironer	£400

Coin-op Washer Offer:

15 lb. capacity	Electrolux/Stima front loading washer (List price £450)	£250
	Also non-coin model on special offer	£275

All models backed by Electrolux service if required. Spare parts available. Special offer prices subject to VAT. Full details by phone or post:
Electrolux (Commercial Equipment) Ltd., Laundry Division, P.O. Box 24, Oakley Road, Luton LU4 9QE.
Tel: LUTON 53255



SAIRSET* 'E'

—is one of the range of Cements, Castables, easily obtainable from your nearest

A.P. GREEN Depot.

Insulating Castables and Mouldables are manufactured in the U.K. to the highest standard of quality control at our Pyramid Works at Bromborough.

*SAIRSET IS A TRADEMARK

A.P. GREEN REFRACTORIES LTD.

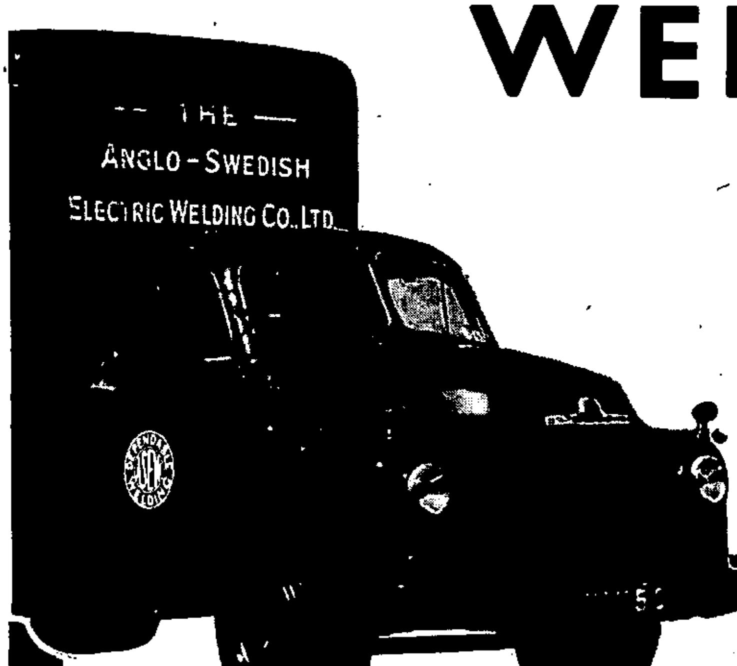
Dock Road South, Bromborough, Cheshire. Telephone 051-645 0701

WELDING-

Anywhere—Anytime

For Reliable Repairs to
Boilers (incl. Retubing)
Pressure Vessels
Iron and Steel Castings
Mobile Plant for Site Work

Manufacturers of:— Tanks, Chimneys, Bunkers, Air Trunking, etc.

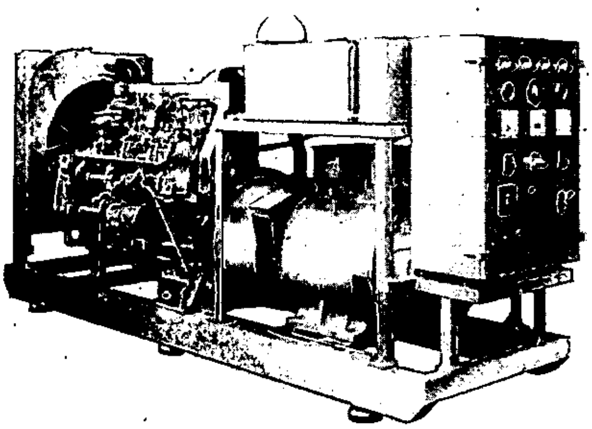


Anglo-Swedish
ELECTRIC WELDING CO. LTD.

HEAD OFFICE and WORKS
Dreadnought Wharf, Thames Street, Greenwich London, SE10
01-858 2024/5

ALSO AT
Glasgow - Newcastle - Leith - Liverpool

continuous operation



'Powermaster' diesel generating sets provide a reliable source of standby power–all the year round.

Manufactured by Tilsley & Lovatt Limited, they can be supplied with outputs of up to 500 kVA and can be delivered promptly–at the right price.

A comprehensive contract maintenance scheme is also available to ensure continuity of service.

'Powermaster' 100kVA diesel generating set.

To find out more–post the coupon or contact:

Tilsley & Lovatt Ltd.
specialists in diesel power
Newstead Trading Estate, Trentham
Stoke-on-Trent ST4 8HT Tel: 0782 657331

I would like to know more about 'Powermaster' diesel generating sets.

Name..
Position..
Organisation..
Address..
....
Telephone Number..

Classified Advertisements

OFFICIAL APPOINTMENTS
SITUATIONS VACANT
COURSES, EQUIPMENT ETC.

APPOINTMENTS

Wiltshire Area Health Authority

Area Works Officer

Salary £6612–£8082

Applications are invited for the above post from appropriately qualified staff serving in the merged Health Services in England and Wales.

The person appointed will be expected to provide advice to the Area Team of Officers and to the Area Health Authority on all works matters and will be accountable for the efficient running of the Area Works Department. A high degree of managerial and professional ability is required.

Sound experience in the management of the maintenance and operation of engineering service and/or maintenance of buildings in the National Health Service will be required, and the individual must be capable of carrying to a high level of responsibility in relation to the Authority's Capital Works Programme.

Application forms and job description are available from the Area Personnel Officer, Rowden Hill House, Chippenham SN15 2AN. Telephone Chippenham (0249) 51251 ext. 20. Closing date the 18th April, 1975.

HOSPITAL ENGINEER

Hospital Engineer to be responsible to the District Works Officer for the maintenance of engineering services in five hospitals; based at Kidderminster General Hospital which is an expanding District General Hospital with planned maintenance scheme.

Applicants must have a sound knowledge of Boiler Plant, Mechanical and Electrical Equipment and wide maintenance experience and should possess one of the following qualifications:—

H.N.C. or H.N.D. in Mechanical or Electrical Engineering.
Full Technological Certificates—part III or equivalent.
Salary—£2550–£3000 with £108 special responsibility allowance and £229·68 Threshold Payment.

Job description and application form, returned by the 21st April 1975, can be obtained from District Works Officer, Hereford and Worcester Area Health Authority, Sunnyside, Mill Street, Kidderminster DY11 6XN.

IEE medical electronics volume 2: monographs 7-12

edited by Dr. D. W. Hill and Dr. B. W. Watson

172 pp., hard covers, six papers, 230 × 150 mm, letterpress, ISBN 0 901223 51 4, published 21st January 1974, £6.50

Contents:
Microelectrodes and input amplifiers, *C. Guld.* Fundamental properties of physiological electrodes, *W. Greatbatch.* Instrumentation for electroencephalography, *C. D. Binnie.* Cardiac pacemakers, *J. Kenny.* Evoked-response audiometry, *J. R. Roberts and B. W. Watson.* Myoelectric control, *R. N. Scott, P. A. Parker and V. A. Dunfield*

Medical electronics continues to find an increasing acceptance in a wide variety of medical disciplines, both in the development of specific instrumentation and in clinical applications. Each year, a more detailed understanding is emerging of how electronic techniques for diagnosis, therapy and data reduction can play a significant part in both routine medical services and research.

This second volume in the IEE Medical Electronics Monographs series provides a valuable source of reference material for departments in hospitals, medical schools and pharmacological-, physiological- and psychological-research laboratories. Subjects covered range from the design of implanted cardiac pacemakers and microelectrodes, and their associated amplifiers for use in electrophysiological investigations, to techniques for use in evoked-response audiometry and the use of myoelectric control systems in aids for the handicapped. The book will be of great value to medical doctors, life scientists, engineers and physicists who wish to add to their knowledge of useful techniques.

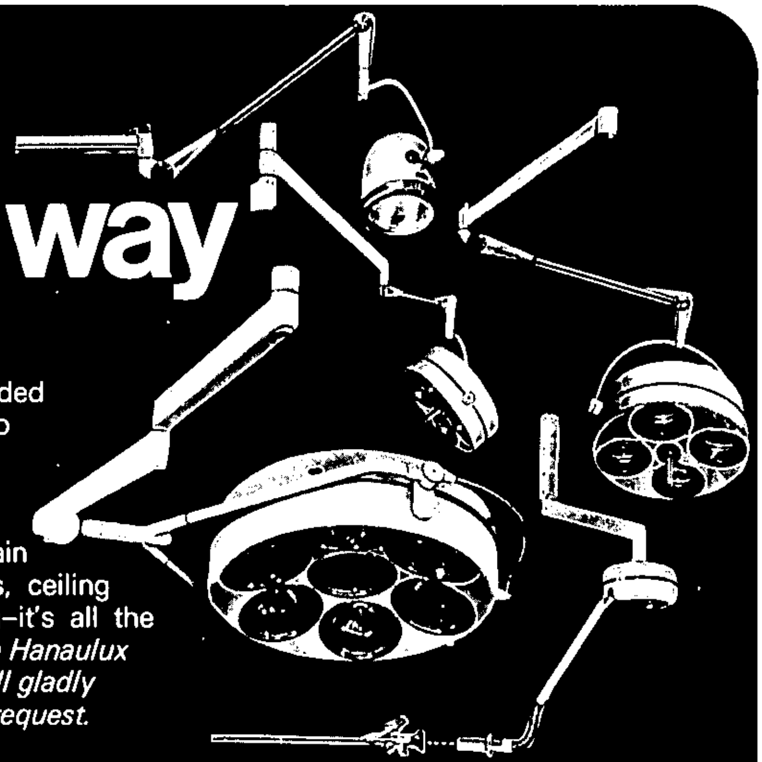
Orders, with remittances, should be sent to:
Publication Sales Department, Peter Peregrinus Ltd., Station House, Nightingale Road, Hitchin, Herts. SG5 1RJ, England

Index to Advertisers

Please mention 'Hospital Engineering' when replying to advertisers

Sierex lights the way

...with HANAULUX



From the cool, highly intensive light provided by the Boston operating lamp, to concentrated illumination for cavities from the Glass Fibre Optic Satellite lamp, Sierex can supply the right lighting for all surgical procedures. Main lighting units, with or without satellites, ceiling mounted, wall mounted or free-standing–it's all the same to Sierex. *You really should see the Hanaulux range before committing yourself. We will gladly supply full technical details on request.*

Sierex

Sierex Limited
15/18 Clipstone Street, London, W1P8AE, 01-580 2464
Branches in *Birmingham, Bristol, Bury St. Edmunds, Dublin, Edinburgh, Glasgow, Leeds, Liverpool, Manchester and Reading.*
Agents in *Belfast, Newcastle and Newport.*

It would take more than this space to tell you about Hobart

But Hobart are expert space-savers. No. 1 in the UK and worldwide leaders in specialised catering equipment. Hobart pioneered the Flight dishwashers, the Turbo-mixer and patented a host of new ideas. Kitchen-wise, we're unbeatable for dependable, design-right machines that are hygiene-conscious, thrive on volume production and keep maintenance to a minimum. Sales and service teams cover the country, ready to help at the pick-up of a phone.

Mail coupon now for facts

HOBART

The Hobart Manufacturing Co. Ltd.
Hobart Corner,
New Southgate, London N11 1QW
Telephone: 01-368 1212

Tick box(es) for leaflet(s)

☐ Dishwashers ☐ Glasswashers ☐ Food Waste Disposal Units ☐ Chippers ☐ Coffee Mills ☐ Cream Air Whips ☐ Dicer-Chippers ☐ Food-cutters ☐ High-speed Mixers ☐ High-speed Dough Kneading Machines ☐ Meat Saws ☐ Meat Tenderisers ☐ Mincers ☐ Planetary Mixers ☐ Peelers ☐ Slicers ☐ Puree, Shredding/Grating, Soup Strainer Attachments ☐ Veg. Prep. Units ☐ High-speed Steam Cookers ☐ Mobile Turbo-Mixers ☐ Computer Scales and Automatic Wrapping Machines ☐ Food Processing Machines for large production ☐ Salad Drier ☐ Regular Machine Service

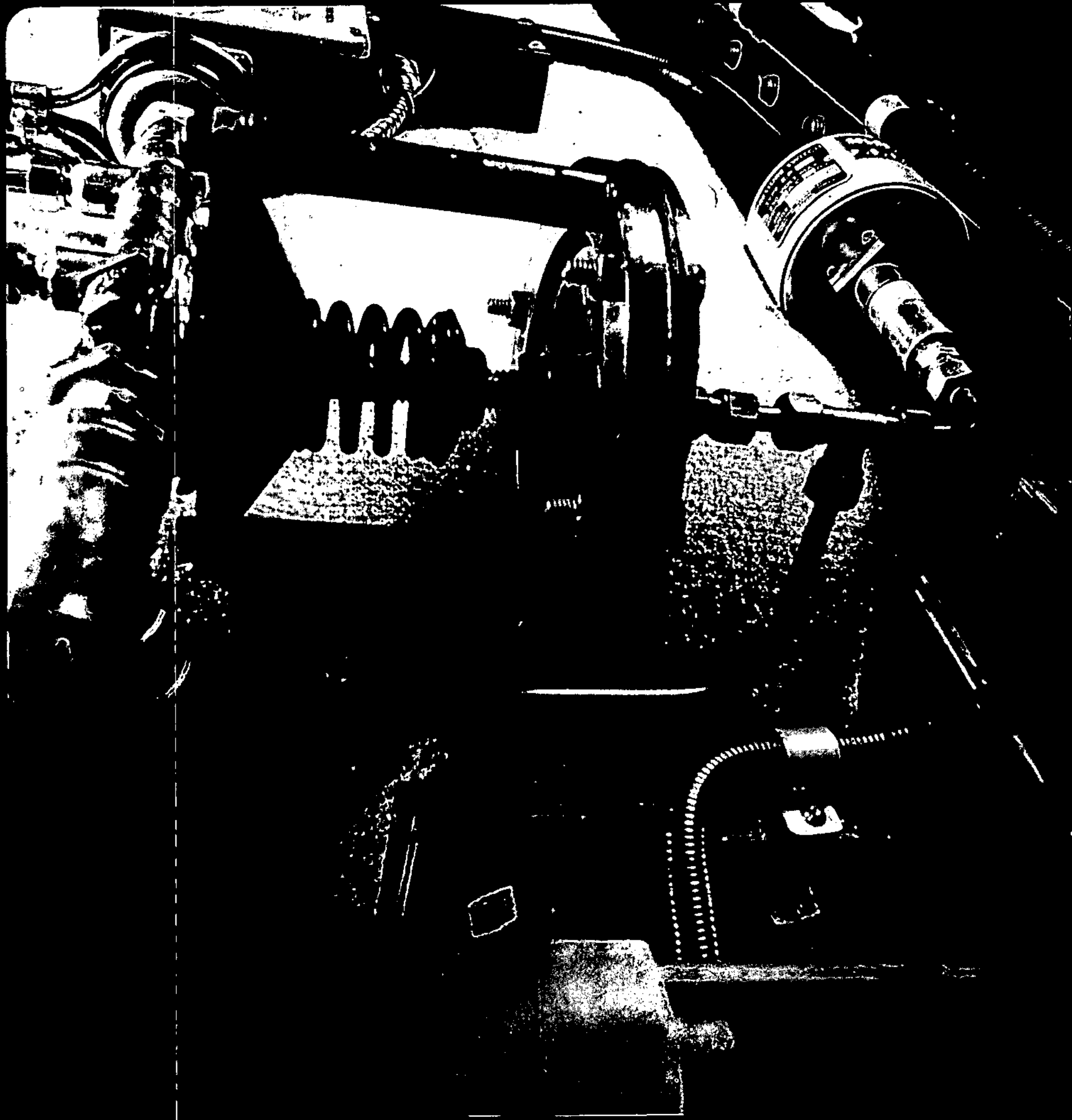
NAME ....

COMPANY ....

ADDRESS ....

....

THACKRAY



This is one of our new autoclaves

Inside you'll find an electro-mechanical programme controller, vacuum pipe work screwed and soldered, a unique partial pressure air detector, cam operated valve assembly, the unique pressure sealed autoclam® sliding door and other precision engineered parts.

All models are designed for safe, simple and reliable operation.

For further information about our new range of autoclaves please contact:
Chas. F. Thackray Limited, P.O. Box 171, Park Street, Leeds LS1 1RQ. Tel: 0532 42321